Quantum Relativity is a complementary approach to conceptualizing established physics. All working solutions apply in degrees relative to context. By not attaching to exclusive ideas, we can see how they complement each other and solve problems like asymmetric baryogenesis and what came before the Big Bang.

Quantum Relativity provides an architecture and categorically investigates the key processes of the universe from propagation into chromodynamics through renormalization, then deconstructing spatial focus into unfolding temporal distribution. We begin with Special Relativity defining spacetime generically and linking it with the intimate processes of Thermodynamics.

We follow with the cases for light (latent) and matter (discrete). These are brought into mutual complement with the case for distribution. Each case is subject to proportional transformations of volume into pressure, and space into time. The result is a combination of open and closed systems, where the finite spaces of things created and destroyed ultimately flow into time without beginning or end where big bangs happen.

QUANTUM RELATIVITY PŭMa Tse 樸麻子

Quantum Relativity

Second Edition

COLOR Edition

ESA/Hubble picture
MACS J0416.1-2403

PŭMa Tse 樸麻子

Quantum Relativity

second edition

PŭMa Tse

Akademé (http://akademe.org)
ISBN 9781078479417
In color: 9781079111682

Proceeds of Akademé materials and services support Akademé Foundation's mission to promote sustainable civilization through education and advancing understanding and compassion.

Cover Photo: MACS J0416.1-2403 at z=0.397
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We want to start by thanking our critics….

We especially want to thank readers for feedback and students for their questions.

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Introduction

> Fundamentally, I have an ideal of what a physical theory should be. It should be something that doesn't refer in any specific way to human beings…
> It shouldn't have human beings at the beginning in the laws of nature.
> And yet I don't see any way of formulating quantum mechanics without an interpretive postulate that refers to what happens when people choose to measure one thing or another thing.
>
> —Steven Weinberg[1]

Physics is the foundation of the sciences. Adding anything to a foundation creates layers of complication. Physics appears hard for a variety of reasons, such as the over-thinking struggle to understand, and the flood of information without establishing a conceptual cohesion among the definitively working parts. Popular media distorts all fields for the sake of audience appeals. For science to function properly, it must control its own conceptual modeling.

Taming the flood of knowledge with cohesive understanding of practical established physics is my goal here. Theoretical physics is not about fishing with hypotheses for what sounds good, invention, catering to whatever is popular, or having a clever title. Theoretical physics is the art of conceptualizing the established science to make it accessible to others. That accessibility leads to applied innovations in the other sciences that provide new ways to dig even deeper in experimental physics.

The hardest parts of physics are its human dimensions. It is too easy to get caught in a line of abstract ideas that create an elegant reality that never actually adds up to a functional reality, or to the extent of excluding other perfectly valid aspects of reality. Our own self-examination and humility play key roles in stepping away from our own thinking long enough to appreciate and potentially integrate other working solutions.

Nothing compels self-examination like failure. If you aren’t making mistakes while trying to understand, then you either aren’t trying or are just reinforcing your ego’s wants and expectations. Humility then takes the next step of putting boundaries limiting significance to the practical extent of function. The advantage of scientific formalism is the ease by which one can determine the degree and perspectives of function. Understanding it enough to separate the wheat from the chaff requires experience in both content and language.

The Path Through

I was born into physics, specifically the study of photonics bridging into communications technologies. Steven Weinberg perfectly expresses the particular view of physics I grew up with and continue half of a century later. It was this reasoning that compelled me to pursue social sciences and better understand the scientist so I could eliminate the human element.

I didn't start writing about physics until 1993. You won't find it or the several books up through Quantum Relativity for a really good reason: I'm a scientist and my view of the world can and does dramatically change with new evidence. This is the first time that my understanding of physics did not change so radically between editions that I went ahead and declared a second edition instead of outright deprecating the whole previous line of thought.

It was this first writing specifically on a topological model of dimensions and cosmology that inspired my advisor to suggest I pursue learning and development theory. It took several years and writing several books in epistemology and normal psychology before I realized WHY she had pointed me that direction. It turned out that putting the models together came up with an algorithm very similar to the way I was breaking down the variables of physics.

I know from experience having filled each of these roles there are six types of theoretical physicist:

- Those who develop alternate realities that inspire the imagination into science (Isaac Asimov, Arthur C. Clark, H.G. Wells);
- Those who frame everything relative to a fixed ideology, inadvertently inverting the scientific method (Lemaître);
- Those who use their own knowledge and experiences to frame and comprehend concepts for themselves (Albert Einstein);
- Those who use common experiences to frame and encourage others to comprehend concepts (any good teacher);
- Those who coordinate observed facts and working solutions into broader algorithms that make testable predictions (Niels Bohr);
- Those who construct an entire framework to study a body of concepts (Sir Francis Bacon, Isaac Newton).

It can be really hard to distinguish among the last four. The first two are the most common way we see theoretical physics. These are popular science because they are socially expected and useful. Unfortunately, scientific fields in college do something different from other departments.

Instead of introducing you to the conceptual framework holding that field together meaningfully, you are simply drowned in what is considered the most elementary topic. For physics that is classical mechanics of Newton to include calculus. Needless to say, most of the fish jump out of that hot water pretty quick, and universities think nothing of that fallout or attrition rates.

Like IQ testing, the system ranks based on expected norms. If all you are doing is training robots to do a specific thing, then you want those norms. Except you aren't. Science is an evolving thing that requires different types of intellect to manage different stages of the process. It is also vital to the function, sustainability, and confidence of society. Entry level classes really need a framework to give context for those who won't go further, and guidance to the different paths of contributing to the field.

Another casualty of failing to provide a comprehensive theoretical framework (e.g. following the scientific method even in teaching) is leaving that job to popular science. If you are a real expert, you know the media version of your expertise can outright contradict reality. This is true for every subject. I keep seeing what is the equivalent of a dentist conducting neurosurgery, or a general practitioner rebuilding an engine. Nobody seems to know their boundaries anymore.

That isn't to say popular isn't useful or is outright wrong. It is just really easy to over-do it, go too far. Going too far is as simple as giving priority to the speculations then adapting the empirical evidence to fit. That is no longer science or evolving understanding. More commonly I see advanced subjects like black holes or neutrinos being manhandled by generalists following popular theories.

As Feynman said, "**If it doesn't agree with experiment, it's wrong. In that simple statement is the key to science**."[2] My upbringing created a rather unique concrete foundation. I insist on physically proving absolutely everything. If you don't have the backbone to be wrong nearly all the time, then science isn't for you. Only religion, politics, and your boss have their own versions of reality where they are right all the time. The rest of us suffer the differences.

A scientist explores and understand objective reality. Our reality is not an opinion or popular agreement. It is tested against practical reality like Feynman said. Yes, the literature is fun and inspiring, but it can also distort your view. The scientific method, employed correctly, should enable you to break down the lens you were given to view reality and develop a more practically functional understanding.

Yes, the literature inspired me. I looked out at the universe of physics through the optics of Big Bang and exclusive solution like everyone else. By exclusive solution I mean being able to only accept one cosmology perspective over others without seeing the degrees and ways they can apply together. In science we are conditioned to assume we are wrong and everyone else is likely right. This alone contradicts exclusive solution.

Then I got into the math and how the variables actually relate to reality. Meanwhile, my academic and consulting careers took diverse paths. This was only good in the sense of no expectations my investigations would do anything. As Goethe described,[3] I was an unfettered mathematician.

> Mathematicians are like Frenchmen: whatever you say to them they translate into their own language and forthwith it is something completely different.

Applied mathematics became a meditation where I regularly reinvented existing established physics. This got a bit frustrating and led to an inconvenient observation: there are serious educational, critical thinking, and cultural bias problems in physics. These are all symptoms of diminishing returns due to failure to conceptualize. Moving forward starts when our current level of physics is literal child's play.

There is near zero attempt to actually conceptualize or see that some concepts (like black holes and singularities) evolved beyond the popular versions. In the overlooked footnotes are the rational retractions of the originators as their understanding continued while most everyone else stood still. Thankfully, some did keep moving. Physics is suffering from the law of diminishing returns: too much of perfectly good things.

The content is fine. Interpretations often stray the mark into speculation, and quite often people think they are too smart to look things up but are really just playing a sophisticated form of popular knowledge. The speculations typically attempt relating to existing concepts like Big Bang for a variety of possible reasons like trying to be significant. In a way it is like unconsciously stating your cultural identity.

This field is too vast. It is too easy to get caught in echo chamber chasing non-problems or already solved problems due to asking the wrong questions. The information age is very bad. Predictive algorithms are too happy to give you what you the popular and what expect to find out of a vast sea of valid answers.

Physicists will understand the term renormalization to mean simplifying infinites into finite generalizations.[4] This is what conceptualization does in research and education. It takes a diverse body of information and converts it into tangible, mentally and socially accessible constructs, while providing a simple procedure for solving a whole class of problems. That procedure makes testable predictions then supported empirically so it constitutes working theory.

We can condense this vast field into a working architecture that includes all the working conceptual frameworks. What we are doing today will hopefully be soon considered "old school physics" and "child's play." This should be the basics we build on and start entirely new ventures, most of which we never conceived. Some we are just beginning, but are doing so awkwardly because we are on an unstable foundation. Once the details are manageable, we can move forward rather than getting lost in them.

Quantum Relativity

> Quantum theory yields much, but it hardly brings us close to the Old One's secrets. I, in any case, am convinced He does not play dice with the universe.[5]

Einstein's famous 1926 statement to Born is often easily misconstrued. Some construe the "god does not play dice" to suggest he rejected or did not get QM. On the contrary, he significantly contributed. To interpret this as determinism is to not comprehend the layers and vast numbers of variables leading into Bell's theorem.

Physics is the foundation of the physical sciences, the pursuit of how reality works. Quantum physics has become a science of hidden variables, mathematical constructs defiant of conventional thinking, predictive probabilities, and other algorithms to show what we cannot see. In the beginning it was Planck's pursuit of fundamental units of scale. Ironically, most of the variables only quantize under relativistic conditions.

This of course begs the question: what is Relativity? Relativity isn't just one thing either. Special Relativity is about light, spacetime, and frames of reference. It is incredibly quantum and in many ways more fundamental. General Relativity shows the application of Special Relativity to classical field theory by means of gravity. It incorporates a very quantum concept of manifolds (contextually shaped spaces).

We can arguably divide the relative from quantum universe by the concept of renormalization. Relativity then becomes the universe of discrete generalizations like mass and gravity. The quantum universe is all the inconvenient hidden details that become overwhelming. The difference between them is very subtle. A specific thing derived from generalities is relative. A generality achieved by too many specifics is quantum.

Do not confuse this with scale. A proton is smaller than the quarks used to construct it. The fundamental are often hiding in plain view, even on grand scales. The only thing limiting them are relativistic things. A field of light (photon) is a specific relative thing. Variations of density in that field individually are relative. Generically they have infinite potential to perturb as matter being quantum. It doesn't matter how big or small, both perspectives have ways to apply.

Our experiential perspective of physics is a very misleading distribution of quantum and relative, of latent possibilities and discrete certainties. Starting with a foundation in spacetime as the **special case** we then follow the **latent – discrete = distribution** cases outlining the architecture. Conceptualizing and organizing into context does affect interpretations prone to distorting observations or over-application. It does not change the laws of physics or empirical facts. It does add algorithm layers, expand the laws, and applies them.

Outline

Outlining is a form of mnemonic syllogism. Syllogism establishes a logical ordering to argument. Every leaning process needs a plot sequence fitting a perspective that helps the mind map information meaningfully. I am attempting to follow nature's sequence of priority adapting to our human ability to grasp. An instructor may choose a different order, or you may find yourself lost in details trying to see how they fit into the bigger picture. This outline will hopefully help resolve any related confusion.

The Special Case

1. A Bridge Too…

Instead of going too far with one theory, we give each its functional space and show how they work together using an ISO-compatible architecture. This provides a object-oriented, process-driven tools to contextually organize, analyze, and predict. Acting like an operating system, subsystems like interconnectivity and transformation regulate the key operations of physics.

Critical modules, like Thermodynamics, span the model's depth connecting subsystems to working variables, to transitive values. In this, the closed (conserved) fabric of spacetime is woven by the simple connection of time and transformation of propagation. Multiply connected open objects are brought hyperbolically into focus while those values are shaped into hypersphere contexts relative to the role of time.

2. The First Frontier

Distributions in spacetime are defined by manifold transformations and interactions. The manifolds comprise a hyperspace of four dimensions split across two phases. In the first phase, linear pressure unfolds into enfolding angular volume. The phase changes in the optical spectrum to linear volume unfolding into enfolding angular pressure. This is a universe in which space defines discrete things (e.g. light and matter), but the difference we see as distance between things is a distribution in time.

3. Dark-ish Matters

Wheeler's pulsar accident tops a related series of distortions and over-generalizations circulating popular science. In this chapter we set the records straight, showing Thermodynamics and Special Relativity don't work right generalized or distorted for popular consumption. You have to route out the details, like the three different identity approaches to the first law of Thermodynamics. The second law's Virial theorem adds kinetic energy (not hidden mass) that can perturb a hypersurface—the strong interaction feature that explains black holes. How entropy works leads into rotating axes then Fleming and flux leading to QED and QCD.

4. Dilation Processes

Dilation defines the scale applied to a space creating relativistic frames of reference for discrete identities. The constants of spacetime, like the speed of light, do not change between reference frames. This is an opportunity to bring energy into focus as matter, or conversely to accelerate matter such that its energy goes out of focus ultimately propagating. The conversion to latent propagation inverts the effects of dilation into the redshift process and converting volume into pressure.

The Latent Case

5. Change Functions

Tessarines, quaternions, and Boolean logic are explored to unveil a system of change as imaginary, complex, and hypercomplex functions. The concepts are then illustrated in a variety of contexts to clarify how the logic works algebraically and graphically. QCD color association and truth reveal the process of virtual emerging through interaction into real.

6. Let There Be…

Light is a latent form of propagating energy critical to understanding how spacetime is constructed. Doppler, like many even into the present, conflated the opposite effects of sound waves with electromagnetic radiation. Doppler radar and the Tolman effect beg for an explanation of mechanism. Leybourn's roller provides the mechanical framework leading to Euler's solution to the d'Alembertian wave function identity providing the first flat spacetime solution in 1748. Fourier analysis then provides explanation of the informational content. This sets the first two laws of propagation as compatible with those of motion and Thermodynamics.

7. The Path of Light

Light gradually transforms with propagation due to interaction with the environment. At a minimum this interaction is with CMB and other lesser perturbations like CNB. The path of each propagation is unique, its interference affecting the Hubble parameter measuring the rate of radiant volume repurposed or converted to temporal pressure consistent with redshift.

Complex space law shows the whole process of converting from enfolded linear pressure to unfolded angular volume phase shifting to linear volume in the optical spectrum and converting to angular pressure. Dilation processes then explain the accelerating effect of these transformations leading to the spherical wavefronts of CMB and static volume-pressure consistent with the background temperature.

8. Latent Fundamentals

Scalar energies at the root of all valuation derive easily from Fleming's rules. They transfer in wave form mechanically and electromagnetically. Quantization creates new virtual matter that must confine in interaction or annihilate. In interaction, the spaces are sequentially created and shaped as microstates value flows through. The mass problem is easily seen as an array of elements contributing in degrees.

The Perturbative Case

9. Quantum Morphology

The hierarchy of life provides a similar sequence for matter. The evolution of seven strong interaction types follows this plot through to hadronization and nucleon interactions to form isotopes. The particle plot simplifies into a three act play: virtual particles, unbound identities, and weak confinement. We put Weyl fermions and Fermi surfaces to good use winding the maze of complex interactions to understand weak interactions, mass, and much more.

10. Instantiation

New matter creation is a potential of the first type of strong interaction. Again we must turn to biology for terms like mitosis, meiosis, and evolutionary processes not accounted for in physics. Inadequate language makes finding information in physics so difficult that even experts get lost and confused, wasting time with wrong questions like baryonic asymmetry. Schrödinger and eigenfunctions help normalize, oscillate, and ultimately confine the details making matter do what it does.

11. Virtual Anatomy & Cytology

Weak bosons provide an array of clues for how virtual spaces form, function, diverge, and evolve. Bose-Einstein microstates apply to all the bosons, but uniquely with weak bosons. Here they are causal of a mixing effect called gloming resulting in mass. Weak bosons diverge into leptons and quarks, their features subject to opportunistic (uncertainty) factors like oscillating between identities. This accounts for their divergence paths and how the next three generations of particles assemble.

12. Brane Surgery

Each generation of matter generalizes into a manifold form linking perturbations to latent and distributive processes. An examination of how axes function and interact shows how one axis can describe nearly all virtual particles, but also how many decompose into multiple axes.

Lie algebra analyzes axis interactions in degrees, and a breakdown of variables shows the subtle obstruction of the Yang-Mills mass gap challenge. To solve this challenge requires understanding the difference between field interaction and distribution in time. Octonions provide the next step in change logic needed to find real temporal axes to activate dilation factors of wave function mixing into a distribution.

The Distributive Case

13. Relative Field Theory

To understand the mechanisms and qualities of relative fields we first need to understand macrostates. Macrostates are the different ways we can decompose/reconstruct the spaces making up a relativistic thing that are causal of contextual attributes to include mass and gravity.

By recognizing the quantum mechanical aspects, we can see six forms of gravity referenced or even outright defined in Einstein’s field equations. Only the geodesic surface gravity behaves as we expect. This is our habitual way of looking at the variables simply because Einstein was proving his theory by relating it to Poisson and Gauss’s functions. The other five forms in basic terms define tension, volume, pressure, displacement, and ranged interactions.

14. Confined Morphology

Atoms are the final stage of renormalization. To understand how one thing can have contextual properties we need the Copenhagen "complementarity" interpretations. Bohr and Heisenberg recognized that nucleons, electrons, and their interactions still have quantum qualities being confined through renormalization into atoms.

Macrostate structures individually provide tidy solutions to specific problems. We also recognize that each atom has many such tidy perspectives that contextually apply making them collectively untidy. Macrostates of atoms examined here affect valence states, isotope ranges, the mechanisms of magnetism, and limits to the periodic table.

15. Degenerate Distribution

Our geometrized universe of mechanical interactions and uncountable groups of things is Wonderland. Ours is the unusual perspective nestled between virtual matter constructing spaces and continuing simplification deconstructing space into temporal effect. Our reality comes into perspective by forming points that can be arranged into tangible things.

This is done by differentiating the information of the complex into real and semi-real octonion axes defining the array of chemical interactions. With so many possibilities the next steps naturally continue to simplify as atoms compound to form celestial objects that themselves can simplify to uniform fields and together form solar systems. A pattern for galaxies, clusters and filaments diverge space into expanding temporal volume.

16. Dimensional Analysis

An object-oriented matrix clues into relationships among variables, giving an organizational interface to the architecture of physics. Interface accounts for the human elements, which account for our approach. The Matrix provides ways to dissect the various forms of electromagnetism like the weak interaction, Helmholtz free energy, and orbital mechanics. We close with the interactions and changes in information that keep the whole process moving forward through equilibrium.

Endnotes

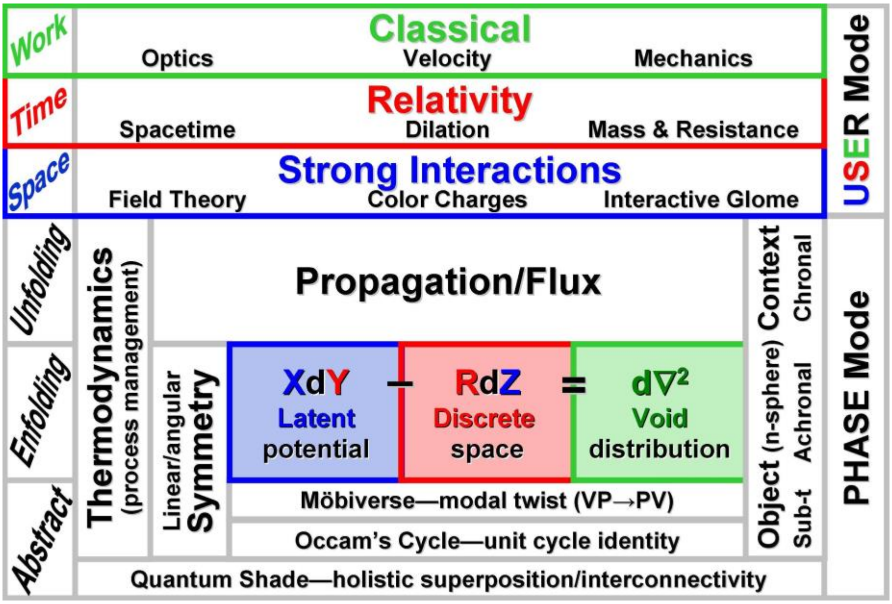
[1] Folger, T. (July 2018). Crossing the Quantum Divide. Scientific American.
[2] Pomeroy, S.R. (Nov. 13, 2012). The Key to Science (and Life) Is Being Wrong. https://blogs.scientificamerican.com/guest-blog/the-key-to-science-and-life-is-being-wrong/.
[3] Moncur, M. (2018). www.quotationspage.com/quote/22893.html.
[4] Sutton, C. (ret. Apr. 20, 2019). Renormalization. britannica.com/science/renormalization.
[5] Canetta, E. (Sep. 1, 2014). Physics and Beyond: "God does not play dice", What did Einstein mean? stmarys.ac.uk/news/2014/09/physics-beyond-god-play-dice-einstein-mean/.

The Special Case

The more success the quantum theory has, the sillier it looks.

—Einstein, May 20, 1912
to Heinrich Zangger[1]

[1] Home, D. & Whitaker, A. (2007). Einstein's Struggles with Quantum Theory: A Reappraisal. NY: Springer.

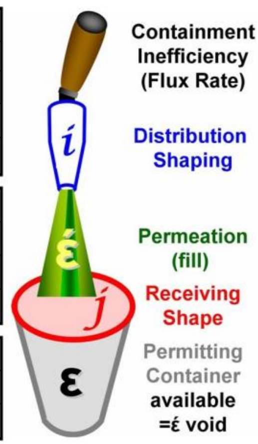


Cosmology Architecture

Permeability			
Class	Symbol	Constant	SU
Magnetism	μ_0	3.14159265358979E+07	m s²/kg
Linear	$\acute{\varepsilon}_L=G=c^2/\varepsilon_L$	6.70197080364171E-11	m³/kg s²
Angular	$\acute{\varepsilon}_A=c^2/\varepsilon_A=4\pi/\mu_0$	4.00000000000000E-07	kg/m s²

Permittivity			
Magnetism	$\varepsilon_0=1/\mu_0 c^2$	3.54167512704815E-25	kg/m³
Linear	$\varepsilon_L=c^2/G$	1.34103117585718E+27	kg/m
Angular	$\varepsilon_A=1/4\pi\varepsilon_0=k(\varepsilon)$	2.24688794684204E+23	m³/kg

Linear-Angular Axis Conversions			
Rotation	$\varepsilon_V=G/\hbar\varepsilon_A=2\sqrt{2}$	2.82842712474619 …	/m² kg s
Spin	$\hbar$	1.05457172646947E-34	kg m²/s



Permittivity and Permeability Constants

Legend:

ε	=	Permittivity (energy application/potential)
έ & **μ**	=	Permeability (energy flow)
0	=	Maxwell's magnetic constants
L	=	Newtonian linear/gravity constants*
A	=	Coulomb's angular constants
S	=	Planck's spin constants
V	=	Axis rotation constant (2 sec φ)

1. A Bridge Too…

A thesis statement is the obvious and easy way to break the ice and start any argument. A joke often works just as well. Either way, the opening provides a hook to pull the audience into a frame of mind. That frame of mind contains the syllogistic elements of logos (logic), ethos (meaning), and pathos (motive).

Physics creates a fundamental foundation for the natural sciences by studying matter and energy to understand how the universe works. In a way it provides an objective view of our physical environment, role and ways to work with it. By understanding it we can optimize ourselves. Physics likes to forget its human side. Then guys like Einstein and Lemaître come along with a good story, turn the head of humanity, and the eyes of physics. Physics is long on substance but short on stories.

One story doesn't cut it. Established physics is a mountain of solutions in desperate need of stories to make them accessible. Accessibility is a function of understanding making abstract things concrete. Most of the problems of physics have actually been solved for a long time, buried in the concrete roots of identities glossed over in class and forgotten simply for lack of a story explaining them better.

The beholder is no less important in the process than the beholden, not to mention the means to behold. So we start with a basic framework, a story for the mind to wrap itself around. Cosmology is a "sciency" story that gives our pursuits meaning. It tells us our place in the universe, inspires us to a life of adventure giving us tools to sustain said adventure. It is a mnemonic tool like organizing a bookcase of references.

My goal is to teach advanced concepts in established physics. They are advanced not just because you find them in advanced sources, but because we dig deeper than the superficial and familiar. To do this I start with conceptual frameworks so the reader knows where the elements presented apply in context. We solve a lot of problems simply by being thorough and establishing these contexts. This is just an overview though. It is not a substitute for specific studies or classes.

Decompiling

Physical reality presents many really good stories. Many of these stories have winding and twisted plots. Big Bang is only one story in a twist of a plot series. We have to be careful not to get carried away with our tools and apply a hammer when a scalpel better applies. A comprehensive cosmology provides the whole toolbox with all the possible twists.

From an educational perspective, you want to start with the children's Big Bang story, you just don't want to act like that is the whole story. You didn't learn addition and subtraction being told there was nothing else to mathematics right? That is precisely the problem in the world today. Most, even in physics, are convinced this one story does it all. Not even close. Once committed to one line of thought, it is very hard to see any flaws in over-applying that perspective.

I'm starting with an obvious thing that Big Bang does not explain: the structure of physics itself. Big Bang wasn't designed to help physics solve problems. It was brilliantly designed for social purposes by a non-physicist: a priest. Nothing wrong with that. Priests are the teachers of the general populace. When people stop formal learning to go about their lives, they turn to religion for higher purposes and guidance.

If you are reading this book, I hope you have at least some math and physics behind you. The more the better. You should have enough of a grasp of reality to recognize that three laws of Thermodynamics is not the entire field. Any experience in the kitchen shows the simple way those laws are typically described doesn't cut reality. And when you dig through the research, you learn the laws aren't as simple as they were taught.

The same needs to be recognized with Big Bang. It was a children's story getting you in the door. Now let's grow up and introduce you to the real toolbox. Most physicists I know have at least some experience with programming computers. It is a rather popular area for people with degrees in physics to apply themselves. Because of this, it is easy for us to pull a tool out of the programmer's toolbox and will.

Modern programming is typically object-oriented, meaning you design an algorithm, program it as a module, then apply that module wherever it is needed. The routine for opening a file needs only to be stored once then referenced by all the programs. A color palette only needs defining once, then all the programs use it. Many algorithms are hidden away within the workings, like the mathematical algorithms. Again, they get defined once and are called into action in context as needed.

When you finish putting a program together in a language you can comprehend, you then compile it into machine language that the computer can execute. If something doesn't work right or needs adjusting, you need the human language source file to modify simply because the machine language is impossible to wade through. You can either keep a copy of that source file or use a program called a debugger or decompiler to convert from machine language to human-like language. Since we didn't write the code of the universe, we in physics instead try to decompile it.

The most common angles to decompile from are matter and energy. We look at all the observations and try to find patterns in them. From those patterns we attempt to reconstruct how something works and to then make hypothetical predictions to test. These patterns aren't strictly linear. They are typically syllogisms combining at least two diverse things into a common model. A working model in science is called a theory—although not all things with the name deserve it.

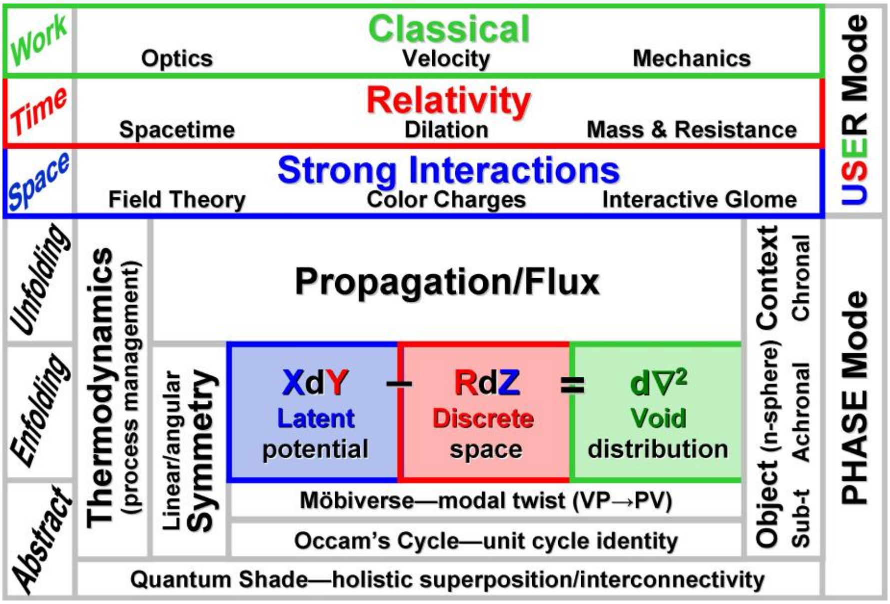
The programmer is at least quasi-aware of their working environment. There are two levels of compiling: hardware specific or operating system environment. Hardware specific compiling acts directly like a particle accelerator. An operating system manages all the hardware and software. This enables the use of object-oriented programming methods where you can address the hardware directly or the system superficially.

The end user has no idea of any of this. They run a program and to them that program is computing. If we decompile the structure of physics into the Open Systems Interconnection model,[1] at the top is the application layer handling process-to-process interactions consistent with classical mechanics. It is the ordinary universe of interacting things; our ordinary and most familiar working perspective. It is essentially a void distribution describing the difference and interaction among things.

The next layer down is called the presentation layer. It standardizes information between the USER mode layers, consistent with renormalizing and relativistic reference frames. Renormalizing is generalizing the quantum into the relative, limiting an infinite into a finite frame or group.[2]

This is where everything gets put into motion creating discrete focus and resistance by defining temporal density and mass. Space resists change in position: contextual identity loss. Time resists the flow of change setting scale. The creation of a local scale is the creation of a discrete space. Renormalization eventually leads to familiar classical conditions.

The lowest level of USER mode is the session layer that opens and closes connections consistent with perturbation. Perturbations are simply change systems forming where fields overlap and interfere. They are opportunities for advancing material interactions or breaking down matter into propagation (light). These spaces are therefore latent. This is the quantum realm of strong interactions, spooky action, fields, Bose-Einstein microstates, and complex interactive spaces (glomes).



1.1 Physics in the OSI Model

Processing

PHASE (kernel) mode has three layers for actual processing. From the bottom up these are: abstraction (hardware and data link with MAC & LLC), network, and transport. USER mode functions apply as parallel and proportional processes in the network layer labeled here as "enfolding." You don't just squeeze these in. They are like vectors defining their own axes intersecting the network layer. The network layer in computing is used to package and route information. In a way it is where we define and isolate our variables into their respective roles.

Surrounding this parallel processing are layers and sub-routines. The sub-routines span layers for management of process (Thermodynamics), input/output (symmetry), and objects (n-sphere). There are different ways to break this down, like combining process and object in one subroutine, or not spanning part of a subroutine due to common elements with executive services (transport layer, propagation here).

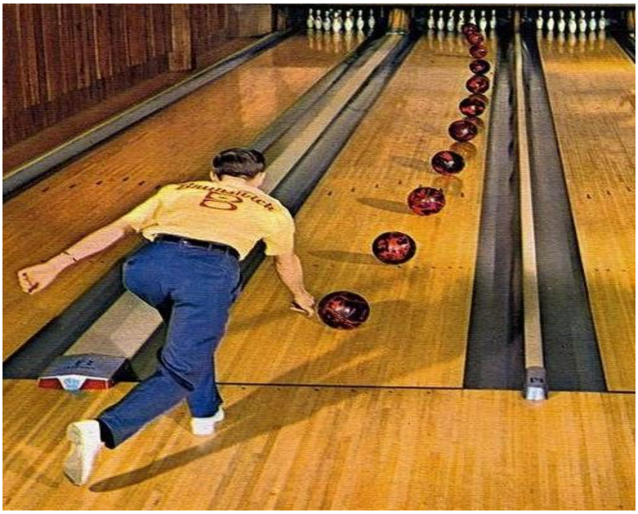
The effects of time and Thermodynamics apply to the elements between them, so they are shown to span PHASE mode. Latent, discrete, and distributive modes with their symmetries affect and are affected by propagation. Symmetry is a qualitative feature whose transition begins with identity and change definition. It then manifests functionally as vector spaces. Vector spaces are intrinsic and interactive. They affect polarization enabling the formation of ranged interactions, but do not propagate.

Everything but the whole is an "also played" derivative of process, flux, and object. The whole is at the bottom: the abstract hardware sub-layer shown here as Quantum Shade. Quantum Shade is a science fiction term used as a time and space defying gimmick in Dr. Who.[3] Quantum Shade describes everything and <u>every when</u> simultaneously interconnected.

This is the grand generalization of the finite and infinite aspects of universe. It is something we have a hard time wrapping our minds around, but really it is very simple. It is the statement of being to which change and variations then apply. It is very important to grasp this concept because all the points of a thing are not necessarily simply connected. They can be simply connected in a continuous line, multiply connected as distinct points, or a vastly separated but distinct set. And like the mechanism for propagation, they can be a combination of these factors.

Closely related to this hardware sub-layer is the data-link sub-layer, where the whole gets divided into manageable parts. Here we will use complex change operators to define the primary units. In latent context they are color charges that strongly interact into discrete context. The change function is a sequential routine or package known simply as a cycle. The cycle is the object in total no matter its nature.

These simple unit definitions and their twisted processes are sub-temporal. The Möbian symmetry twist simply takes one value and applies it in two different but complimentary ways by rotating one axis into another. Like adding a twist to a pitch or roll, the initial direction gradually takes a different direction.



1.2 Directional Change by Angular Twist

This is exactly like twisting a yarn with bulk into a thread with tension, or unraveling the tension to create a bulk. The mechanism for this twisting is distribution enhanced by anomaly (information). We label this Möbiverse because this layer makes latent distribution (propagation) into the fabric of spacetime. Don't worry, we'll get to all of these details.

As sub-temporal, the abstraction sub-layers provide fundamental qualities of change and flow from which time ultimately derives as resistance. The degree of temporal resistance is like the degree you open a valve to allow a flow of something mechanical like water or air. That valve is the achronal context of time in that it is not measuring the duration but rather limiting the unit of flow. Flow doesn't actually apply until we unfold in the transport layer as propagation.

Resistance

The Oxford English Dictionary gives four definitions to "resistance:"[4]

1. The refusal to accept or comply with something.
2. The ability not to be affected by something, especially adversely.
3. The impeding or stopping effect exerted by one material thing on another.
4. The degree to which a substance or device opposes the passage of an electric current, causing energy dissipation. By Ohm's law resistance (measured in ohms) is equal to the voltage divided by the current.

Let us simply equate resistance with definition and any attempt to create, alter, transform, violate, or destroy a definition. Every definition consists of elements put into a context describing a whole. Root elements of definition in physics describe measurable qualities that transform into other measurable qualities of the same class. These elements are called dimensions. A generalization of a class that is not in its sequence is an adimension, meaning not a true dimension.

Being adimensional is not an argument of validity, authenticity or reality. It is simply a way to categorize so we have a better idea of role and what to expect. No dimension is represented by a constant, and very few variables actually qualify as fundamental dimensions. Most emerge from a composite of things, quite often across different concept categories like acceleration consisting of distance and time.

Resistance is generally based on three factors: the density of spacetime, the way value and spacetime interact, and the availability to interact. The four leading forms of resistance are temporal dilation, discrete mass (resisting acceleration), luminosity (latent mass resisting redshift), and flux distribution (dilation). The two types of mass are part of the sequence but time and distribution are adimensional, deriving form interactions of changes and manifolds—their related primary sequences.

Object Contexts

These temporal terms apply specific to topology in hypersphere terms (aka n-sphere).[5] Hyper means over or above the expected norm, although a hypersurface being a singular dimension is n-1 of the ambient 3.[6] For us, the expected norm is three spatial dimensions. This Euclidean system for Cartesian coordinates is our convenience for plotting position in time. We can use any number of alternatives for that.

The real universe uses manifold spaces where one dimension can define a line, a surface, and volume boundary, etc. It is these contextual “many shapes” that give them the name manifold. They can also conditionally define the same geometry so long as they aren’t completely valuing and defining one position twice simultaneously the same way (resulting in exclusion).

Here, each manifold is defined by a change symmetry (linear/angular) with one object context that can be either a hypersurface or hypervolume, transforming relative to the other. The object context relates how the space is being defined apart from time (sub-temporal), as a point without duration and not separated in time (achronal[7]), or with the duration of time.

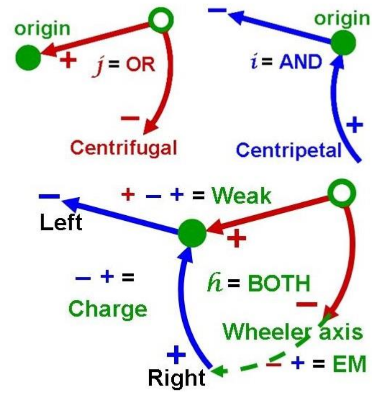
0-Sphere—a sub-chronal (sub-temporal) length, connecting an origin to its boundary. Alone it is like a spacetime breeze only going one way. It does not complete the requirements for perturbation of a singularity and must be converted for a volume.

1-Sphere—an achronal circumference OR surface. The entire space is created no matter how you divide time. These have a Schwarzschild radius[8] (r_1=2MG/c^2) or angular density limit of p_V=4π/$\mu_0 c^2$. A cycle but not a time duration is applied. Like the 0-sphere, the 1-sphere has a geometric origin. Instead of connecting the line with the origin, the line goes around the origin either as a circular (**ν**) or sinusoidal (**μ**) cycle. The 1-sphere decomposition of a volume is a torus.

2-Sphere—chronal (ij=s²) volume OR the surface on that volume alone. Chronal means it applies in any duration of time. The 2-sphere has half the 1-sphere radius ($r_1=2r_2$). This is the temporal form of a Weyl fermion or color charge including singularity. Because it is one or the other, the second space filled is excluded as a change violation.

	Complex $=k$	Real $\neq 0$	Real $=0$
$0 \Rightarrow i$	Light	Volume	Blue
$\frac{1}{3} \Rightarrow j$	Electro	Surface	Red
$\frac{2}{3} \Rightarrow h$	p⁺ | pulsar Neutron p⁻ | pulsar	GFE	Phase

Diversity (S-Entropy) — Space Type



1.3 Glome Change Operator-Defined Entropy

3-Sphere Glome—a glome is "higher dimensional," only occurring in hyperspace evaluations (3-manifolds, 4-sphere in Euclidean terms).[9] It is more intuitive than it appears as it describes the degree of interaction between a surface and volume. This is where the weak interaction combines the information of axes into an angular Wheeler space definition. The generalization forms an angular pressure zone.

4-Sphere—geodesic and other complex field interactions generalizing from the 3-sphere glome like surface gravity, displacement consistent with mass and microgravity, etc.

Maxwell's quaternionic solutions[10] lead to Adler's Quaternionic QM[11] and many more applications over the last century of physics.[12] The probability operator for interaction is a complex (k=h|i|j above) or real (t) generalization of entropy (dS) defining how value is distributed. The chiral changes and helicity are currently studied as "octonions."[13]

Glomes are renormalized composite temporal objects. A glome defines all aspects of a space: it surface, volume, and how those are combined. Their parts break down to sub-temporal, but not the whole object without losing object identity. Glomes occur where two active manifolds share a geometry requiring a third to act as a functional void. That functional void we will call a Wheeler space.

Glomes ironically fall back into the achronal segment of the object management sub-routine. They define an entire spacetime in the same instant. Any changes to that would be temporal functions of propagation. Propagation is not just light but any form of energy distribution.

Propagation just behaves very differently when it is conveyed mechanically as discrete points instead of as a latent field. Either way the end result is a void distribution in time.

Glomes are ambiguous on one level, while precisely what we expect on another. We expect volume and surface to occur together. In this way, a glome is so obvious we can inadvertently over-think it. Singularity confines volume much like a balloon being filled with air. The balloon and its fill are distinct things. The entropy (uncertainty) value is ∅ but treated as 0 because the volume and surface are not "mixed." They are distinct.

Complex glomes are ironically simple-ish. An *i*-glome is distributing (XdY) independent of intrinsic RdZ spaces. A *j*-glome has material focus. To have material focus requires value information confined by a microstate sequence defined by three complex spaces. The first space is defined by applied value. The second is defined by attributed value. The third is an exchange spacetime with both volume and pressure qualities—a distribution space. All three of these axes share the same geometric origin.

The degenerate case applies value to both surface and volume, while leaving an attributed exchange spacetime. As the word suggests, the exchange spacetime is a role handler for microstates. There always needs to be a spare space to manage the internal flow of energy. In a degenerate /nuclide density,[14] the extra distribution space is Wheeler's quantum foam[15] that alternates roles with degeneracy pressure ($2Gk^2\rho_m=f\rho_e\mu_0$).

$$\rho_m = \underbrace{\left(\frac{4\pi f}{\mu_0 k^2}\right)}_{\text{Unit Foam}} \underbrace{\left(\frac{\mu_0}{2G} = 2.34378\times10^{17}\frac{s^4}{m^2}\right)}_{\text{Density Constant}}$$

1.4 Quantum Foam in Degenerate/Nuclide Density

The helicity sequence (k) is the complex ordering of linear and angular axes. The order can be chiral consistent with anti-matter. Quantum foam is distribution space you can pour more value (f) into, but the volume increases to sustain the density. Clearly absences and emergent adimensions are no less important than what is there.

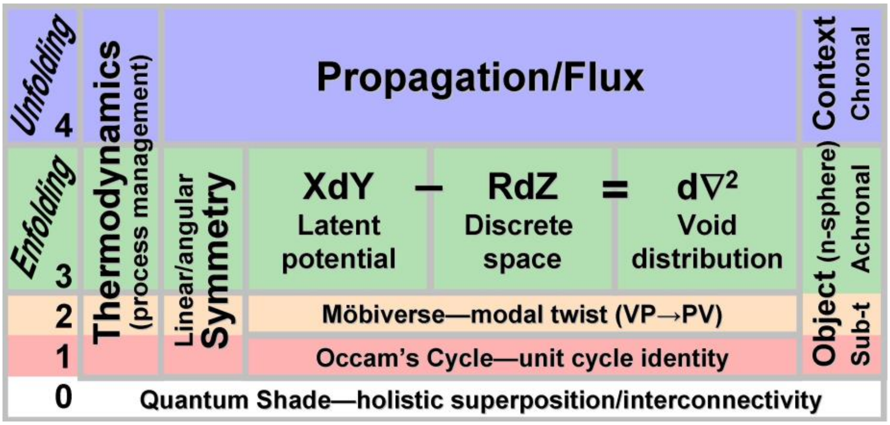
Our glome discussion seemingly takes a jump off of a technical cliff. One of our biggest challenges is juggling multiple advanced concepts at the same time. A physicist or mathematician looking at this, immediately wants detailed explanations of our operators and variables. Unfortunately, this is an elephant we are eating one bite at a time starting with the soft tissue trunk. We'll get to the harder things when their time comes. If you want to learn right, you need to slow down and not rush ahead over seeing a glimpse of more.

Process Logic

Like computers, we humans love a simple sequential process with simply defined variables. We don't like thinking of our mothers (or daughters) as wives or girlfriends, or conversely our fathers (or sons) as husbands or boyfriends. These discomforts are social programming that assure genetic diversity and prevent genetic conflicts.

The real universe recognizes each variable is like a person: it is many different context specific things. One variable can simultaneously be parent, child, sibling, worker, friend, enemy, etc. depending on context. All processes begin with an object. My inclination as a physicist it to start with literally nothing then add value in a way that defines something.

If I have nothing, then necessarily my diversity or distribution (S-entropy) is also nothing. I don't have anything to plot on a map ($d\nabla^2$). I just have an arbitrary map. When I add value to this map, I will be adding it to nothing much like a shotgun leaving a pattern on a target. Each point, however I'm defining those points, interacts with the other points relative to nothing. That interaction defines one of many possible change operator conditions. If the plot is going out of focus (XdY), it is unfolding (propagating) and the change operator becomes a polarized and simply chronal operator. If the plot is coming into focus (RdZ), it is enfolding into specific details.



1.5 Sequence of Light as Process Object

I can't just inject value into nothing. I need to have that value in a latent form, meaning it is available to do things. Nothing is also a form of opportunity. The latent object (XdY) and void object ($d\nabla^2$) already exist. Their relationship determines whether RdZ is coming in or out of focus. A change operator with focus is matter. A change operator without focus is light. I say light because energy is light put into a functional material context. Let's see what happens when we follow the sequence of light.

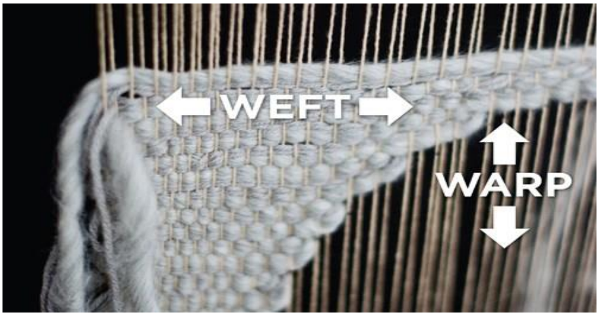
At the root we have the interconnected universe, which is required for the mechanism of propagation as we will see later. This is our third law nothing. At step 1, the first law of Thermodynamics defines a unit object. The valuation is defined by the separation of high and low potential in the second law. This gives symmetry that applies a specific modal change feature (2). Steps 0 – 2 are sub-temporal, meaning these are simply the definition without actually changing. Step 3 simply differentiates the time-relative spaces.

The time-relative spaces can be simply described as latent=out of focus, discrete=into focus, and distribution. Take an achronal cross section in time of the object so there is no difference in time between the points of that object. What is it doing in that cross section and how is that mapped? Finally apply the flow of change (flux) that time will resist. Any point in that process defined by Thermodynamics can be analyzed from all lesser stages. By following this process, the fabric of spacetime emerges.

It is unclear who actually coined the term "fabric of spacetime," and it is probably more accurate than originally intended. Clifford is credited with the fabric of spacetime concept in its present form, including the "belief (1870) that matter is only a manifestation of curvature in a space-time manifold."[16] I'm no weaver, but there are certain concepts of weaving we can all fathom easily.

To create a fabric, you first need yarn (e.g. bulk) to weave with called weft. This is our raw latent value in its initial state. The weft of spacetime is the energy of light unfolding volume consistent with heat. Stretch the yarn and twist and it will eventually become a thin and taught twine. Similarly, as light propagates it stretches itself and becomes taught and changes its role from unfolding volume to enfolding pressure.

Secondly, the twine is called warp, "the fiber you wrap around your loom,"[17] The loom of spacetime is the proportion of pressure and volume. The expansion we perceive is necessary for the opposite pressure to work. The pressure is the mechanism of low potential for propagation to flow into. They are two mutually dependent aspects of the same thing.



1.6 Weave (W) of Weft (X) in Warp (Y)

Third, we interlace the weft across the warp in a pattern. Of course in nature these are going in every which direction such that the warp acts as the mechanism propagating weft. The pattern of interaction is the difference between the weft and warp, a void space. It is available space for other things to happen. Things can build up in this space and be emitted in the same pattern. The more void available, the easier it is for things to pass through that space.

When you roll up your fabric in a tight bundle, it becomes harder for things to pass without getting stuck in the weave. This is putting light into material focus. Only interaction changing identity change the weave. The weave is essentially the microstates (ω=probability density) defining the entropy of identity ($S=k \ln \omega$ distribution).

So long as material identity exists, the entropy (uncertainty) value does not change. Change S and you change the nature of the identity and the absorption-emission pattern. Light, however, accumulates changes then loses them as it shifts and further interacts. Information must change for the universe to function. Sometimes it is held constant. Other times it is simply added to. But then it is also destroyed and over-written.

The fabric analogy for spacetime provides an excellent concrete example of functional parameters fitting light and latent space. Unfolding volume (X) is the transient heat energy of light, which here would be weft. The warp (Y) is spacetime pressure familiarly called temporal dilation. Dilation defines unit density. Finally, the Wheeler space (W) is the void distribution weaving X in Y.

The weave would thus be the void interaction of pressure and volume. In photon terms it would be the parts of light that can get through an interaction. Redshift $z=(E_1–E_2)/E_2$ describes a change in weft density. Weft density typically diverges with length as it also phase shifts, but the focus can be adjusted variously along the way. The phase shift provides opportunity for information changes like absorption lines to apply in sequence leaving at least some record of the propagation path.

Endnotes

[1] Mitchell, B. (July 9, 2018). Open Systems Interconnection (OSI) Model. https://www.lifewire.com/layers-of-the-osi-model-illustrated-818017.
(ret. Feb. 13, 2019). Application Layer. Techopedia - The IT Education Site. https://www.techopedia.com/definition/6006/application-layer.
… Presentation Layer. techopedia.com/definition/8955/presentation-layer.
… Session Layer. techopedia.com/definition/9322/session-layer.
[2] Baez, J. (Dec. 9, 2009). Renormalization Made Easy. math.ucr.edu/home/baez/renormalization.html
[3] Dollard S. (Nov. 21, 2015). "Face the Raven." Dr. Who. BBC.
[4] (ret. Feb. 4, 2018). https://en.oxforddictionaries.com/definition/resistance.
[5] Weisstein, E.W. (ret. Feb. 13, 2019). Hypersphere. MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/Hypersphere.html.
[6] Bazylev, V.T. (ret. Oct. 15, 2018). Encyclopedia of Mathematics: "Hypersurface." encyclopediaofmath.org/index.php/Hypersurface.
Rowland, T. & Weisstein, E.W. (ret. Oct. 15, 2018). Hypersurface. http://mathworld.wolfram.com/Hypersurface.html.
[7] (ret. Feb. 13, 2019). "Achronal." yourdictionary.com/achronal.
[8] Schwarzschild, K. (1916). About the Gravitational Field of a Mass Point According to Einstein's Theory. Berlin: German Academy of Sciences.
[9] Weisstein, E.W. (ret. Feb. 13, 2019). Glome. MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/Glome.html.
[10] Huray, P.G. (Nov. 4, 2011). Maxwell's Equations. Hoboken, NJ: John Wiley & Sons.
[11] Adler, S.L. (1986). Quaternionic Quantum Field Theory. https://projecteuclid.org/download/pdf_1/euclid.cmp/1104115172.
… (1995). Quaternionic Quantum Mechanics and Quantum Field Theory. Oxford University Press.
[12] CERN. Quaternion QM. cds.cern.ch/record/384318/files/9904067.pdf.
Graydon, M.A. (2011). Quaternions and Quantum Theory. uwspace.uwaterloo.ca/bitstream/handle/10012/6168/Graydon_Matthew.pdf.
[13] Wolchover, N. (July 20, 2018). The Peculiar Math That Could Underlie the Laws of Nature. https://www.quantamagazine.org/the-octonion-math-that-could-underpin-physics-20180720/.
[14] Nave, R. (2017). Nuclear Size and Density. University of Georgia. hyperphysics.phy-astr.gsu.edu/hbase/Nuclear/nucuni.html#c4.
(2018). Atomic Nucleus. cyberphysics.co.uk/topics/atomic/nucleus.htm.
[15] Wheeler, J.A. & Ford, K.W. (2010). Geons, black holes, and quantum foam : a life in physics. New York: W.W. Norton & Company.
[16] Bell, E.T. (1940, reprint 2017). The Development of Mathematics. Dover.
[17] (Apr. 23, 2018). The 3 Elements of a Quality Weaving (And How to Achieve Them). mirrixlooms.com/blogs/mirrix-blog/the-3-elements-of-a-quality-weaving-and-how-to-achieve-them.
Picture credit: https://www.theweavingloom.com/what-does-warp-mean-basic-weaving-terminology/.

2. The First Frontier

SPACE! The final … err… first frontier?

Three centuries of modern scientific debate has not settled what space is.[1] To pun off Cummings with an echo of Leibniz, space prevents everything from happening together. It does so much more than limit the value in it. It also limits the ways values and distributions apply. Space isn't just one thing. It is a continuum of things resisting change in identity.

Existentialist Kantian arguments of space and time try to suggest we have been duped by Relativity. To the existentialist, space and time are just illusions—a distortion of reality.[2] That isn't as bad as it sounds. Illusions have a mental or social function, delusions (hallucinations) do not. Classical treatments of time and space for plotting are concepts with social function. They don't deny other working views (delusion), they just don't go there (humble focus). They are convenient to our basic practical purposes.

Relativity offered a different approach. It was a challenge to physicists in its day. As I look out into the world of PhDs in physics backing a comment declaring spacetime isn't real and doesn't do things, it is obviously still a challenge. If it isn't real and active, you don't have dilation, fields, lensing, etc. You are back to 17th century classical physics because the 18th century already figured out what Einstein's work punctuated.

Relativity took a different path by putting time and space together. This was a step in the direction we take here that applies the quantum solution of "everyone is right from their perspectives." At one end is Leibniz' field space dependent on things. On the other: Clarke's void space that is something and remains despite or simply as an absence of things. The continuum between space-like (time resisting change and space resisting change in position) and time-like (space resisting change and time resisting change in position) is spacetime.

The real questions are: spacetime is active in what ways? What does it do? How? What are space and time? Let's start with an overview.

Special Relativity

It was 1905 when Max Planck made the greatest discovery in the history of physics: Einstein, the original and some would argue only true physics superstar. What makes the physics superstar?

Timing—Timing is a function of quantum mechanics, namely a comedy of events all coordinating at a seemingly improbable point drawing attention to itself. Einstein debuted with the birth of modern media.

Conceptualization—Einstein was young and trying to put things together into working algorithms for himself. He basically took two centuries worth of physics and brought it together in one set of related ideas.

Imagination—He expressed those related ideas in story forms that inspired the imaginations of experts and ordinary people alike.

Practicality—And they provided testable solutions that were not only proven but put into practical use from nuclear power plants to satellites and smart phones. Beware not to confuse scientific with social practicality, although quite often they rhyme.

Support—Max Planck gave him the opportunity to make his debut and have an audience. Many become superstars just by drawing an audience despite having nothing real or useful to offer.

Einstein did all this by publishing a series of papers few fully understood then, or even now, around which Special Relativity formed. At the heart of these was the study of how energy and spacetime work. Unfortunately, he got distracted by fame from completing these studies. What he did was enough to baffle scientist even through today.

Special Relativity establishes reference frames, states the laws of physics are constant within a frame, and the speed of light is the same for all reference frames. The difference between reference frames is temporal dilation that slows clocks with acceleration and reduces "length."[3]

The term inertial appears regularly with reference frames. Inertial means having a rest state quality—a feature of matter. It is also used to describe anything with a constant velocity. As a rule, non-inertial is used to describe acceleration relative to an inertial frame.[4] In his own words: [5]

> THE special theory of relativity is based on the following postulate, which is also satisfied by the mechanics of Galileo and Newton.
>
> If a system of co-ordinates K is chosen so that, in relation to it, physical laws hold good in their simplest form, the *same* laws also hold good in relation to any other system of co-ordinates K′ moving in uniform translation relatively to K. This postulate we call the "special principle of relativity." The word "special" is meant to intimate that the principle is restricted to the case when K′ has a motion of uniform translation relatively to K, but that the equivalence of K′ and K does not extend to the case of non-uniform motion of K′ relatively to K.
>
> Thus the special theory of relativity does not depart from classical mechanics through the postulate of relativity, but through the postulate of the constancy of the velocity of light *in vacuo*, from which, in combination with the special principle of relativity, there follow, in the well-known way, the relativity of simultaneity, the Lorentzian transformation, and the related laws for the behaviour of moving bodies and clocks.

2.1 Einstein on Special Relativity

All the language around this is classical motion. We will expand this to include the propagation of light and its effect on the qualities in light. This shifts our focus from dilation to the complex velocity function in the dilation function that carries over into redshift. This is the same velocity function originally called "radial velocity" that later evolved to "apparent velocity" and all Hubble's challenges to Lemaître's expansion interpretation.[6]

New data to be expected in the near future may modify the significance of the present investigation or, if confirmatory, will lead to a solution having many times the weight. For this reason it is thought premature to discuss in detail the obvious consequences of the present results. For example, if the solar motion with respect to the clusters represents the rotation of the galactic system, this motion could be subtracted from the results for the nebulae and the remainder would represent the motion of the galactic system with respect to the extra-galactic nebulae.

The outstanding feature, however, is the possibility that the velocity-distance relation may represent the de Sitter effect, and hence that numerical data may be introduced into discussions of the general curvature of space. In the de Sitter cosmology, displacements of the spectra arise from two sources, an apparent slowing down of atomic vibrations and a general tendency of material particles to scatter. The latter involves an acceleration and hence introduces the element of time. The relative importance of these two effects should determine the form of the relation between distances and observed velocities; and in this connection it may be emphasized that the linear relation found in the present discussion is a first approximation representing a restricted range in distance.

Hubble's 1929 Conclusion

DECEMBER 31, 1941.—[PART I.]

Savant Refutes Theory of Exploding Universe

Mt. Wilson Astronomer Reports Results of Long Searching With 100-Inch Telescope

DALLAS, Dec. 30. (/P)—The world's largest telescope shows that the universe probably is not exploding but is a quiet, peaceful place and possibly just about infinite in size.

The observations were made with the 100-inch telescope at Mt. Wilson, Cal., and reported to the American Association for the Advancement of Science tonight, by Dr. Edwin P. Hubble, the astronomer who for years had done the most study of the far-out parts of the universe.

This telescope sees an area about 1000 light-years across, a light-year being the distance light travels in one year. The earth is at the center of this space, with the Milky Way immediately around the earth.

In this space there appears to be about 100,000,000 other milky ways, or nebulae, each a vast family of suns, gases and presumably comets and other familiar celestial objects.

UNIFORMLY SPACED

These 100,000,000 nebulae show two things:

One, they are on the average uniformly distributed, about 2,000,000 light-years apart, with near-vacuum between them.

Two, the light of the more distant ones is dimmed in a peculiar way, called the red shift. This dimming could mean that they are receding, rushing away from earth, and if that is true, the farthest away ones now visible are traveling 25,000 miles a second.

This speed of recession led astronomers a few years ago to say the universe probably is exploding.

THEORY REFUTED

But Dr. Hubble reported that six years' scrutiny through the 100-inch eye does not bear out the explosion theory.

The nebulae could not be uniformly distributed, as the telescope shows they are, and still fit the explosion idea.

Explanations which try to get around what the great telescope sees, he said, fail to stand up. The explosion for example would have had to start long after the earth was created, and possibly even after the first life appeared here.

REMAINS MYSTERY

Another explanation, the supposed curvature of space, requires a density of distant nebulae which the telescope fails to find.

While the expanding theory cannot be abandoned, Dr. Hubble said, the nebulae may be endlessly distributed, on and on, virtually to infinity.

2.2 Hubble's Refutation

Hubble was derided in the L.A. Times article,[7] his evidence flubbed. Then he is regularly misrepresented, as with the claim of him stating the law given his name in the three page document from which the concluding paragraphs above comes from.[8] As NASA observes:

> The Big Bang model is not complete. For example, it does not explain *why* the universe is so uniform on the very largest scales or, indeed, why it is so *non*-uniform on smaller scales, i.e., how stars and galaxies came to be.[9]

Most think the case on expansion is closed. Few realize the evidence conflicts (depth of field increases but surface does not) and Lemaître was opposed by the scientific community now claimed to support him. Those claims caused a lot of friction in the scientific community lost in the history written by the victors. Closer examination shows the problem is more complex than expansion. It also shows popular media is casting a long shadow over real science and history, which is unhealthy to progress.

Science is not a competition. It is fair if not expected to respect the genuine work and theories of other scientists. That means turning over all the historic rocks and asking why Einstein, Tolman, Hubble, Eddington, de Sitter, and so many more rejected Lemaître's interpretation. Each of these scientists had a legitimate case to make, even if they did not always have the perfect words or superstar moment available to make their cases.

We are not here to make any of those cases or arguments. We are here to solve the problem of the pattern within which these interpretations arose. We can then assume all the perspectives are correct within the reasonable boundary conditions of their frame of reference. The quantum solution says all perspectives are contextually right.

History placed its bets on the probability density Lemaître defined. Lemaître defined the most accessible perspective, consistent with Leibniz's matter-dependent space. Lemaître's expanding universe is open with perpetually increasing entropy. It's missing a few things like functional spacetime, space being something (Clarke), conservation and some of the less familiar aspects of the laws of Thermodynamics. These are what Einstein was attempting to re-assert with his static model.

Now let's see how cultural habits and science are both right.

Shape Models

Shape models study path angles (linear, hyperbolic, circular)[10], connectivity (simply, multiply), and limits (finite, infinite).[11] All of these are true depending on perspective. Our biggest challenge is showing how all these perspectives come together into one working universe.

The universe consists of an uncountable but finite number of discrete finite things occupying their own positions (**finite**, **multiply** connected). Discrete things can take in or put out as much value as is available. Their displacement and related dilation process make these **hyperbolic** spaces.

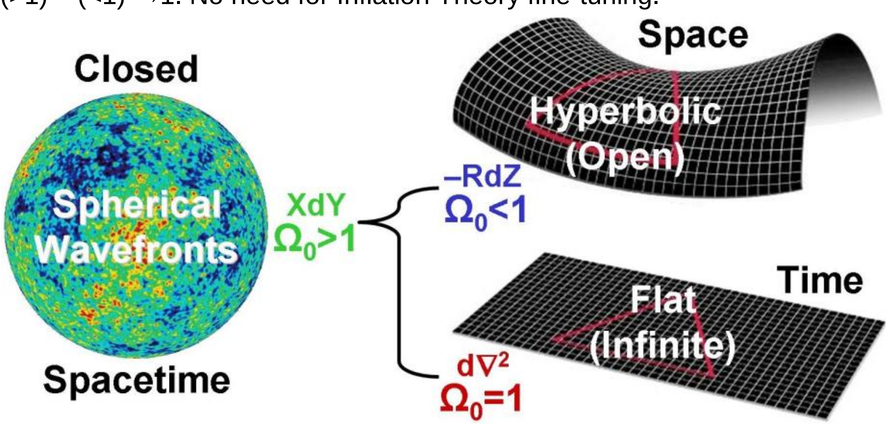
Time defines the positions and paths of these things. The path of time is **linear**, and its uninterrupted duration (**simply** connected) as a flux resistance to change is without beginning or end (**infinite**). These two systems interact and transfer value forming **spherical** wavefronts that confines finite value across infinite position. Confinement hides from direct observation by strong interaction shaping spacetime.

Geometry describes the way path and position are determined. For example, a straight walk on Earth will bring you into a circle describing a spherical geometry. As NASA Reports:

> WMAP has determined the geometry of the universe to be nearly flat. However, under Big Bang cosmology, curvature grows with time. A universe as flat as we see it today would require an extreme fine-tuning of conditions in the past, which would be an unbelievable coincidence.[12]

Fine tuning that conforms facts with more hypothesis to fit theory is a human coincidence. What is unbelievable is science putting social expectations ahead of empirical facts and critical thinking. Their answer is an Inflation hypothesis that cannot be proven. Let us help them by putting the facts together.

Big Bang is hyperbolic, unfolding in a perpetual process of expansion. CMB consists of spherical wavefronts. These are standing waves ideal for converting roles by changing the nature of focus, like the coil in an ice machine. Their difference flattens enfolding space into unfolding time, expanding hyperbolic volume into conserved pressure. It is basic math: (>1) – (<1) →1. No need for Inflation Theory fine-tuning.



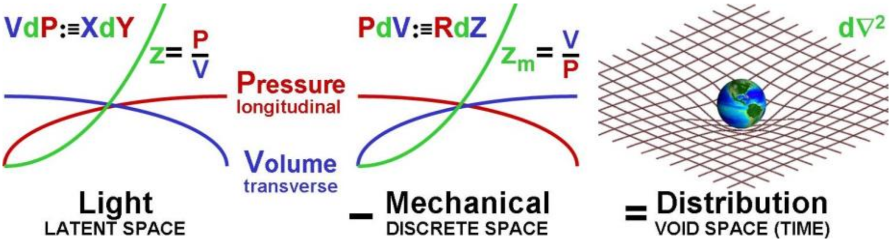
2.3 Cosmological Geometries

This is a solution Einstein and Lemaître can finally agree with. At least at first. Lemaître will eventually realize this means his cosmic eggs hatch all over the universe on their own time scales—a quantum mechanical nightmare for those wanting easy answers. Their continuing processes are the multiply connected points in the anomaly of CMB. If Lemaître were really smart, he would take this as a win, declare time and the process as god's creation, let science go back to being science, and leave the Vatican in a better position to sustainably adapt with science than ever before.

Space Basics

Wave functions and Thermodynamics provide ways to dissect and reconstruct spacetime. Wave functions divide into three syllogistic groups: mechanical, light, and field. From our perspective, light is a special case of electromagnetic field potential. In an applied sense, electromagnetism describes a reciprocating field conserved by exchanging value with itself. As a potential, light's reciprocation is typically indirect, and unlike a field, without direction to make it a vector.

Energy always flows from high to low potential. This is the ideal way to write the second law of Thermodynamics. It is typically read in mechanical wave terms where distribution (S-entropy) converts pressure (isolation) into volume distribution.[13] Clausius, the father of this law and entropy (S), saw it goes both ways as we are describing.[14] There is a significant difference in state between these paths.



2.4 Möbian Wave Shifts

The space of a mechanical wave is a multiply connected set of discrete material points. This is Leibniz's space as a relation among things.[15] Each point has individual qualities affecting wave shape, speed, and amplitude. This space is not "free." We will call this a **discrete space** because it represents a set. In external context it creates a hyperbolic displacement. It is a working space (δW≡PdV→RdZ), equivalently assigning energy roles to spatial manifolds P:≡R|Y and V:≡Z|X.

Light does not have discrete space. Light offers void and discrete spatial potentials. Light potentials are dormant, hidden until a context can reveal them making them **latent spaces**. Latent space is a potential space (δQ≡VdP→XdY) with both discrete space-like and time-like qualities. The Möbian shift is from space-like volume (X) to time-like pressure (Y).

Waves define a whole space in a simple unit cycle. The shift in the cycle twists two sides by circular function into one. However… A discrete space consists of local wave spaces confined as circular functions. The whole is open, creating a hyperbolic displacement where value is exchanged with latent space. Any value change affects unit values of scale (dilation). The most familiar is value flow diverging ($\imath$) from focus ($\jmath$) resisted by time ($dt=\delta\jmath+\delta\imath$). Dilation affects the flux rate allowed.

If discrete working space is our thesis, then latent potential space is its antithesis. These synthesize ($\delta Q-\delta W=dU$) into Clarke's concept of what remains when you take everything else away: **void space** ($d\nabla^2$). A void space is the difference between a whole and its parts, a Laplacian generalization. That difference is best described by TdS: the entropy (S) distribution of thermal value (T).

Laplacian gradient distribution flat d'Alembertian

$$\left(\nabla = \frac{\partial}{\partial x}i + \frac{\partial}{\partial y}j + \frac{\partial}{\partial z}k\right)^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} = \Box + \left(\frac{1}{c^2}\right)\left(\frac{\partial^2}{\partial t^2}\right)$$

2.5 Flat Distributions

The Laplacian (∇) describes a "divergence of the gradient,"[16] here shown as a rectilinear (Cartesian xyz) generalization distributing a value matrix (ijk). Notice the value matrix is given quasi-complex operators as reference. These blend into the square in a way similar to actual complex operators (*hij* always shown in *Lucida Calligraphy* font).

The d'Alembertian ($\Box$) was devised in 1746 and expanded by Euler in 1748 to generalize the wave equation ($\psi\Box^2=0$). The result is a conserved and flat spacetime.[17] It does this by combining two phases of the wave that draw upon each other to flow.

Void is a flat, simply connected distribution in time. As flux resistance to change, time is like void space: not technically a dimension. As Ray Cummings (1921) put it: "time is what keeps everything from happening at once."[18] A dimension must have an independent intrinsic function to which value applies. Void and time are dependent variables making them adimensions. They measure relationships between independently functional things in a common proportion ($c=\nabla/t$).

> Thirty spokes are joined together in a wheel,
> but it is the center hole
> that allows the wheel to function.
>
> We mold clay into a pot,
> but it is the emptiness inside
> that makes the vessel useful.
>
> We fashion wood for a house,
> but it is the emptiness inside
> that makes it livable.
>
> We work with the substantial,
> but the emptiness is what we use.[19]

Void and time provide the space and increment needed to function. We often forget not only the requisite emptiness, but the limit to that emptiness that makes it functional. This is particularly relevant to matter. Matter needs to provide a space for its value to define. If there isn't at least one available space to exchange value with, then that space must be created by excluding something else.

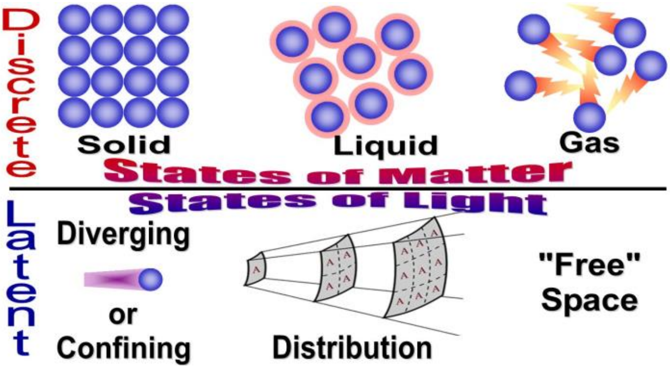
Phase Modeling

Phase is physics for the moment in time, but it also means an aspect or stage in a process. Our space basics provided two phase states (discrete and latent) and their difference (void). These phase states are generalizations of how space is being defined and used.

While the difference accommodates traditional Euclidean dimensions and other coordinate systems of convenience, the two states describe a functional hyperspace. Hyper~ means over, which in this case is more than the traditional three acting as the ambient space for mapping position. The individual derivative dimensions are labeled hypersurfaces (R and Y) and hypervolumes (X and Z) to indicate their roles and group membership.

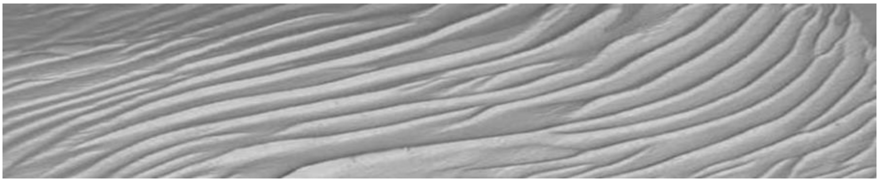
Hypersurface is inaccurately but commonly described as "one less than that of its ambient space."[20] It is n-1 because it is part of a more complex definition of space that is m+1 dimensions. That is where hyper~ (over) applies instead of hypo~ (under). A hypervolume is also defined in only one spatial dimension.

The only thing seemingly missing from this spacetime model is time, which determines the presumptive shape. The moment of time (phase) consists of all the coordinates no matter their hyperspace membership. When you add a time variable specifically, you set the entire model into motion by giving it a duration of resisted changes. While that is practical in an applied sense, we first need a map of the entire phase model.



2.6 States of Matter and Light

From the phase states perspective, the states of matter and light are simply familiar observational points along a shifting continuum. Phase shift for any group type has only three forms: surface, volume, and relative balance. These stages stand out well as the solid, liquid, and gas states of elements. These stages assume stable matter, not perturbations.



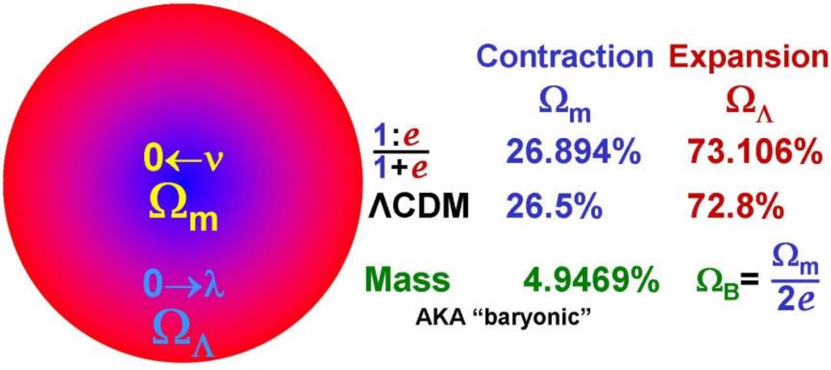
2.7 Bay Floor Shape "Perturbations"

Perturbation occurs when energy in a field comes into focus fitting a material definition. They are generally temporary and can move around in the field. If the bay and its floor are a field, then the shapes on the floor can be classified into forms. Perturbation is wherever a defined form occurs. The defined forms for matter are interactive so they can compound in ways that become independent of the field. When they are independent they are officially discrete using the hyperspace variables RdZ.

Some list five states of matter, adding plasma and Bose-Einstein condensate.[21] Five is inaccurate because a plasma is a group of confining nucleons, and a condensate is a group of diverging weak bosons. These groups exist as changes in the definition of matter split along the phase state borderline into discrete convergence and latent divergence.

This of course begs the question: when do you apply RdZ or XdY? A neutron star or other baryonic degenerate is individually convergent and presumably discrete (RdZ). Electron degeneracy (pressure) like a white dwarf, weak bosons, or other divergence are latent (XdY). Increasing value focuses their use of space.[22] Atoms are incorrectly classified as baryonic despite being a balance of both.

Both XdY and RdZ can satisfy the geodesic field requirements for mass by the way surface (R|Y) and volume (Z|X) interact. Mass increases Z (volume) and Y (pressure), decreasing R (pressure) and X (volume). The result is a degenerate density (RdZ) like a neutron star increases its volume until it emits the excess, most likely as jets. Electron degeneracy (XdY) conversely contracts until exclusion forces emission.



2.8 Spacetime Bubble Proportions

Clearly, matter is not just discrete. A significant part of matter consists of latent spaces. An extremely small part of matter is truly discrete as needed to ideally satisfy RdZ like true baryonic matter. Beware definition differences. Baryonic ($\Omega_B = \Omega_m / 2e < 5\%$) in astronomy includes all matter with mass proportional to dark matter but a subset of the dark energy statistic.[23]

NASA's Wilkinson Microwave Anisotropy Probe (WMAP) is a satellite project for gathering CMB information.[24] That includes the clearly hyperbolic parameters of the ΛCDM model[25] with a universal proportion of $1{:}e$.[26] Dark matter ($\Omega_m = 1/(1+e)$) is contraction, the ΛCDM symbol for mass density. Dark energy ($\Omega_\Lambda = e/(1+e)$) is spacetime expansion (distribution).

Their interference is a flat phase space ($\Omega_k = \Omega_m + i\Omega_\Lambda$) with circular detail—"a rolling homogeneous scalar field" referred to in the arcane term quintessence.[27] Phase means the moment, giving spacetime a functioning metric, an active spacetime metric as E=PV suggests. These popular science distinctions have everyone, even scientists, understandably confused.

Symmetry Shift

The Möbian shifts internal to discrete and latent spaces are dilation and redshift. Conjoining these into a function to shift between latent and discrete is complex velocity. The twists can be helically smooth or disconnected as we see with states of matter. Not only do Möbian twists shift within the categories, but also between them. The universe is full of these "timey wimey" twists shifting symmetry, which is why we called this architecture sub-process the Möbiverse. It is literally everywhere.

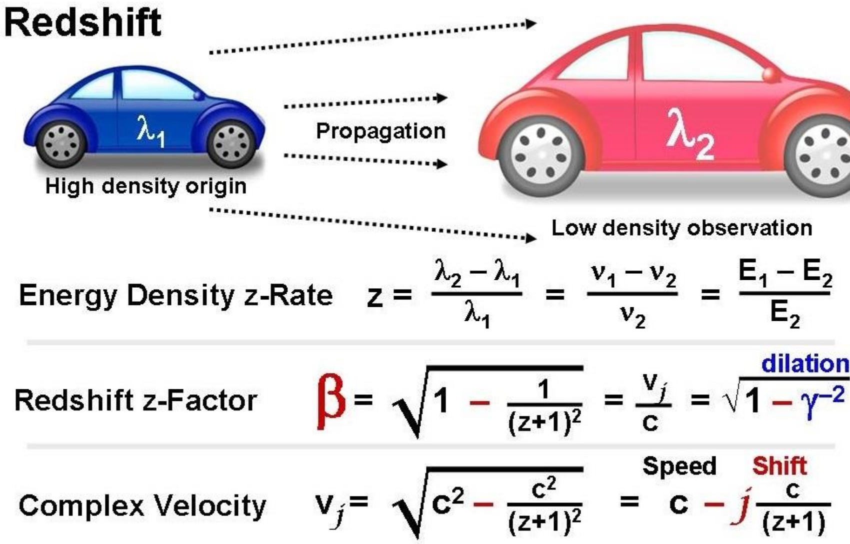
$$\underbrace{\gamma^{-2}}_{\text{dilation}} = 1 - \left(\underbrace{\beta^2 = \frac{v_f^2}{c^2}}_{\text{complex velocity}} = 1 - \underbrace{\frac{1}{(z+1)^2}}_{\text{redshift}} \right)$$

2.9 Complex Velocity in Context

Just as modern astronomers bundle all mass under the heading "baryonic," they also bundle all motion and distance with redshift. This is an echo of a problem that haunted both Hubble and Doppler we will detail soon. Scientists working with these phenomenon on Earth don't have these problems. To better understand the details to come, we will start with the big picture.

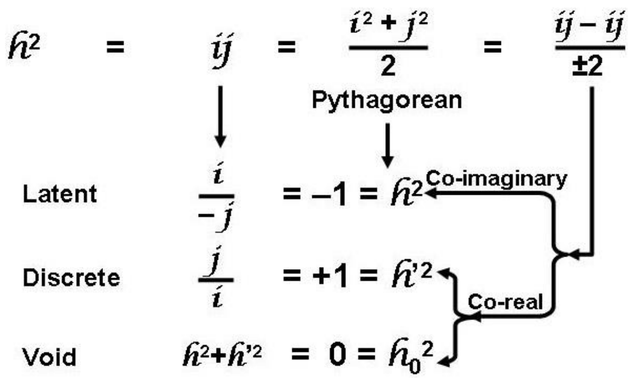
Chiral means imperfect mirroring. As we have already seen, latent and discrete spaces have chiral qualities. Each state is subject to a shift that converts between volume and pressure defined alternately by linear and angular values. These distinctions are more clear and stable in discrete spaces. In latent spaces they generalize and are vulnerable to losing their original identities.

Flat spacetime distribution ($d\nabla^2$) provides the variables common to both discrete RdZ and latent XdY: change in position relative to time. In mechanical wave terms this is radial velocity. As material motion it is β=v/c subject to dilation by Lorentz factor as the role of energy is divided between motion and redefining the local space. Hubble used “apparent velocity” to try to describe the analogous redshift effect with light.



2.10 Complex Velocity and Redshift

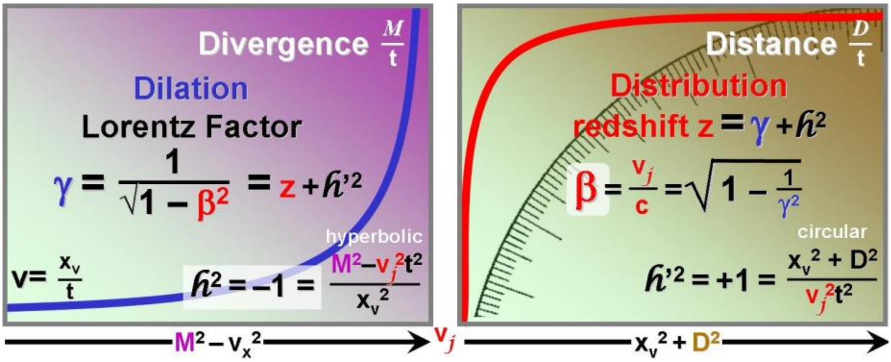
We will use the term “complex velocity” to cover the full range. **Complex velocity** is the variable rate in how a space changes over time. It is not a statement of motion although it does contain motion elements. Those elements follow a logical symmetry where divergence leads into velocity on one side while velocity leads into distance on the other.



2.11 Hypercomplex Symmetry Definition

Real numbers fail to show the changes. If we apply the scalar effects to their classes, dilation (γ) is discrete, redshift (z) is latent, and z –γ=–1. The –1 hides a hypercomplex variable ($\hbar^2$=–1) in plain view.

This hypercomplex is called phase entropy because it provides the entire probability range of change symmetries in any and all moments. Each complex change operator also has a symmetry of its two spaces. The difference is in the logic defining the operator (+OR– =j, –AND+=i) and under what conditions those roles change. The squares of all three of these operators are –1.



2.12 Complex Velocity Symmetry Shift

Latent roles (i) flip only on direct interaction (product and division). They behave as we expect with basic math. Discrete roles (j) change opportunistically, like magnets flipping to line up. This flipping roles in sums and differences provide counter-intuitive results like $j+j=0$ and $j-j=2j$. We observe that $i^2+j^2=-2$, which is indistinguishable and therefore follows the context from $2\hbar^2=ij-ij=2ij$ instead of 0. The ±2 basically says it doesn't matter which comes first.

We will come back into these in great detail later. This is enough at the moment to see a change in orientation between latent and discrete spaces doesn't continue or perfectly mirror the effect the same way. They are chiral. The chiral forms of the operators square to +1. Just when you thought math couldn't get any more annoying, complex variables can hide in plain view even with a +1. Just look for changes in logic and symmetry.

Complex velocity is the common thread spanning the full continuum of reference frames. Traditionally, reference frames are about material motion and observational differences. They are normally divided into inertial (moving uniformly together) and non-inertial (accelerating or angular).

As you accelerate, your use of spacetime focuses the surface (R) proportional to the Schwarzschild radius. This puts the volume (Z) under pressure until it reaches its limit, spills out of its surface and diverges as emission (X). The same concepts apply in reverse and slightly different ways with redshift.

Redshift is the ratio of energy change to observation $z=(E_1-E_2)/E_2$. Luminosity in Watts/frequency=(kg m^2/s^3)(s/cycle) is light energy. Its mass equivalent ($m_L=L/c^2$) resists phase shift in light. The higher the redshift, the lower the resistance is to change. Light distribution follows inverse square law ($E=I/r^2$) allowing for an easy way to measure distance if you know the change in energy, as with radar.[28] The energy isn't lost. Its density is simply distributed and systematically converted from unfolding volume (X) into enfolding pressure (Y).

Endnotes

[1] Thomas, E. (Oct. 19, 2017). What is space? The 300-year-old philosophical battle that is still raging today. https://phys.org/news/2017-10-space-year-old-philosophical-raging-today.html.
[2] West, L.J. (ret. Mar. 18, 2019). Illusion. britannica.com/topic/illusion.
[3] Sevian, H. (Apr. 10, 1998). Special Relativity. Boston University. physics.bu.edu/py106/notes/Relativity.html.
[4] Howard, D. (ret. Jan. 11, 2019). Inertial Frame of Reference. study.com/academy/lesson/inertial-frame-of-reference-definition-example-quiz.html.
Guwahati, I. (Dec. 31, 2009). Non-inertial frame and Fictitious forces. https://nptel.ac.in/courses/122103011/3.
[5] (1997). The Collected Papers of Albert Einstein. Vol. 6. Trans. by A. Engel. A.J. Kox, M.J. Klein, R. Schulmann eds. Pg 147. hermes.ffn.ub.es/luisnavarro/nuevo_maletin/Einstein_GRelativity_1916.pdf.
[6] Sandage, A. (1989), "Edwin Hubble 1889–1953", The Journal of the Royal Astronomical Society of Canada, Vol. 83, No.6. https://apod.nasa.gov/diamond_jubilee/1996/sandage_hubble.html.
[7] Harnisch, L. (Dec. 31, 2011). Hubble: No Evidence of 'Big Bang' Theory. ladailymirror.com/2011/12/31/hubble-no-evidence-of-big-bang-theory/.
[8] Hubble, Edwin (Jan. 17, 1929). A relation between distance and radial velocity among extra-galactic nebulae. PNAS. **15** (3): 168–173. www.pnas.org/cgi/reprint/15/3/168.
Robert P.K. (Jan. 6, 2004). Hubble's diagram and cosmic expansion. PNAS. http://www.pnas.org/content/101/1/8.full.pdf+html.
[9] Wollack, E.J. (Apr. 16, 2010). Beyond Big Bang Cosmology. NASA, WMAP. https://map.gsfc.nasa.gov/universe/bb_cosmo.html.
[10] Schombert, J. (2015). Cosmology: Geometry of the Universe. abyss.uoregon.edu/~js/cosmo/lectures/lec15.html.
[11] Tegmark, M. (2014). Our Mathematical Universe: My Quest for the Ultimate Nature of Reality. NY: Knopf.
[12] Wollack, E.J. (Apr. 16, 2010). What is the Inflation Theory? https://map.gsfc.nasa.gov/universe/bb_cosmo_infl.html.
[13] (Jan. 3, 2016). Work. UC Davis LibreTexts. http://chemwiki.ucdavis.edu/Physical_Chemistry/Thermodynamics/Path_Functions/Work.
[14] O'Connor, J.J. & Robertson, E.F. (Dec. 2000). Rudolf Julius Emmanuel Clausius. www-groups.dcs.st-and.ac.uk/history/Biographies/Clausius.html.
[15] Thomas, E. (Oct. 19, 2017). What is space? The 300-year-old philosophical battle that is still raging today. https://phys.org/news/2017-10-space-year-old-philosophical-raging-today.html.

[16] Nave, R. (2017). The Laplacian. University of Georgia. hyperphysics.phy-astr.gsu.edu/hbase/lapl.html.
Horan, R. & Lavelle, M. (Apr. 4, 2005). The Laplacian. https://www.plymouth.ac.uk/uploads/production/document/path/3/3744/PlymouthUniversity_MathsandStats_the_Laplacian.pdf.
Weisstein, E.W. (ret. Jan. 14, 2019). Laplacian. MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/Laplacian.html.
[17] Weisstein, E.W. (ret. Oct 16, 2018). d'Alembert's Solution. http://mathworld.wolfram.com/dAlembertsSolution.html.
[18] Cummings, R. (Jan. 8, 1921). The Time Professor. Argosy All Story Weekly. Vol. 129, Issue 3.
[19] Lao Tse's Tao Te Ching v11 quote by Soon Teo. (Dec. 5, 2015). A Pot is Useful for its Emptiness. tao-in-you.com/a-pot-is-useful-for-its-emptiness/.
[20] Bazylev, V.T. (ret. Oct. 15, 2018). Encyclopedia of Mathematics: "Hypersurface." encyclopediaofmath.org/index.php/Hypersurface.
[21] Bagley, M. (Apr. 11, 2016). Matter: Definition & the Five States of Matter. https://www.livescience.com/46506-states-of-matter.html.
[22] Rieke, G.H. (Nov. 24, 2007). White Dwarf. Tucson: University of Arizona. ircamera.as.arizona.edu/NatSci102/NatSci/lectures/whitedwrf.htm.
[23] (ret. Jan. 28, 2019). Baryonic Matter. Swinburne University of Technology. astronomy.swin.edu.au/cosmos/B/baryonic+matter.
[24] Griswold, B. (Dec. 22, 2017). Wilkinson Microwave Anisotropy Probe. https://map.gsfc.nasa.gov.
[25] (Jan 18, 2018). Dark Matter. home.cern/about/physics/dark-matter.
[26] (Jan 18, 2018). Dark Matter. CERN. home.cern/about/physics/dark-matter.
[27] Ratra, P. & Peebles, L. (1988). Cosmological consequences of a rolling homogeneous scalar field. Physical Review D. https://journals.aps.org/prd/abstract/10.1103/PhysRevD.37.3406.
Dvali, G. & Matias Zaldarriaga, M. (Jan. 8, 2007). Changing α With Time: Implications For Fifth-Force-Type Experiments And Quintessence. cds.cern.ch/record/515241/files/0108217.pdf.
[28] (ret. Jan. 26, 2019). How radar works. weather.gov/jetstream/how.

3. Dark-ish Matters

The speed of dark is c.

What is dark leads naturally to, what is light? You look up at the night sky and see points of light representing planets, stars, and even galaxies. Between them you see a vast dark space. Surely that is darkness right?

Our whole idea of darkness is based on observing the unfolding distribution of volume as light. The universe is a giant unfolding volume. Most of that is not unfolding in ways fitting direct optical observation and thereby classified as “dark energy.”

Not all volume is unfolding. Surfaces provide pressure that changes light qualities, contains it, acts as low potential for high potential volume to unfold into, etc. In general these are the enfolding qualities of the universe consistent with the concepts of dilation and dark matter.

Within this contraction of spacetime is the familiar subset of matter, including both discrete and latent forms. Likewise, all motion, whether latent of discrete in nature, gets classified as dark energy. Dark matter, dark energy, and everything between are basically Thermodynamics effects on relativistic spacetime. These problems aren’t such mysteries when you associate with people whose work explains the laws.

Black Oops

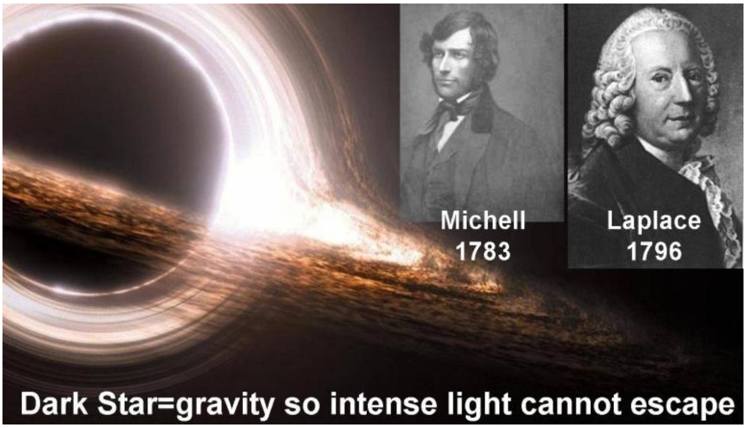
Thermodynamics debuted in the 19th Century and has become indisputable practical engineering, fundamental to changes on every scale. There is no shortage of ambiguous explanations or attempts to enhance the laws as with the so-called “zeroth law” (commutation of equilibrium: if a=b and b=c then a=c).

Being pragmatic, we want to get to the point and show how energy works with minimal ambiguity. Ironically this means showing both barrels of each of the original three laws. To complete the energy picture we need to add Perkins’ conversion and Fleming’s sequence. We also need to account for the emergence of singularity and its perturbation in the second and third laws. This perturbation solves a fifty year old misunderstanding of black holes.

> In the fall of 1967… I argued that we should consider the possibility that the center of a pulsar is a gravitationally completely collapsed object. I remarked that one couldn't keep saying “gravitationally completely collapsed object” over and over. One needed a shorter descriptive phrase.
>
> “How about black hole?” asked someone in the audience. I had been searching for the right term for months, mulling it over in bed,

> in the bathtub, in my car, whenever I had quiet moments. Suddenly this name seemed exactly right.
> When I gave a more formal Sigma Xi-Phi Beta Kappa lecture … on December 29, 1967, I used the term, and then included it in the written version of the lecture published in the spring of 1968. (As it turned out, a pulsar is powered by "merely" a neutron star, not a black hole.)
>
> —John Archibald Wheeler[1]

The controlling feature is indeed the degenerate density of a neutron star. The cool "pulse" effects are a part of its quantum foam (another Wheeler term) still acting like a singularity. Wheeler is saying the closest thing to a gravitationally completely collapsed object is a degenerate density (2.3478E17kg/m^3), NOT a black hole. A black hole is a totally different type of gravity phenomenon.



3.1 The 18th Century Dark Star

A dark star is what he was trying to describe by gravitationally collapsed object. It was an idealization of gravity dreamed up by Mitchell and Laplace in the 18th century.[2] It doesn't actually work despite prestigious echoes like NASA's: "A black hole is a place in space where gravity pulls so much that even light can not get out. The gravity is so strong because matter has been squeezed into a tiny space."[3]

The popular media loved the idea of gravitationally collapsed as did the rest of physics. It inspires the imagination with questions to nowhere. It isn't that the ideas are entirely wrong, just over-played. Sound familiar? Everyone jumped on this incorrect interpretation and completely missed the source's retraction, or as with other scenarios the more authoritative voices of dissent. It made great headlines and sold a lot of ad space.

Hawking radiation is another retraction everyone conveniently misses. It is entirely dependent on surface gravity[4] even when you ignore everything else wrong with it. Hawking retracted it by eliminating its main requirement: "The definition of a singularity of spacetime is given in terms of geodesic incompleteness."[5] Geodesic incompleteness means a black hole has no surface gravity consistent with Birkhoff's Theorem.[6] But let's not get too far ahead of ourselves.

As a teacher, I am prone to looking for mnemonic devices. To that end, I took the liberty of associating key names to each of the laws. The law number isn't half as important as comprehending the totality of the law and the main contributor to that line of thought.

1. Noether's Law (Conservation)

Energy transforms but is not created or destroyed. This has three parts: closed and conserved, open and inefficient, and fixed unit.

- **An isolated system is closed, not working or being worked on, cyclic and holds the unit of energy constant.**[7]
  dU=TdS–PdV is circular because TdS╪PdV are two aspects of the same thing. If TdS is the energy distribution definition then PdV is the effect. Change to one is simultaneous to the other.
  If TdS and PdV were the same the difference would be 0. Because they are different aspects, dU is hypercomplex satisfying a circular function. Its unit value is then set by…
  Boltzmann's ergodic hypothesis is volume proportional to isolated static energy where all configurations are equally probable.[8]
- **The effect of work done on (+) or by (–) the system is hyperbolic inefficiency (dU= δQ±δW), which is non-cyclic.**
  The total amount of energy applied (**δQ**) cannot be converted to work (**δW**).[9] The sum or difference is then the unit value for internal circular functions defining the object as an isolated system.
- **The open system interacts with an identity as a fixed unit such that the entropy defining an identity is held constant.** (see 2nd law).

Algebraic commutation does not apply (TdS–PdV ≠ δQ±δW) because the relationship is a significant change in state between circular and hyperbolic functions. They commute one into the other via dU but you cannot middle dU out of the equation without losing this vital detail. The symbolic choices are simply insufficient until you adapt for modal logic.

$$
\begin{aligned}
2+2 = 4 &- 9/2 + 9/2 &&= \sqrt{(4 - 9/2)^2} + 9/2 \\
&= \sqrt{([4^2 - 2*4*9/2] + (9/2)^2)} + 9/2 &&= \sqrt{([16 - 36] + (9/2)^2)} + 9/2 \\
&= \sqrt{([-20] + (9/2)^2)} + 9/2 &&= \sqrt{([25 - 45] + (9/2)^2)} + 9/2 \\
&= \sqrt{([5^2 - 2*5*9/2] + (9/2)^2)} + 9/2 &&= \sqrt{(5 - 9/2)^2} + 9/2 \\
&= 5 - 9/2 + 9/2 &&= 5 \quad \text{Therefore, } 2+2 = 5
\end{aligned}
$$

3.2 Proof of 2+2=5

This 2+2=5 proof[10] shows the landmines of algebraic commutation (if a=b and b=c then a=c) in complex processes. In the real world this is using four units of apples to make five apple pies, where 9/2 is the scaling catalyst for change. This proof is a valid change of state contained by a complex variable putting the pie in the oven in plain view at $-0.5 \neq \sqrt{(-0.5)}^2$.

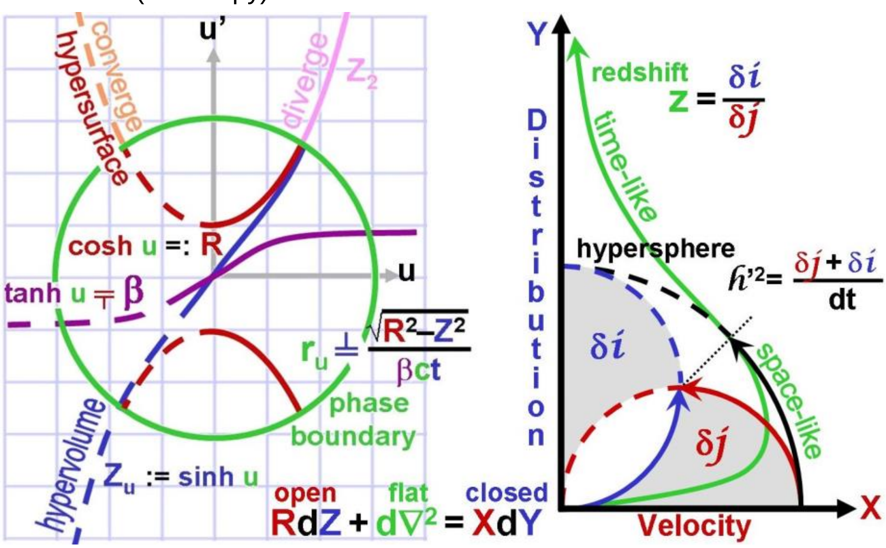
Assign[11] A**:=**δQ±δW, B**:=**dU and C**:=**TdS–PdV. According to basic logic, if A=B and B=C then A=B. The problem is failure to show the direction of action versus dependence. We could use modal logic except the symbols are too ambiguously defined. Let's keep it simple.

dU=δQ±δW implies algebraic manipulation like dU–δQ=±δW applies that can trip us up. **δQ+δW≛dU** is evolution or formation by combination, as with gaining value by work being done on the system. Such a combination suggests putting the ingredients together in a way that creates a new identity by destroying others. Decomposition (**δQ–δW⫧dU**) means something is breaking down, like loss of value by doing work.

Either way, δQ±δW╪dU are two ways to say dU derives from δQ±δW. Furthermore, the increments (δ) of change are not being derived. As such we should be assigning U':=δQ±δW. This change state is reversible and sequential (╫) with TdS–PdV defining a unit identity (1=).

$$1 = \left(\frac{\delta Q \pm \delta W}{U'} \ \text{╫}\ \frac{TdS \ \text{╪}\ PdV}{dU} \right)$$

We also note U'≡ $\delta j \pm \delta i$ =dt because i and j are the functional change operators. This means dU also contains elements of resistance to change consistent with temporal dilation acting on the isolated system.Now when we put dU in the denominator as with TdS/dU, we are saying to take the derivative increment of S with respect to U. We are also acknowledging conversion from the open hyperbolic form of U', such that the change in distribution (S-entropy) is closed and circular.



3.3 Open Hyperbolic v. Closed Circular

Semantics has a profound effect on interpretation. The difference between these two graphs assumes related latent and discrete roles. Individually they are subject to the same evaluations. Open (hyperbolic) systems always change unit value. This applies to defining the unit of any identity gaining or losing value. Closed is how you treat the inner workings of any identity. A closed system is circular, working with the unit it has.

2. Clausius' Law (Distribution)

Energy flows from high to low potential into proportional equilibrium.[12]

Equilibrium suggests equalizing value in one class. Proportional equilibrium recognizes conversions between classes and that energy doesn't sit still just because it has a superficial equality. It constantly moves and transforms.

We use the term potential because spacetime has ambiguous axes and relative density. For example, Z-volume diverges from R-surface pressure by exceeding its allowed value. To propagate as X-volume it needs Y to provide surface pressure away from R. Y is the enfolding pressure potential enabling the unfolding of X-volume. This leads to the traditional…

- **Distribution (S) increases in isolation but is held constant for unit identity.**

S is traditionally termed "entropy" defined as uncertainty, disorder or energy unavailable for conversion into mechanical work. It is "not a vague predictor of universal decay."[13] "Numbers like the temperature, pressure and volume give you all the information you actually care about,"[14] is also revealing of entropy as an abstraction for complex distribution.

Unit identity describes the distribution of value in active hypersurface, hypervolume, and void of the working hypersurface. We will call the last a Wheeler space (W). W is the available surface for energy of microstates to convey among each other and for work on or by the system. As energy is added, this space becomes unavailable consistent with dilation, but the emission and absorption patterns are consistent with the entropy of identity that does not change.

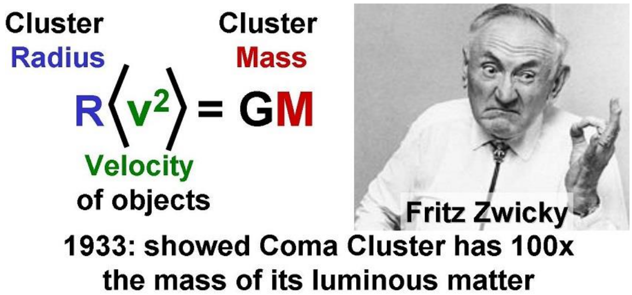
That brings us back to the word "isolation" that we are reading as a closed system. A closed system has a presumptive initial order giving the idea of disorder relative to that initial state. We have mapped changes in distribution to recognize entropy in an isolated system converts pressure to volume, and volume to pressure. Both phase states as units increase distribution up to proportional equilibrium.

What happens when we don't have a unit?

- **Sharing in an open complex system isolates into a unit of order.**

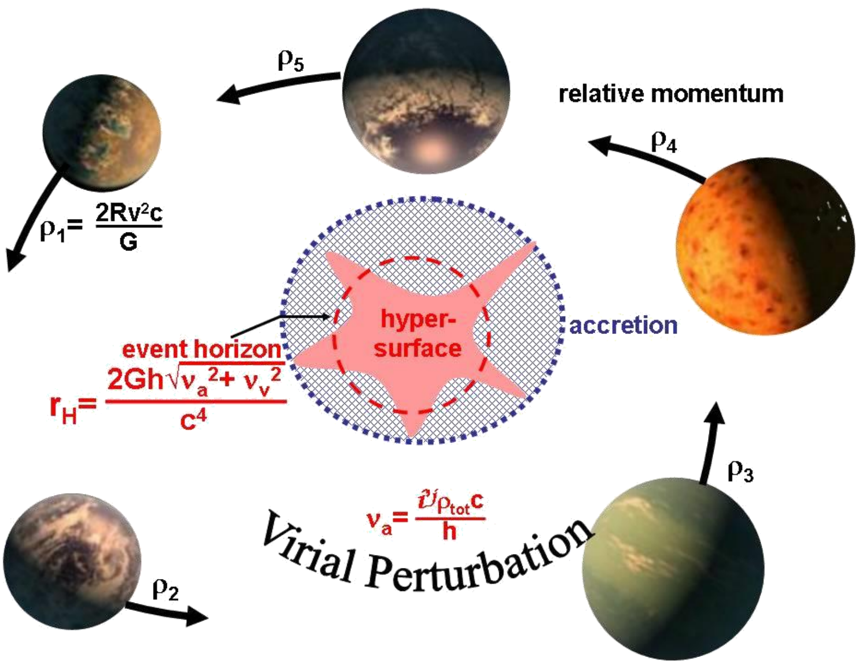
Entropy is not just about disorder or being unavailable. Clausius, the father of these concepts, provided **Virial theorem** as a means to *associate angular momentum into a common mass*. Astronomers follow Zwicky's

1933 "dark matter" example[15] which is fun for those looking for random mysteries. Except there is no random mystery or need to look for extra matter. It is the energy of the system. Sure there is some extra matter, but the significant feature is the angular momentum.



3.4 Dark Matter & Virial Theorem

Where the momentum is shared, a hypersurface perturbation (R) occurs. For the set it creates a common order consistent with a unit identity. Locally, however, the shared value is non-transferable setting T=0 and triggering singularity in the third law. Each contributor provides a 0-sphere value. The 1-sphere boundary of the event horizon is where they form a common function of causal perturbation. Such a singularity satisfies the definition of a partial Cauchy hypersurface.[16]



3.5 Virial Perturbation

3. Cauchy's Law (Reduction)

At convergence or absence of entropy (S=0), no energy is available for distribution (T=0), reducing the system to an inert hypersurface (Y or R) symmetry.

- **Propagation and its causal mechanism cancel in a standing wavefront.**

This incorporates Euler's solution to the d'Alembertian where wave forms in isolation converge and eventually neutralize as the Y hypersurface potential. Not only does this law have two barrels, each barrel has one of two chiral loads consistent with the two types of black hole and CMB "polarization" (symmetry).

- **Exclusive linear or angular valuation determines singularity symmetry as an inert hypersurface.**

The symmetry difference can be summarized in inertial and non-inertial terms, where the inertial condition is linear surface and consistent and the non-inertial is angular perimeter. This adds Birkhoff's Theorem to the conventional form: a "perfect crystal" at absolute 0=T has no disorder (S=0). More simply: at dU=PdV, T=dS=0.[17]

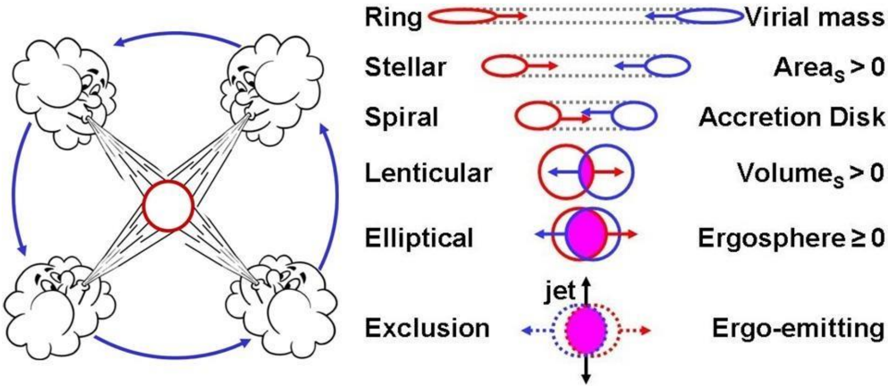
Birkhoff's theorem is stated briefly and ambiguously by every source. It assumes linear valuation one way or angular the other due to examination of geodesic reduction. Geodesic "reduction" of Einstein's field equation goes either to the scalar curvature (½R pressure) or the Ricci volume. Both variables are given as 2-sphere surfaces to act in common with each other, which confuses matters.

> Birkhoff's Theorem states that the Schwarzschild geometry is the only spherically symmetric solution of Einstein's equation. This result is remarkable, in that the Schwarzschild geometry has a **timelike symmetry** (Killing vector), even though this was not assumed; spherically symmetric vacuum solutions of Einstein's equation are **automatically time independent**![18]

The vague descriptions rarely mention it is a metric direction preserving "hypersurface Killing vector."[19] Descriptions typically focus in the temporal aspect consistent with the surface-volume features of the geodesic field equation. The "time independent" feature mentioned above is seen by decomposing the 2-sphere to show how it is created.

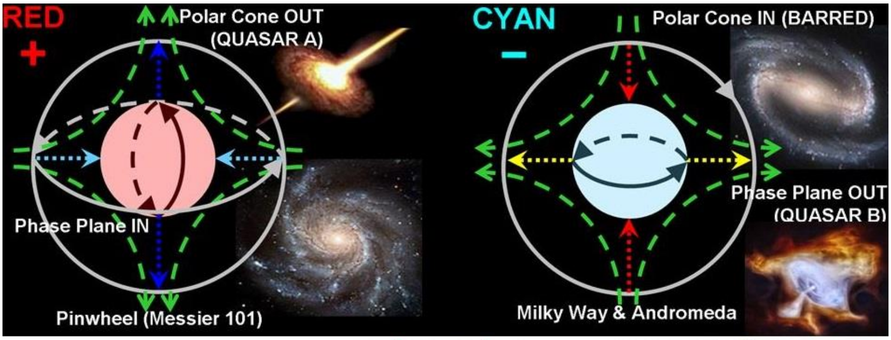
Singularity as a reduction of the geodesic incorrectly suggests the cause is contraction. Virial theorem provides a means to focus energy into a common geometry and satisfying the focus of value needed for S=0. The pressure only satisfies singularity when the opposing pressures around that space overlap. Even then, something actually needs to be pushed in to split the space into its parts and be an active black hole. Otherwise it is just another density perturbation with a low mass potential.

As the diagram below suggests, interacting bodies form a torus shape that contracts under its own Virial gravity. The contraction simply brings the phenomenon into focus. The 0-sphere momentum and 1-sphere shaping of the volume around it are causal. The 1-sphere contributing shape is either flat toroidal (inertial) or with a non-inertial twist making it spiral.



3.6 Perturbing a Pressure Plane

The twists create a sinusoidal pattern consistent with a centripetal action like a common ceiling fan. This is also consistent with “negative temperature”[20] like a fire tornado. It then satisfies the Schwarzschild radius requirement indirectly by satisfying the angular length parameter ($4\pi/\mu_0$=4E-7kg/m s^2).



red symmetry — cyan symmetry

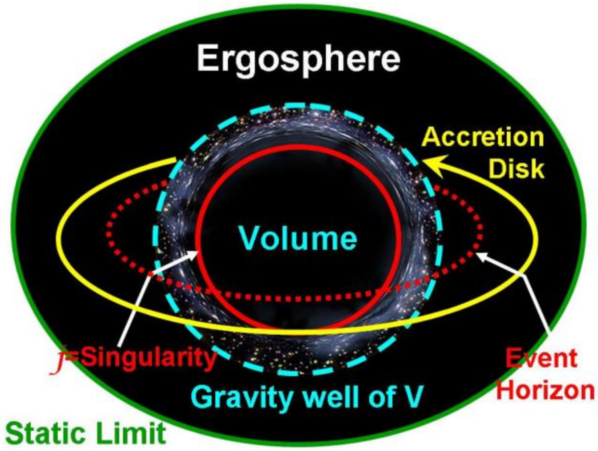
$$\frac{8\pi G T_{\mu\nu}}{c^4} \Rightarrow \frac{8\pi G}{\mu_0 c^4} = \left(\frac{2G}{c^2}\right)\left(\frac{4\pi}{\mu_0 c^2}\right) \text{ OR } \left(\frac{4\pi}{\mu_0}\right)\left(\frac{2G}{c^4}\right)$$

stress-energy, units, surface, volume, perimeter, force

3.7 Singularity Types

The object and its surrounding space are static/inert because they are just a perturbation defining space. Everything else is acting on them as causal. The object’s existence is a unique **potential for mass**. That potential is not technically gravity but rather an opportunity. In its temporal form, the surface applies to the sphere so the gravity acts as tension handled by the stress-energy field equation. As Birkhoff’s theorem states, it does not radiate gravity.[6] Other features of the system and breakdown of spacetime make up for this.

Like a riverbed, the accretion field simply provides a path opportunity. It is not the action. Likewise, crossing the Schwarzschild event horizon is also passive in that energy is not added into motion. Instead, the field of gravity defining the singularity applies at c which voids mass identity causing annihilation.



3.8 Surface Anatomy of a Black Hole

The freed energy is then confined by strong interaction to the volume. This part of volume is a fully occupied spacetime causing all spacetime paths to bend around it consistent with a gravity well. The rest fits the "ergosphere" term in that it allows objects to conditionally pass through the same space. The displacement also creates a very dense spacetime condition that will cause high luminosity to perturb and deflect as x-rays. Such deflective boundaries are called static limits.

"A Kerr black hole is a type of black hole that possesses only mass and angular momentum (but not electrical charge – the third possible property of a black hole)."[21] While I used terms fitting a rotating "Kerr" black hole,[22] we can't describe it as rotating or possessing these variables. Despite displacement, the surface and volume never mingle to form surface gravity to satisfy the geodesic needed for mass—voiding Hawking radiation hypothesis even in his own words.[23] It is always a mass potential as a space, not a mass.

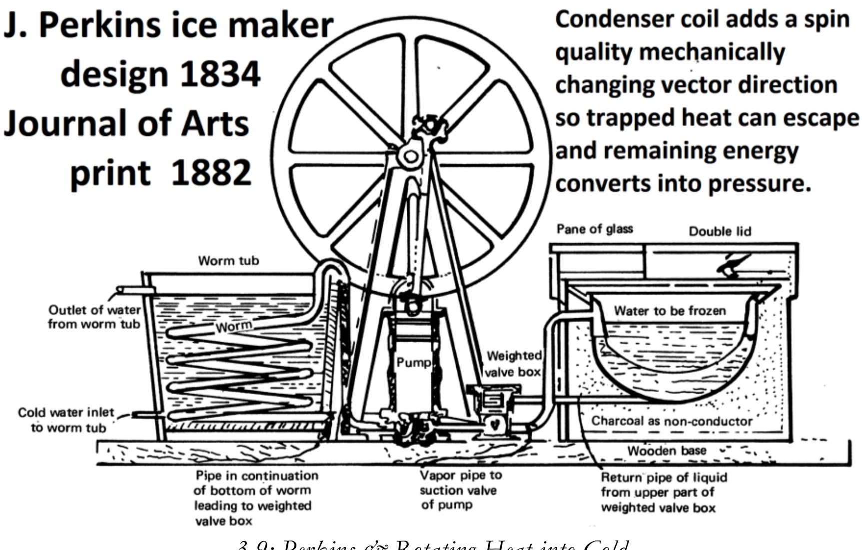
With no radiant gravity or mass, "frame dragging" does not apply, at least not this way. Frame dragging refers to a difference between current position and the effect of gravity or another vector function. Perturbation contributions are achronal, also excluding frame dragging. Frame dragging can only apply to the functionally temporal features with mass needed for radiant gravity like objects in the space, and the system as a whole.

Singularities strongly interact with their environments. Mass has to be pushed across the event horizon where it is subject to gravity at the speed of light. This annihilates the subject and confines them to the available volume in a quantum leap.

Hawking's spaghettification[24] does not happen. Identities retain their shape as they shift across reference frames. Parts of a whole can be stripped away looking like spaghettification, but that is not the same. The accreted matter propagates as energy in the volume of the singularity until it reaches degenerate density and is excluded by jets or ring pulses.

The two singularity types are thus classified as red (inertial surface) and cyan (non-inertial perimeter) color charges. These are easily identified by their environmental interactions we see as the accretion field symmetry consistent with the opposite blue and yellow color charges. When these opposite charges converge into a common geometry, they form a temporal volume. That is the volume where the strong interaction stashes matter as propagating energy.

4. Perkins' Law (Conversion)



3.9: Perkins & Rotating Heat into Cold

Helical rotation shifts complex symmetry, metric focus, and sequence.

Möbian twists are caused by distribution enhanced by anomaly, seldom as obvious as a coil. Usually it is a forced variable like surface unfolding and forcing volume. They are like the subtle bumps on a road that steers your vehicle off the road should you not hold the wheel. Keeping your hands on the wheel offers resistance equivalent to identity, but even identities rely on this to fulfill their own twisting features.

This process is like transferring value between hot and cold containers of different sizes and shapes. The size affects metric scale which fits into a sequence pattern. Hot and cold define whether that metric as a vector is contracting into focus or expanding out of focus. The shift in complex symmetry changes the shape of the container.

The shape of space converts potential into work. The shift provides an opportunity range for inefficiency. The universe always takes the path of least resistance—and to degrees all the others too.[25] Fleming's hierarchy adds differences in magnitude through the changes. The common uses include storing energy in coils and converting heat volume to linear pressure (cold). This law framed specifically for radiant energy converts readily to relativistic momentum:

> Helical changes[26] ($\imath$) to radiant ($-\hbar E_1 \equiv pc$) energy apply degrees of work conveniently to AND by intrinsic definition ($-\imath\hbar E_1 \rightarrow \jmath E_0 \equiv mc^2$).

$$\{\ [dU=\imath E_2] = [\delta Q=-\hbar E_1] \pm [\delta W=\jmath E_0]\ \}^2 \equiv \{\ (pc)^2 + (mc^2)^2\ \}$$

This law combines Perkins' ice maker[27] with conservation,[28] Euler's $z=x+\imath y$,[29] Relativistic Momentum,[30] Parallelogram Law,[31] Fleming's rules,[32] and logical operators. The complex components make work on OR by the system equivalent in Relativistic Momentum as ($\hbar^2 \equiv \imath^2 \equiv \jmath^2$)=–1. Relativistic equivalence makes OR into a simultaneous AND.

Work is distributed conveniently (e.g. path of least resistance) in degrees to the intrinsic definition (absorbed) AND by the intrinsic definition (emitted). The universe given two solutions by its own rules finds a way to apply both to the degree each opportunity is available. While this seems like sloppy eating to us, it provides diversity necessary to sustain a flat free space for distribution whether the distribution is motion or propagation.

Treated as a generic mechanical operator, the imaginary number ($\imath$) rotates axes to make linear and sinusoidal systems compatible in Complex Variables (the mechanical roots of Differential Equations). Many simply define it as a quarter rotation and its square a reversal of direction. It works mathematically AND logically the same as the imaginary operators used here to define color change functions. When the operator disappears, the logical function remains to haunt concealed (confined) in the definition.

A black hole is a system of field spaces and the objects or energies in those spaces. The spaces alone are subject to Heisenberg uncertainty so you cannot directly observe them. They do not satisfy conditions of mass, electromagnetism, or angular momentum. They are inert/static.

The no-hair theorem "Shows that mass, charge, and angular momentum are the only properties a black hole can possess."[33] It can only be applied to the greater dynamics that include objects and propagating energies in the observable parts of the black hole system spaces.

Schrödinger Normalization of x in Wave (ψ) over time (t)

normalization of t in the wave over cycle (k)

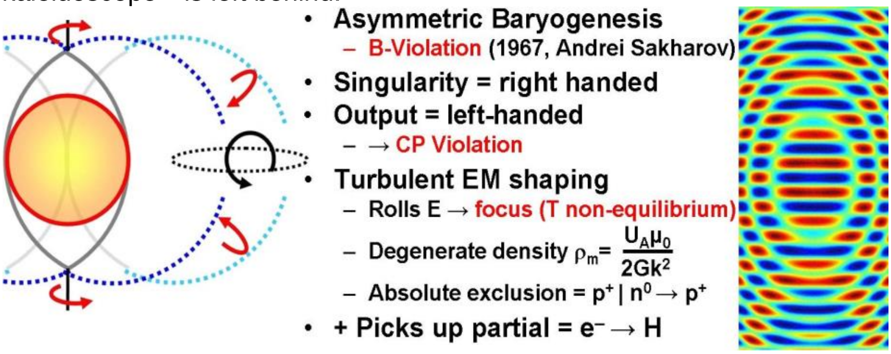
$$\int_a^b \left| \psi \left(x, \int^c \left| \psi \left(t, \int_0^{2\pi} | \psi(k, f_k+\Delta f_x) |^2 \, dk = |k_t^2| = +1 \right) \right|^2 dt = t_k \right) \right|^2 dx = x_t$$

cycle normalization = oscillation

3.10 Normalizing Schrödinger

Only density and exclusion affect propagation outside the volume where the accretion field shapes mass motion orienting vectors into the mass potential. Only propagating energy exists inside the volume, subjected to spaces shaped into rotation. The effect normalizes the information (k,x) and change function ($\acute{k}$) by Schrödinger equation the propagation into a consistent charge state.

These shapes and motions contribute to sustaining the perturbation and creating an electromagnetic field. The electromagnetic field recaptures most of the jet emission (exclusion). What part of the jet emission fails to come into focus, discharges away from recapture. A black hole can effectively kill itself by ejecting all the value that would otherwise sustain its perturbation. When this happens a relic of dilated space called a kaleidoscope[34] is left behind.



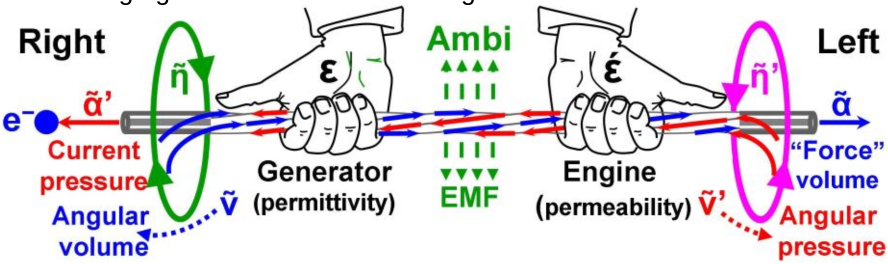
3.11 Electromagnetic Field Effect & Baryogenesis

Focused interference leads to asymmetric baryogenesis, creating new material identities of all scales. It is fairly clear that systems of different scales than the Lyman-α conditions addressed in the image[35] will have different effects simply due to cycle scale and availability of other materials. The turbulence continues to stir up the new matter into larger objects like stars and solar systems.

Notice the plane of a solar system is generally at a right to that of the galactic. And the nature perturbation allows this process to apply to only part of a galaxy. This process can happen over and over in sequence as a singularity is perturbed, behaves, goes extinct and another soon follows creating a series of ring-like features. Parts of a galaxy can be processed without processing the whole, and a part can be ejected mid-process.[36] Galactic cycles and evolution are a more ambiguous than many would like.

5. Fleming's Law (Hierarchy)

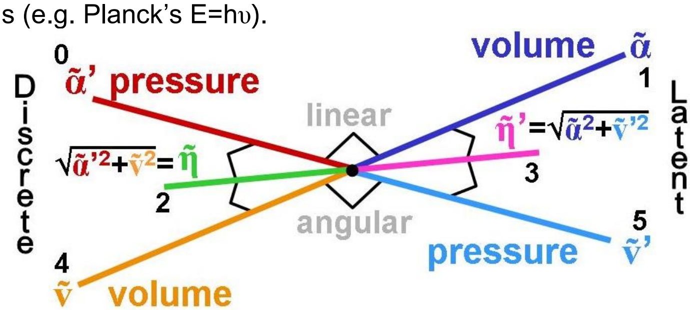
Axes of the same magnitude are at right angles to each other (e.g. Parallelogram Law) and ordered by scale from lowest to highest, and from conforming right-handed to transforming left-handed.



3.12: Fleming's Rules & Force Variables

Fleming's rules from which this derives specifically show energy flow direction, generation, and application in a working engine. Order is set by following the value sequence in Fleming's rules. It demands an evolving system of fields/matter. The rules are also a function of Relativity forming degeneracy toward singularity in a stellar body,[37] and pointing to our symbol choices.

These are energy flux forms ($m^2/s \equiv kg\ m$) that act as scalars adapting to limited functional contexts. The symbols used correspond with their familiar flux forms: diffusivity (thermal $\alpha=\tilde{\alpha}$),[38] viscosity (kinematic $\nu=\tilde{\nu}$),[39] and cyclic/orbital momentum (specific relative angular momentum $h=\tilde{\eta}$).[40] The symbol changes and tilde (~) are used to indicate flow like propagation and prevent symbolic confusion especially with frequency and energy functions (e.g. Planck's $E=h\upsilon$).



3.13 Flux Force Axes

We tend to think of flux in limited ways, primarily in its conveyed volume forms. Pressure is often overlooked forcing us to derive linear diffusion (heat volume) to get linear infusion ($\tilde{\alpha}'$). Kinematic momentum resistance ($\tilde{\nu}=\mu/\rho$) converts by Newtons of force (N) into a dynamic channel (ṽ'=N/µ). They can cyclically revolve into focus (e.g. orbit) as the product of position and velocity vectors=ῆ, or diverge (ῆ') out of focus.

These values provide vital details to how propagation works and defines the fabric of spacetime. If we were weaving the fabric of spacetime, discrete variables define the warp and its pressure (temporal dilation). Latent variables are the weft and its luminosity (unfolding or confined volume). The combination of these resolves either as unchanging void or mass resisting change in these roles.

Role changes result from changes in momentum forms at the root of the Lagrangian (total energy). The Fleming sequence affects the order of spatial axes, where latent spaces are simultaneous and discrete spaces are "stacked" or mingled by entropy. The momentum forms are vectors defining spaces in functional ways. Their root sequence follows the related flux variables valuing their spaces: gravity (p'), thermal/heat (p), centrifugal (L), centripetal (L'), electromagnetic (e). Sequence conflicts have profound effects, as with the iron trigger for supernova.

Endnotes

[1] Wheeler, J.A. & Ford, K.W. (2010). Geons, black holes, and quantum foam : a life in physics. NY: W.W. Norton & Company.

[2] (2013) “History of Black Holes” in Black Hole Encyclopedia. University of Texas McDonald Observatory. http://blackholes.stardate.org/history.html.

[3] Smith, H.R. (Aug. 6, 2017). *What is a Black Hole*? NASA Knows! nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-a-black-hole-k4.html.

[4] Hawking, S.W. (1975). Particle Creation by Black Holes. Cambridge. brainmaster.com/software/pubs/physics/Hawking Particle Creation.pdf.

[5] Hawking, S.W. (June 23, 2014). Singularities and the geometry of spacetime. https://www.epj.org/images/stories/news/2014/10.1140--epjh--e2014-50013-6.pdf.

[6] Olesen, P. (2008). General Relativity and Cosmology. Copenhagen: The Niels Bohr Institute. www.nbi.dk/~polesen/GRC.pdf.

[7] Nave, R. (2017). First Law of Thermodynamics. University of Georgia. hyperphysics.phy-astr.gsu.edu/hbase/thermo/firlaw.html.

[8] Boltzmann, L. (1898, trans. 1964). Lectures on Gas Theory. University of California Press.

[9] Kreidenweis, S. (2011). The First Law of Thermodynamics: Conservation of energy. chem.atmos.colostate.edu/AT620/Sonia_uploads/ATS620_F11_Lecture2/Lecture2_AT620_082411.pdf

[10] Patawari, V. (May 31, 2016). Two plus Two Equals Five, is it possible? www.quickermaths.com/2-2-5-two-plus-two-equals-five/.

[11] (Jan. 30, 2019). Symbolic Logic. philosophy-index.com/logic/symbolic/.
… Forces (╟). http://www.philosophy-index.com/logic/terms/forces.php.

[12] Watson, D. (2010). The Second Law of Thermodynamics. www.ftexploring.com/energy/2nd_Law.html.

[13] Lintner, B.R. (2015). Thermodynamics of the Atmosphere: Lecture 12. Rutgers University. envsci.rutgers.edu/~lintner/thermo/Lecture12.pdf.

[14] Sutter, P. (Jan. 28, 2019). Life's Chaotic: Let's Learn About Entropy. https://www.space.com/43138-life-is-chaotic-entropy.html.

[15] Zwicky, F. (1933). The Redshift of Extragalactic Nebulae. trans. Andernach, H. https://arxiv.org/abs/1711.01693.
Zuhone, J. (June 21, 2015). Bullets and Wine Glasses: The Exciting Encounters of Galaxy Clusters. Eastern Illinois University. https://www.slideshare.net/jzuhone/bullets-and-wine-glasses-the-exciting-encounters-of-galaxy-clusters.

[16] Budic, R. et al. (1978). On the Determination of Cauchy Surfaces from Intrinsic Properties. ccom.ucsd.edu/~lindblom/Publications/10_CommMathPhys.61.87.pdf.

[17] Kyle, B.G. (1994). The Third Law of Thermodynamics. ufdcimages .uflib.ufl.edu/AA/00/00/03/83/00123/AA00000383_00123_00176.pdf.

[18] Dray, T. (2014). Birkhoff's Theorem. physics.oregonstate.edu

/coursewikis/GGR/book/ggr/birkhoff.
[19] Barnes, A. (Mar. 15, 1973). On Birkhoff s Theorem in General Relativity. https://projecteuclid.org/download/pdf_1/euclid.cmp/1103859212.
[20] Braun, S. et al. (Jan. 4, 2013). Negative Absolute Temperature for Motional Degrees of Freedom. science.sciencemag.org/content/339/6115/52?ijkey=kXamUlcWIiV0M&keytype=ref&siteid=sci.
[21] Darling, D. (ret. Jan. 18, 2019). Kerr black hole. www.daviddarling.info/encyclopedia/K/Kerr_black_hole.html.
[22] Reynolds, C. (2015). Kerr Black Holes. astro.umd.edu/~chris/Teaching/ASTR398B_Fall_2015/ASTR398B_Fall_2015_files/class09.pdf.
[23] Hawking, S.W. (Apr. 12, 1975). Particle Creation by Black Holes. brainmaster.com/software/pubs/physics/Hawking Particle Creation.pdf.
(Feb. 17, 2014). Singularities and the geometry of spacetime. epj.org/images/stories/news/2014/10.1140--epjh--e2014-50013-6.pdf.
[24] Hawking, S.W. (Mar. 1, 1988). A Brief History of Time. NY: Bantam.
[25] Holt, M. (Jul. 1, 2001). The Path of Least Resistance. ecmweb.com/content/path-least-resistance
[26] Not to be confused with a heat sink redistribution.
[27] ASHRAEnews. twitter.com/ashraenews/status/895618941887827969/photo/1
[28] Noether, E. (1918). Invariant Variation Problems. Nachr. D. König. Gesellsch. D. Wiss. Zu Göttingen, Math-phys. Klasse. pp 235–257.
[29] Song, H.A. (2008). Euler's Equation. songho.ca/math/euler/euler.html.
[30] Nave, C.R. (2017). Relativistic Momentum. Georgia State University. http://hyperphysics.phy-astr.gsu.edu/hbase/Relativ/relmom.html#c1.
[31] Jeffreys, H. and Jeffreys, B.S. (1988). Methods of Mathematical Physics. 3 ed. Cambridge, England: Cambridge University Press.
[32] Daware, K. (2014). Fleming's Left Hand Rule And Right Hand Rule. electricaleasy.com/2014/03/flemings-left-and-right-hand-rule.html.
[33] Weisstein, E.W. (2007). Black Hole No Hair Theorem. scienceworld.wolfram.com/physics/BlackHoleNoHairTheorem.html.
[34] (Jul. 21, 2016). Space… the final frontier. ESA/Hubble Information Centre. https://phys.org/news/2016-07-space-frontier.html.
[35] Perepelitsa, D.V. (Nov. 25, 2008). Sakharov Conditions for Baryogenesis. phys.columbia.edu/~dvp/dvp-sakharov.pdf.
[36] Arp, H. (1966). Atlas of Peculiar Galaxies. California Institute of Technology. ned.ipac.caltech.edu/level5/Arp/frames.html.
Arp, H. (Aug. 1998). Seeing Red: Redshift, Cosmology and Academic Science. Montreal: Aperion.
[37] Mastin, L. (2009) Creation of Black Holes. physicsoftheuniverse.com/topics_blackholes_blackholes.html.
[38] Lightfoot, R. et al. (1960). Transport Phenomena. Hoboken, NJ: John Wiley and Sons.
[39] (2003). Absolute, Dynamic and Kinematic Viscosity. engineeringtoolbox.com/dynamic-absolute-kinematic-viscosity-d_412.html.
[40] Curtis, H.D. (2015). Orbital Mechanics: For Engineering Students. Oxford: Elsevier Butterworth-Heinemann.

4. Dilation Processes

Newton's laws were established science in the 18th century. The 19th century rhymed, establishing Thermodynamics. Galileo's Relativity from 1632, however, waited until the early 20th century to be properly formalized and established.[1] Special Relativity solved Galileo's problem by introducing dilation, from which Lorentz-Fizeau's fourth law of propagation derives.

When I say dilation, the trained mind typically goes to a special place reserved for Einstein, Lorentz, and Minkowski. The reader may think of a medical procedure, like dilation in advance of child birth, dilation of the pupil in the eye, or of the throat to swallow. To dilate means to expand, "to become or make something, esp. an opening, wider or more open."[2]

4.1 Dilated Pupil

Over a century later, we are still scratching our heads over this despite it being well-established. The head scratching is simply a matter of trying to comprehend what exactly is dilation? Dilation is a change to the metric scale of space. A metric defines the increments of scale and shape (e.g. symmetry) generally needed for topological measure.[3] A metric specifies length and shape in context.

Galileo observed a vital element of Special Relativity: the rules don't change between inertial reference frames. Inertial reference frames are dilations of time changing the density of spacetime. The density of time inversely affects the availability of space because the boundary conditions of spacetime are part of the rules that don't change.

As dilation increases, the space available to hold energy diminishes. Galilean thinking saw this as length contraction. We can now see it as divergence with a margin of error in a giant cycle. Each step another margin of error… a universe of quantum anomalies.

1. **Divergence** in focus (**discrete**) accelerates, causal of velocity.
2. Out of discrete focus it dissociates to propagate as **light** (**latent**) with potential to form long-ranged interactions. These are possible up to…
3. the point where **void** engages as temporal pressure (warp **dilation**= distribution) being the main feature (at z=1 or about 10.9 Gly).
4. Pressure in context becomes **mechanical** (**discrete**), like sound and gravitational waves, converging and diverging volume, completing the cycle.

Flux Scale

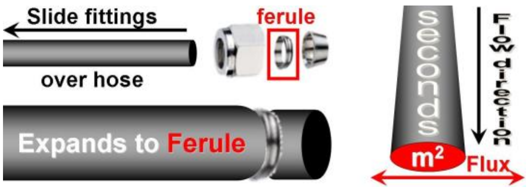
As Einstein rode the streetcar away from the Bern clock tower,[4] he imagined accelerating away up to the speed of light. As he accelerated in his thought experiment, he observed the hands of the clock moving faster and faster. This is the iconic image everyone has of Relativity and time.

4.2 Zytglogge: Einstein's Clock Tower in Bern

This iconic image fails to explain the relationships between distance, space, and time or to distinguish between discrete and latent effects. Flux scale is both fundamental as a unitless scale and oddly behaving. It is only odd because dilation changes roles scaling applies in context. In discrete space it affects distribution of time (distance), whereas in latent space it affects distribution of space (volume).

Dilation is a relative scaling metric. By relative I mean the object's sense of scale remains constant while the environmental scale dilates (enlarges). The effect locally is opposite. In discrete space, increased dilation decreases the applied surface increasing potential by applying more pressure on the volume.

We basically have a flux problem like a pressure tube system (below).[5] A **flux** problem consists of a **length of volume** through which **value** flows. Time is the **surface scale** of the volume the value flows through. The length remains constant, as does the surface and amount of value passing through the tube.

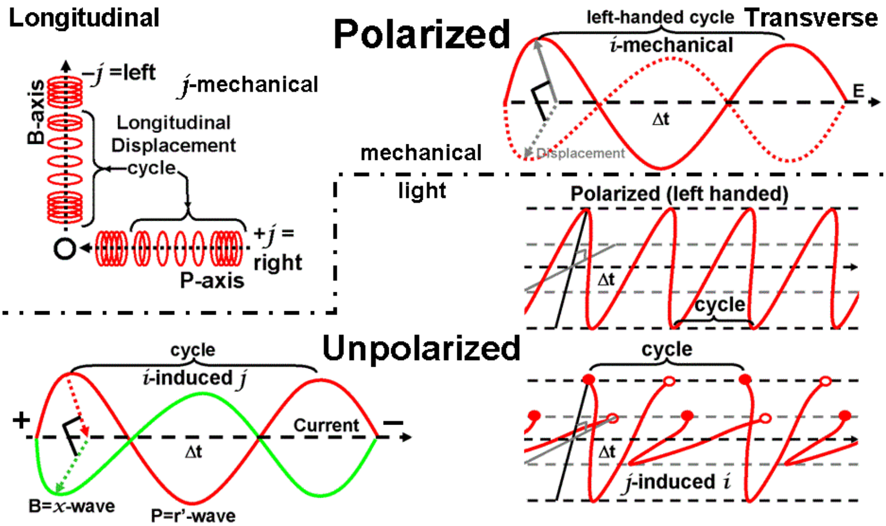


4.3 How Pressure Fittings Work

Acceleration is a discrete measure of motion in meters per second squared. The length metric (m=distance between points) remains constant in the effect while the temporal surface (s^2) dilates. Latent flux does the opposite: duration (s) is a constant length metric while spatial surface (m^2) increases. This is because flow has a heat element pushing to the sides as a mechanical transverse wave.

Wave Types

Value conveys as *information-shaped* waves mechanically from one intrinsic field to another, or as light.[6] Conveyance is by redistributing (right-handed) **or** converting (left-handed) into surface (transverse) or volume (longitudinal). Mechanical waves are space-dependent with one change function (e.g. j or i). Field waves are space-independent and are linear unpolarized or circular polarized.[7]



4.4: Polarized/Unpolarized Waves

Longitudinal waves mechanically displace matter along the line of propagation such that force is toward (+) or away (–) from the origin while the current goes the opposite direction. Longitudinal "polarities" are chiral (imperfectly mirrored) and have no effect on the directional nature of space. The P-axis is primary **compression** like sound,[8] the wave function being left handed and breaking down as pressure gets converted to heat. Gravity waves are B-axis, right-handed "ripples" conveying density distribution in the body of spacetime as its medium.[9]

Field waves have intrinsic and induced change functions. Alone, the intrinsic induces its own space as a medium. Change in the medium (e.g. filtering) interferes and modifies the intrinsic features, such as forcing focus and polarization. Unpolarized are hypercomplex-dependent linear functions converting (left-handed) $j \rightarrow i$ or $i \rightarrow j$. Circular polarization is a right-handed form, where hypercomplex (h) confines change (e.g. surface perturbation), simply distributing without transforming.

The flexibility of a pressure system redirects the widening effect by squeezing back. The pressure system also consists of focused spacetime elements: matter. Matter will retain its focus, whereas light propagates out of focus. Comparatively, latent spacetime barely squeezes back.

Spacetime is so open that light distributes and we don't bother to think it can distribute just a smidge more, or that the distribution is doing something more than a simple "expanding" surface accounts for. I put "expanding" in quotes because the surface of light contracts as spatial pressure, but its distribution is expanded across time. One has to be very careful with word choices here as they easily become misleading.

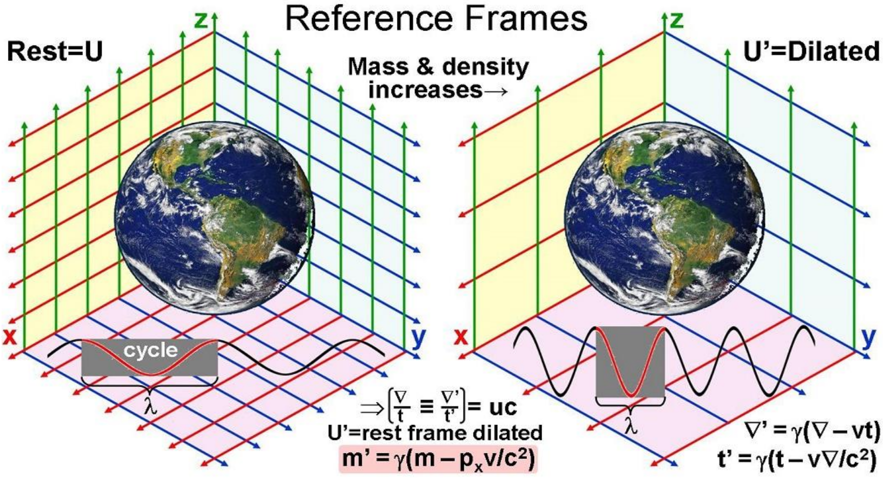
This smidge more is Hubble's constant. Hubble's constant calibrates redshift by measuring distances of galaxies in the depth of the field by the brightness of Cepheid variables and type 1a supernovae.[10] Brightness is the energy density in space, as opposed to frequency being density in time. Depth of field is a **length in time** and not the same as the surface of the field. Hubble showed galaxies are **spaced** on average 2Mly no matter the distance.[11]

This is the cosmological principle. On large scales the density and distribution become homogenous Add to the cosmological principle the Tolman effect. Sound goes out of focus with time because it converts to heat (space). Light comes into focus with time (the Tolman effect) because it is converting to pressure (time). It only loses its identity to interaction or shifting past the minimum frequency. The **surface of the field** is not expanding or contracting. This is what Einstein meant by a **static model**.

Reference Frames

Reference frames describe spacetimes of the same metric density versus other metric densities. They are sub-divided into linear (inertial) and angular (non-inertial) due to compatibility and computational adjustments. Those adjustments are not relevant to our argument. Dilation of space is like rescaling a ruler without changing what is measured.

If U is our rest frame metric, then U' is the dilated frame. Whether we are talking about matter or light, the subject's perspective remains constant. The size of the Earth is the same to the subject in dilation. The observer, however, compares how energy uses the space. They see the scale difference shown is 1:2.



4.5 Dilated Reference Frames

The magnitude of energy emission to have the same wavelength is doubled. It is also more readily available as this is a high potential region for emission. The U-frame is significantly "colder" (low heat potential). Gravity has the opposite effect. It is in highest potential in the U-frame, and since it is intrinsic it is drawn into the U' frame as a whole object without changing its size, only its context.

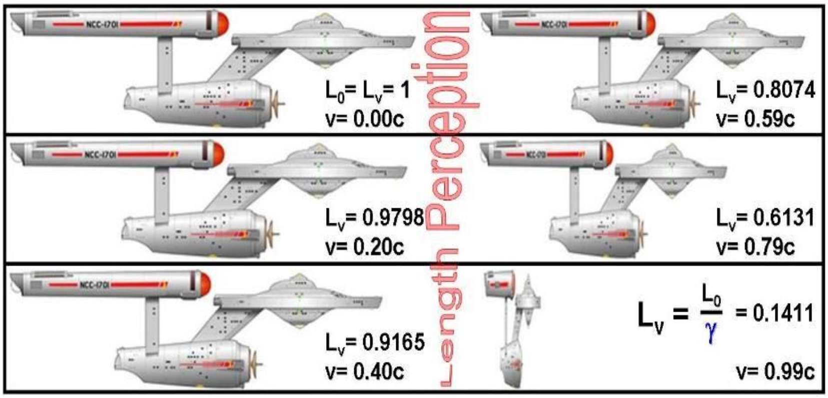
While everyone focuses on the clock in Einstein's thought experiment, they are overlooking the role of time in Special Relativity. Again, the rules don't change between reference frames. The speed of light is constant between frames, holding space and time constant while the scales differ. Distribution scale changes, putting distance as the space between things in time under pressure.

This is vital to modern cosmology for a very simple reason: expanding volume does not mean the distance between things is expanding, but the time is. Distance in time and space in things are not the same. Expanding volume distributes heat. It only changes the positions in time of (distances among) discrete things if the heat excites them to change their motion.

Any excitement, even if it is uniform like divergence (***M***) so motion does not appear to change, affects dilation. This is how redshift's $z=\Delta E/E$ applies to the Lorentz factor $\gamma=z+1$. These are complex forms of the same thing. As complex forms, they mirror each other, swapping variable roles. Discrete velocity derives from acceleration propelling material identity. For light the equivalent feature is its redshift accelerating with distance.

You can think of dilation as standard temperature and pressure of spacetime (STP-S). An identity created as stable in one STP-S takes on high and low potentials fitting dilation changes. The environment is allowing one scale while the identity is demanding another.

This is provided in Einstein's geodesic field equation ($R_{\mu\nu}$–½$Rg_{\mu\nu}$) where ½ applies the hypersurface R into the metric tensor $g_{\mu\nu}$. Surface gravity is the difference between the Ricci hypervolume[12] ($R_{\mu\nu}$) and the hypersurface containing it. When it is negative, it is high potential losing volume as light (e.g. heat). When it is positive it is low potential into which volume absorbs (cold).



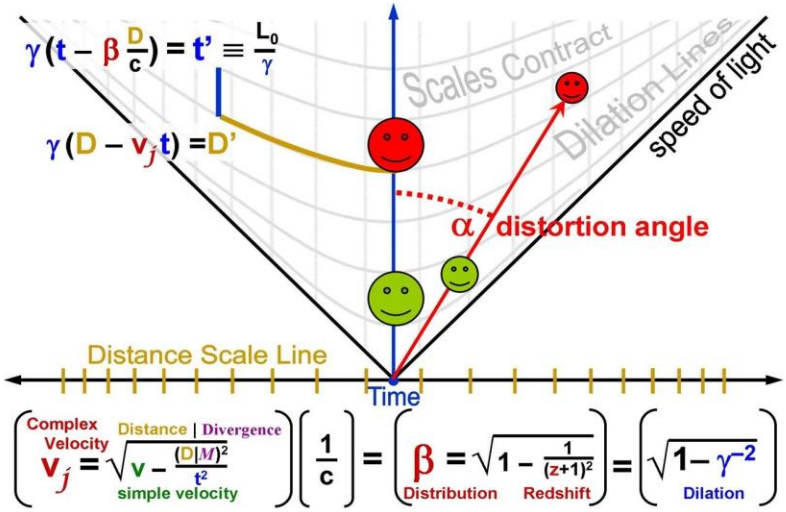
4.6 Dilating Length Perception

The Galilean concept of "length" dilation[13] translates into Relativistic terms[14] as an observational distortion. It relates to but is not the same thing as relative difference in scale. Relative difference in scale doesn't change the size of a thing. It changes the rate by which the environment allows value to define that space. The effect is specifically on the hypersurface affecting pressure.

The Galilean issue is a matter of point positions along any length creating a perceptual range. When you rotate the object it appears shorter because the range is constricted even though the length did not change. The same also occurs in dilation. The length didn't change but the distribution of reflecting points is dilated along the temporal line creating the illusion of shortening.

I put some extra love into the dilation teaching model below to hopefully make it more intuitive. The changes happening in this model are specifically to relative distance (D'), temporal term differences (velocity, change, mass), and the perception of space ($\gamma L=L_0$). Object size isn't changed, only size relative to context changes. Relative distance doesn't mean distance has been changed, it means the space defining that distance has been scaled by the difference in reference frames.

You are a stationary observer on the timeline: green at t=2 and red at t=5. Your twin appears as your anti-color moving at a constant velocity shown by the distortion line and constant angle. At t=2 (magenta), your twin appears smaller. If you could see and compare watches, the twin's watch is slightly slower. At t=5 (cyan), the watch is more slow, and they appear significantly smaller.



4.7 Minkowski Teaching Model

Unlike a normal graph with spatial axes, this Minkowski graph is simply time and distance with coordinates stated as (t,D). The distance lines are curved by Lorentz factor, contracting the time between them and their apparent lengths. Dilation is specific to time variables like mass and the change operators shaping and scaling spaces. The perception translates into classical four dimensions (x,y,z,t) where x is forward and excluding y and z from the effects of dilation.

Metric Constants

Classical dimensions are cute for mapping, but the functional dimensions aren't length, width, and depth. They are surface, volume, distribution. While these will change with dilation, the speed of light and other constants defining the limits of how values apply to those spaces do not change. As a consequence, changes in dilation cause changes in potential. In the table, all hypervolumes have m^3. All hypersurfaces have just m (meters). And don't forget the hypersphere evaluations.

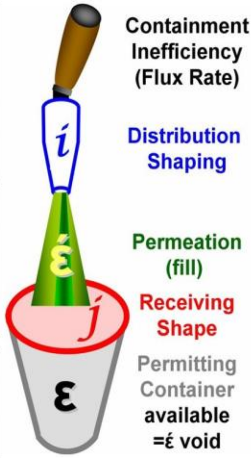
The presumptive condition is that associated with electromagnetism: permeability is how energy acts on space and permittivity is how space acts when energy applies. The reverse is also true if the variables are used in the reverse way. If the first space is linear, the second is angular. If the first space is a hypersurface, so too is the second space and it is available.

If the first space is a volume, the next space is either an available hypersurface or a satisfied hypersurface with a secondary available. The third space is always a magnetic field space that provides for forced variables (e.g. more value than can otherwise fit). There is always at least one available hypersurface. Glomes have two degenerate states to manage their spaces: density (ρ_m) and pressure (ρ_e).

Permeability			
Class	Symbol	Constant	SU
Magnetism	μ_0	3.14159265358979E+07	m s²/kg
Linear	$\acute{\varepsilon}_L=G=c^2/\varepsilon_L$	6.70197080364171E-11	m³/kg s²
Angular	$\acute{\varepsilon}_A=c^2/\varepsilon_A=4\pi/\mu_0$	4.00000000000000E-07	kg/m s²

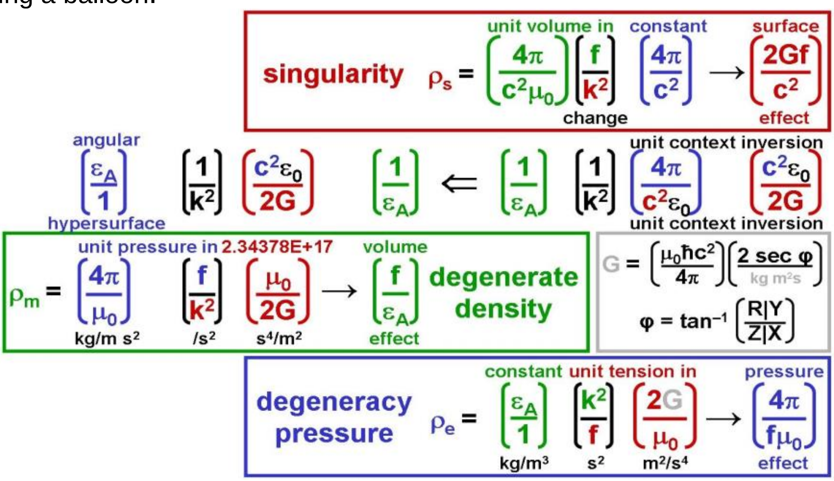
Permittivity			
Magnetism	$\varepsilon_0=1/\mu_0 c^2$	3.54167512704815E-25	kg/m³
Linear	$\varepsilon_L=c^2/G$	1.34103117585718E+27	kg/m
Angular	$\varepsilon_A=1/4\pi\varepsilon_0=k(\varepsilon)$	2.24688794684204E+23	m³/kg

Linear-Angular Axis Conversions			
Rotation	$\varepsilon_V=G/\hbar\varepsilon_A=2\sqrt{2}$	2.82842712474619 …	/m² kg s
Spin	$\hbar$	1.05457172646947E-34	kg m²/s



4.8 Spacetime Metric Constants

A singularity has a special type of glome condition, a hypersurface tension (ρ_s). A singularity has all the spaces, but the hypersurface and hypervolume are separate interacting objects as opposed to interacting parts of the same thing. It is a hypersurface with a volume potential being filled. The filling of the hypervolume actualizes the hypersurface much like filling a balloon.

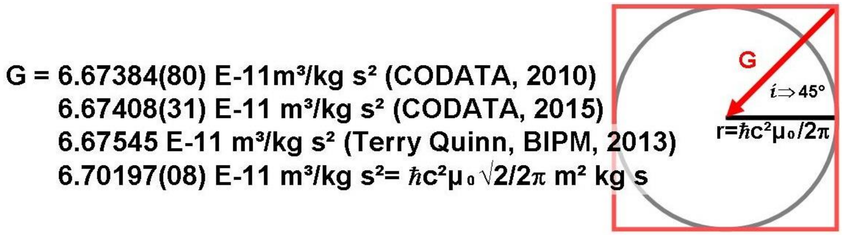


4.9 Degenerate Variable Management

Degenerate density has an available angular hypersurface to which the scalar effect (f) on mass applies. Value added to this increases the volume.

Degeneracy pressure has an available complex manifold surface. The scalar value applies specifically toward the mass variable in G that cancels with its unit likeness in μ_0. The increased value decreases the volume of effect by proportionally increasing pressure focusing the use of space.[15]

Degeneracy density and pressure are diverging and converging spaces respectively. G is inconveniently not constant.[16] It fluctuates with changes in distribution and specifically the rotation ($z=x+iy$) of the angular into or out of the linear axis. The active hypersurface is the focus, such that the angle of rotation is determined by the arc-tangent of the manifold ratio: $\varphi=\tan^{-1}$ surface (R|Y)/volume (Z|X).



4.10 The Not-so Universal Constant G

This angle gives $2\pi G=\mu_0 \hbar c^2 \sec \varphi/m^2 kg\ s$, where the rotation modifier is defined as $\varepsilon_V=2 \sec \varphi$ /kg m^2 s. The bottom value illustrated above is where R=Z, $\sec \varphi = \sec 45°=\sqrt{2}$. This Cabibbo mixing angle is analogous to Weinberg weak mixing angle[17] we will revisit with Bose-Einstein.

Latent Mass and Focus

It is important to remember that in Relativity, spacetime limitations, energy, and distance are absolute. Just because I recalibrate my ruler does not mean things I am measuring are actually larger or smaller. If I start with an 8 oz. glass full of water and change the scale of the glass to 6 oz., changing the glass size did not change the amount of water I'm trying to keep in it. Assuming there is nothing to help balance the equation, that water is now diverging. Converging is obviously the opposite condition where a low potential like an available funnel mouth draw in more value.

Permittivity and permeability define a space by a latent mass value. Unlike ordinary mass, this value is just a potential. It needs the right context to resist acceleration and be discrete mass. Instead, it resists loss of focus. When it is added to an available space, not only is there less space available to add into resisting the ability of energy to do work, quite often divergence applies outright resisting more acceleration and risking identity changes.

I used to think of permittivity and permeability as boundary limitations. It is not so simple. When I started working with degeneracy, I had to rethink the variables significantly. Most of these constants have at least two if not all three metrics. The key metrics are the relationships between latent mass and a volume or length of space. Each object, no matter its nature, has three spaces: a volume, pressure, and tangent. One or two of these is active, and only one is a low energy potential—a second available is a charge potential.

Nature combines these three spaces and forces its variables. Yes, these are limits, but the limits can be squeezed with dilation. They are combined either by the strong interaction with the same origin by strong interaction, by separated origins in weak interaction, or discretely apart from each other completely.

Shared origin with separate identities describes every type of singularity—converging like a black hole (real forms of *j́*-entropy) or diverging like light (uses the *í*-operator). These hypersurfaces are pressure coming into or going out of focus.

Complex forms of *j́*-entropy also describe pressure but in a single complex space that includes both surface and volume variables. Because they combine into one space, they are mirrored by an opposite space that is also complex with a tangent. The tangent is the available space for energy, and the opposite complex space is a charge potential. It is that charge potential that wraps the electron around a proton.

Finally, degenerate density's main feature is its volume. The volume is comingled with a hypersurface and its tangent. The hypersurface and its tangent are typically combined in a charge sequence like the degenerate pressures are. And like the degenerate pressure, this complex space is mirrored by an equally complex space. Otherwise the tangent is discrete allowing a free-flow of forced variable energy in the form of magnetism to the degree the nuclide structure allows.

In each of these, the common geometry enables far more latent value to apply by having more axes to apply it into. The tangent axis is particularly tricky because, as magnetism, it can potentially project itself out as far as it wants to go up to z=1. 10.9 Gly is a massive magnetic field line potential. Mingled together, however, triggers significant restrictions like exclusion.

The available space must be available. It can be filled nearly all the way, just not all the way without triggering exclusion. It isn't supposed to be filled because it has the important job of acting as energy intermediary for microstates. Without it, energy cannot keep flowing. A charge potential space, like that of an electron, however, is welcome to be filled. It causes no violations by itself.

4.11 Scale Dilation Diverges Density Into Energy

Once the spaces are confined and renormalized to the point of discrete mass, there are clear boundary conditions. The change function of identity defining how the spaces are woven together is constant (**conserved**) despite adding and removing value up to the point of identity change. Any new latent value ($p=m_0v$) added rolls into the mass generally (m_2) by means of Relativistic momentum: $(m_2c^2)^2=(m_1c^2)^2+(pc)^2$.

Practical Form

$$\beta = \frac{\sqrt{x_v^2 + (M|D)^2}}{ct} = \frac{v_j}{c}$$

Complex Forms

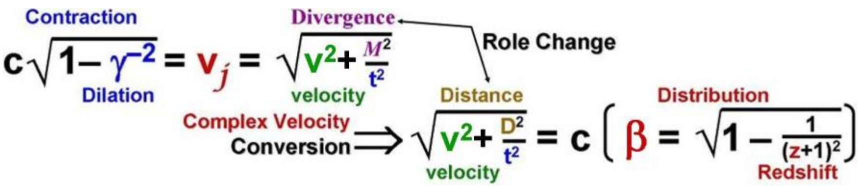
Hyperbolic $\quad j'x_v = \hbar'ct\beta - i'M$

Circular $\quad \hbar ct\beta = jx_v + iD$

v	0.20c	0.40c	0.59c	0.79c	0.99c
M	0.040825*i*	0.174574*i*	0.431135*i*	1.01793*i*	6.94775*i*
β	6.5365E-10	1.2229E-9	1.5890E-9	1.6156E-9	4.6584E-10

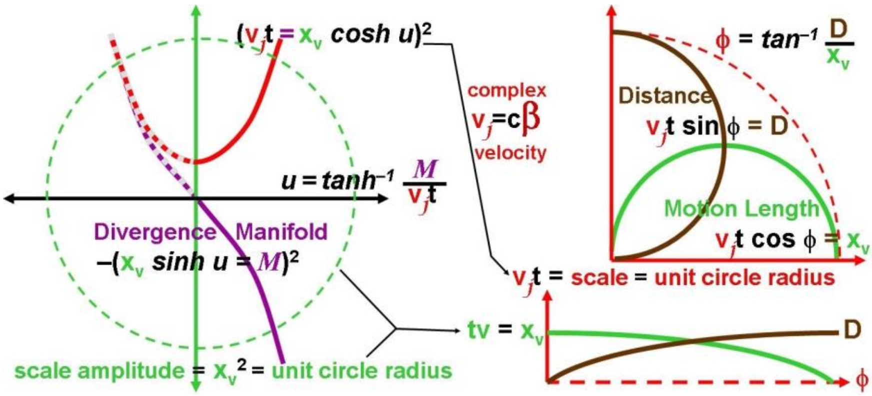
4.12 Diversion Converting into Distribution

The use of space is also somewhat simplified. In this book we are generally treating it as discrete (RdZ). But in common use, the effect is described using a Euclidean context to reduces manifolds to length axes (1-sphere). Instead of a Laplacian distribution the Euclidean dimensions are presented as a scale distribution function: $s^2=x^2+y^2+z^2+(ict)^2$.[18]



4.13 Variable Axis Role Conversion

Sustained velocity length (tv) is a length. As it increases, the dilation effect (γ) on scale (s) also increase. A part of the volume becomes a high potential manifold (*M*) distributing as energy into distance (D). This energy can propagate away as light, be trapped locally, or be directed by magnetic fields into what CERN refers to as "particle beams."[19]



4.14 Hyperbolic to Circular Conversion

Manifolds assume the available shape. A particle beam is nothing more than discrete energy of identity converted into latent energy and kept in focus by magnetic field lines. Without a means to focus, either by spatial restriction or shaping like this, the effect of divergence is generalized. The generalized part is a volume distribution proportional to velocity.

This is the initial redshift value where the entire shift represents motion length of velocity. The wavelength of the cycle is the only amount of that emission that is distance. The higher the energy, the higher the frequency, shorter the cycle coming into hypersurface (Y) focus and longer wavelength of the unfolding volume (X) radius.

$$2c^2 = \frac{x_v^{\,2}}{t_u^{\,2}} + \frac{x_u^{\,2}}{t_v^{\,2}} = \lambda'^2\nu^2 + \nu'^2\lambda^2$$

As light propagates (angular XdY), the value shifts from X to Y resisted by its latent mass value in the process of redshift getting us finally to the fourth law of propagation. More conventionally, the changes in position (x) relative to time account for both motion and distance.

Flux Parameters

Hubble's constant was originally 500 km/s/Mpc or 160 km/s/million light years=1.6E11 m ly/s. It has since been cinched down to 70.4.[20] We are going to show the statistical analysis of this variable is wrong because it is object specific and should not be generalized. As such, we need to explain exactly what it is and how to put it in the right units.

The first step is always to simplify. 1Mpc=3.125Mly and a light year=9.46E+21m simplify Hubble's constant to H_0=5E5*9.46E21/3.125= 1.5139E+27m^2/s—ratio of viscosity to density being resistance to flux.[21]

at H_0=70.4 km/s/Mpc=2.13115E+26 m^2/s

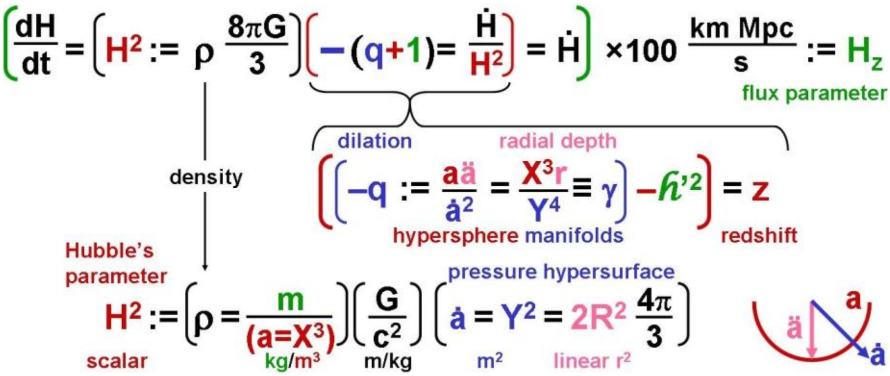
$\hat{H}_0$=4.692305E-27 s/m^2

The cap (Ĥ) indicates a directional variable enabling propagation. This variable in Big Bang cosmology is treated as a smoking gun of expansion. Let me rephrase it. It is the smoking gun of propagation: the radial distribution of volume (1-sphere). The flux of volume changing into pressure hypersurface is the observed 2-sphere effect.

This is conservation: the first law of Thermodynamics.[22] In other words, you cannot separate energy of any type from space of some type. Since energy only transforms and is never created or destroyed, the same is true of space. Hubble's constant (parameter=H) is simply light's form of acceleration in its flux process.

Hubble's constant calibrates redshift statistically by measuring distances of galaxies in the depth of the field by the brightness of Cepheid variables and type 1a supernovae.[23] Depth of field is a **length in time** and not the same as the surface of the field. Hubble showed galaxies are

spaced on average 2Mly no matter the distance.[24] This means the effects of redshift are an intrinsic feature of light, not an indicator of expansion.



4.15 Hubble's Flux Parameter

Hubble's parameter shows the qualities specific to a propagation are shifted along the spectrum over time. One generic constant only works to over-simplify. Being propagation specific means we can actually test and observe this empirically on Earth. The equation breaks down into three parts defining a flux parameter.

1. The first part is the pressure function defining the amount of value being propagated and ultimately transformed from volume to pressure. Density is entirely too vague, and the initial equation overlooks the s^2 units in G. Linear permittivity (G/c^2) resolves this with the hypersurface effect ($\dot{a}=Y^2$).

Breaking it down into specific detail resolves the problem. The mass value for light is latent (potential) taken from the energy for luminosity $L=mc^2$ and held constant through the process. Its density is volume-defining. As a transverse propagation, the relative volume ($a=X^3$) unfolds as a relative radius in time ($\ddot{a}=r$), then as enfolding hypersurface.

2. The second part consists of a series of unnecessarily abstract variables referred to as the "deceleration parameter." Analysis of those variables reveals they are a hypersphere[25] evaluation of redshift. The FLRW interpretation of these equations sets t and "a" as cosmic variables.[26] This interpretation is not empirically reproducible or provable. Object-specific time (since emission=distance) and volume manifold variables ($a=X^3$) makes them relativistic and empirically provable.

In context, "a" is traditionally presumed a 3-sphere. That presumption includes a surface. Without the surface it is a 2-sphere deriving to a 1-sphere surface to 0-sphere length. The first derivative ($\dot{a}=Y^2$) is the enfolding hypersurface (also a 2-sphere), the 1 or 0-sphere evaluation is the second derivative: the relative radius in time ($\ddot{a}=r$). Lorentz factor dilation is the ratio $X^3r/Y^4=\gamma$. Adding a hypercomplex operator ($\hbar'^2=+1$) completes the role change to redshift ($z+\hbar'^2=\gamma$).

3. Applying of units[27] (100km Mpc/s = 3.08567758128e+27m^2/s) provides the flux parameter.. This parameter is specifically a form of kinematic viscosity, the inherent resistance to flow.[28]

The flow being resisted is conversion from volume to pressure. As the spectrum shifts, parts of the value not otherwise lost to other interactions pass a point of no return at the minimum frequency (υ=1.727E-17 Hz=$\sqrt{4\pi\varepsilon_0 G}$). That irreversible change that obeys the first law of Thermodynamics is what the flux parameter measures.

Explained simply, the variables of this function are similar to filling a balloon with a volume (X^3) of air. As you fill, the surface (Y^2) expands, distributing the value of the volume. The relative radius of the filling balloon (r) is independent but derivative of surface radius ($\dot{a}=2R^2 \Rightarrow \ddot{a}=r$).

Connecting them in the form of a steradian makes it easier to see how this function derives from inverse square law (see pg. 98). Their difference in proportion as X becomes Y defines the flux parameter. They are independent because transformation separates the sources of their values.

In spacetime, the radius (r) is the temporal distance of propagation—the unfolding of volume. The volume began compacted into the mass density. If by filling our balloon we used vaporizing dry ice, we would see the radius increasing with increased temperature (coefficient of linear thermal expansion).

The mechanical balloon form unfolds volume that remains volume. The volume and radius are connected and put under pressure by the surface tension. Its process does not define the surface. In spacetime, light distributes into a transverse value that enfolds along a surface. The radial connection is with the surface, leaving volume available.

The volume defined by the density (e.g. luminosity) is just potential surface. Knowing the initial luminosity, as with Cepheids, enables connection between the three variables which calibrates redshift for that one observation. It does not calibrate redshift for any other observation. Because it is object-specific, the variables and their roles can be confirmed by empirically reproducing them on an observable level instead of just speculatively asserting.

Endnotes

[1] (2010). 1609-2009: 400th Anniversary of Galileo's Astronomical Discoveries. solar-center.stanford.edu/galileo/.
[2] (ret. Sep. 23, 2018). Cambridge Dictionary. "dilate." dictionary.cambridge .org/us/dictionary/english/dilate.
[3] Weisstein, E.W. (ret. Oct. 6, 2018) Metric. MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/Metric.html.
[4] Image credit: Ashmarin, S. (Aug. 21, 2014). Zytglogge Tower/Bern, Switzerland. https://commons.wikimedia.org/wiki/File:Zytglogge_Tower_-_Bern,_Switzerland_-_panoramio.jpg.
[5] Baser, O. (Sep. 9, 2015). Medium Pressure Tube Fittings used in stainless steel tubing; 3 types. https://handytube.com/medium-pressure-tube-fittings-used-in-stainless-steel-tubing-3-types/.
[6] Henderson, T. (ret. Oct. 6, 2018). Categories of Waves. physicsclassroom.com/ class/waves/Lesson-1/Categories-of-Waves
[7] Erdogan, T. (2018). Understanding Polarization. Lake Forest, IL: Semrock, Inc. https://www.semrock.com/understanding-polarization.aspx.
[8] Henderson, T. (ret. Oct. 6, 2018). Sound is a Pressure Wave. physicsclassroom.com/Class/sound/u11l1c.html.
[9] (ret. Oct. 6, 2018). What are Gravitational Waves? ligo.caltech.edu/page/what-are-gw.
Wills, S. (Feb. 11, 2016). LIGO's Payoff. Research News. https://www.osa-opn.org/home/newsroom/2016/february/ligo_s_payoff/.
(Feb. 11, 2016). Gravitational Waves Detected 100 Years After Einstein's Prediction. https://www.ligo.caltech.edu/news/ligo20160211.
[10] Feild, A. & Riess, A. (June 2, 2016). Three Steps to Measuring the Hubble Constant. nasa.gov/image-feature/goddard/2016/three-steps-to-measuring-the-hubble-constant/.
[11] Hubble, E. (Nov. 23, 1924). Finds Spiral Nebulae are Stellar Systems. The New York Times. nytimes.com/1924/11/23/archives/finds-spiral-nebulae-are-stellar-systems-dr-hubbell-confirms-view.html.
Hubble, Edwin (Jan. 17, 1929). A relation between distance and radial velocity among extra-galactic nebulae. PNAS. **15** (3): 168–173. www.pnas.org/cgi/reprint/15/3/168.
[12] Weisstein, E.W. (ret. Oct 8, 2018). Ricci Curvature Tensor. MathWorld. http://mathworld.wolfram.com/RicciCurvatureTensor.html.
[13] Wolfe, J. (ret. Sep. 24, 2018). Relativity: The original references - and some caveats and conventions. University of New South Wales. https://newt.phys.unsw.edu.au/einsteinlight/jw/module1_references.htm.
[14] Nave, R. (2017). Length Contraction. Georgia State University. hyperphysics.phy-astr.gsu.edu/hbase/Relativ/tdil.html.
[15] Rieke, G.H. (Nov. 24, 2007). White Dwarf. Tucson: University of Arizona. ircamera.as.arizona.edu/NatSci102/NatSci/lectures/whitedwrf.htm.
[16] Mohr, P.J. et al. (2012). CODATA recommended values of the fundamental physical constants: 2010. physics.nist.gov/cuu/pdf/RevMod

PhysCODATA2010.pdf.
Newell, D. (2015). CODATA Recommended Values of the Fundamental Physical Constants 2014. codata.org/blog/2015/08/04/codata-recommended-values-of-the-fundamental-physical-constants-2014/.
Moskowitz, C. (Sep. 18, 2013). Puzzling Measurement of "Big G" Gravitational Constant Ignites Debate. scientificamerican.com/article/puzzling-measurement-of-big-g-gravitational-constant-ignites-debate-slide-show/.
[17] Muheim, F. (2006). Nuclear and Particle Physics. Univ. of Edinburgh. https://www2.ph.ed.ac.uk/~muheim/teaching/np3/lect-ZandW.pdf.
[18] Wolfe, J. (ret. Sep. 24, 2018). The Lorentz transform equations, the addition of velocities and spacetime. University of New South Wales. newt.phys.unsw.edu.au/einsteinlight/jw/module4_Lorentz_transforms.htm.
[19] CERN. (Sep. 23, 2018). How an accelerator works. https://home.cern /about/how-accelerator-works.
[20] Huchra, J. (2008). The Hubble Constant. https://www.cfa.harvard.edu/ ~dfabricant/huchra/hubble/.
Wollack E.J. (Mar. 25, 2013). Tests of Big Bang: Expansion. https://map.gsfc.nasa.gov/universe/bb_tests_exp.html.
[21] (ret. Oct. 18, 2018). Kinematic Viscosity Formula. softschools.com/ formulas/physics/kinematic_viscosity_formula/472/.
[22] Lucas, J. (May 19, 2015). What Is the First Law of Thermodynamics? https://www.livescience.com/50881-first-law-thermodynamics.html.
[23] Feild, A. & Riess, A. (June 2, 2016). Three Steps to Measuring the Hubble Constant. nasa.gov/image-feature/goddard/2016/three-steps-to-measuring-the-hubble-constant/.
[24] Hubble, E. (Nov. 23, 1924). Finds Spiral Nebulae are Stellar Systems. The New York Times. nytimes.com/1924/11/23/archives/finds-spiral-nebulae-are-stellar-systems-dr-hubbell-confirms-view.html.
Hubble, Edwin (Jan. 17, 1929). A relation between distance and radial velocity among extra-galactic nebulae. PNAS. **15** (3): 168–173. www.pnas.org/cgi/reprint/15/3/168.
[25] Weisstein, E.W. (ret. Feb. 13, 2019). Hypersphere. MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/Hypersphere.html.
[26] Jones, M.H. & Lambourne, R.J. (2004). An Introduction to Galaxies and Cosmology. Cambridge University Press.
[27] (ret. Mar. 15, 2019). Convert Megaparsec to Meter. https://www.unitconverters.net/length/megaparsec-to-meter.htm.
[28] (2003). Absolute, Dynamic and Kinematic Viscosity. engineeringtoolbox .com/dynamic-absolute-kinematic-viscosity-d_412.html.

The Latent Case

I was at first almost frightened when I saw such mathematical force made to bear upon the subject, and then wondered to see that the subject stood it so well.

—Michael Farraday, Mar. 25, 1857
letter to James Clerk Maxwell
re: "On Faraday's Lines of Force"[1]

[1] (1884). The Life of James Clerk Maxwell: With Selections from His Correspondence. Campbell, L. & Garnett, W eds. p. 200. archive.org/details/lifeofjamesclerk00camprich.

Entropies ×	j	h	i	$\hat{j}$	$\hat{h}$	$\hat{i}$
j	−1	$\hat{i}$	$\hat{h}^2$	0	i	$\hat{h}^2$
h	$\hat{i}$	−1	j	$\hat{i}$	0	$\hat{j}$
i	$\hat{h}^2$	$\hat{j}$	−1	$\hat{h}^2$	j	0
$\hat{j}$	0	$\hat{i}$	$\hat{h}^2$	+1	i	$\hat{h}^2$
$\hat{h}$	i	0	j	i	+1	j
$\hat{i}$	$\hat{h}^2$	$\hat{j}$	0	$\hat{h}^2$	j	+1

to

Colors ×	r	g	b	c	m	y
r	−1	y	m	0	b	m
g	y	−1	c	y	0	c
b	m	c	−1	m	r	0
c	0	y	m	+1	b	g
m	b	0	r	b	+1	r
y	m	c	0	g	r	+1

Color/Change Truth Tables

	Primary	Boolean Operator	Secondary	Alternates: Sum	Alternates: Product	Applied: k^2	$k+k$	$k-k$	Relative k^2	$(x+ky)^2$
h	i	BOTH	j	n	n	−1	$2h$	0	$ij = -i/j \mid \hat{i}'/j$	$x^2+2hxy-y^2$
i	—	AND	+	n	y	−1	$2i$	0	$-hj = h/\hat{j}' \mid j/\hat{h}'$	$x^2+2ixy-y^2$
j	+	OR	—	y	y	−1	0	$2j$	$-hi = h/\hat{i}' \mid i/\hat{h}'$	y^2-x^2
$\hat{h}'$	$\hat{j}'$	BOTH	$\hat{i}'$	y	y	+1	0	$2\hat{h}'$	$-ij = j/i \mid \hat{j}'/i$	y^2+z^2
$\hat{i}'$	+	AND	—	y	n	+1	0	$2\hat{i}'$	$hj = \hat{h}'/j \mid \hat{j}'/h$	x^2+y^2
$\hat{j}'$	—	OR	+	n	n	+1	$2\hat{j}'$	0	$hi = \hat{h}'/i \mid \hat{i}'/h$	$x^2+2\hat{j}'xy+y^2$

Complex Operator Rules Table

5. Change Functions

Einstein used new variables and language to evolve the field concepts of Poisson and Gauss into the more contemporary thinking of Riemann and Ricci-Curbastro.[1] This helped solve old thinking problems, and created its own list of unforeseen problems. For Quantum Mathematical Language (QML), quaternions[2] and related octonions[3] are the fairly new and less familiar. The most popular way to use them does a nod to $i^2=j^2=k^2=-1$, skips the change logic and uses them as linear substitution for matrices.[4]

The quantum case is the case of the fundamental. Fundamental things aren't arbitrary. They belong to categories defined by a single conceptual element like change. Fundamental things are not created or destroyed, so they cannot evolve. Fundamental things can only transform within their category conserved and proportional to other categories. The differences within category are simply perspectives of the concept. Each perspective has an array of application contexts that apply simultaneously.

Change functions increment, sequence, and shape everything on a fundamental level. They help show how spacetime is constructed, revealing confined (hidden) quantum perspectives. Each function has two distinct fields: one order with explicit value and the other disorder with attributed value. As unit axes they relate to the probability density of S-entropy. For this and the classical meaning we call them entropies.

These are vital operators giving action to mathematics, often overlooked in plain view. Among the ranks of functions, these operators define cycles placing them at the root of the architecture. We will define these change functions clearly as Boolean logic concepts satisfying truth analysis such a quaternionic logic. These are complex variables with many very familiar applications in mathematics. Those applications help explain the less familiar concepts of the more advanced logic.

Entropies

Entropies use Boolean logic OR (j=+|–≡cosine), AND (i=–&+≡sine), BOTH (h=j&i≡cotangent) | NOT (t=real positive) truth concepts.[5] In each of these sequences, the first variable is the explicit order value.

Each relates to an axis and is governed by rotational rules such that they are solutions to $\sqrt{-1}$, and chiral forms to $\sqrt{+1}$. Except time. Time is antithetical to hypercomplex making it a linear and positive real value.

Complex functions contain on imaginary element. Hypercomplex functions contain two imaginary elements. We prefer the word **virtual** over complex because it conveys better into forming and evolving matter.

As with the relationship of light and lens with an image, virtual describes a divergence.[6] Likewise with matter, real consists of a stable convergence where virtual is unstable subject to divergence. Careful choice of words enables scalable application.

Leonhard Euler (1707–83) developed the familiar imaginary number ($i=\sqrt{-1}$) into a system of complex variables to relate algebraic and polar axes (constructing ordinary spaces).[7] He did this based on context without any evidence of a logical explanation of HOW i^2 becomes –1 or seeing the need for other imaginary operators embedded in the same logic. We will use similar illustrative methods with graphical applications later.

$$e^{i\omega} = [\cos\omega + i\sin\omega = x + iy] = z \quad \text{at } \omega = \pi,\ e^{i\pi} = -1$$

$$\cos\omega = \tfrac{1}{2}(e^{i\omega} + e^{-i\omega}) \qquad \sin\omega = \tfrac{1}{2}(e^{-i\omega} - e^{i\omega})$$

$$\text{where } e^{i\pi} = -1 = \hbar^2 \quad | \quad -e^{i\pi} = +1 = \hbar'^2$$

$$[e^{i\pi} + 1]^2 = e^{2i\pi} + 2e^{i\pi} - \hbar^2 = e^{2i\pi} + \hbar^2 = 0$$

Tessarine and quaternion truth tables devised later (below) have a mutual problem: contextual validity with no tangible explanation HOW. Quaternions are asymmetric, making sequence important so ji=–ij. In all three, ij=k or –k.[8] Cockle's tessarines are symmetric (ij=ji) and use $j^2=+1$.[9] Contemporary tessarines are $j^2=-1$.[10]

Asymmetric — Quaternions (Hamilton)

×	j	k	i
j	–1	i	–k
k	–i	–1	j
i	k	–j	–1

Symmetric — Tessarines_O (Cockle)

×	j	k	i
j	+1	i	k
k	i	–1	–j
i	k	–j	–1

Symmetric — Tessarines_N (Negulescu)

×	j	k	i
j	–1	i	–k
k	i	+1	j
i	–k	j	–1

5.1: Quaternions v. Tessarines

Around 1847, George Boole (1815–64) devised the system of syllogistic logical operator concepts: OR, AND, and BOTH/NOT.[11] NOT (t) is excluded here. Although ideal for the task, this logic was never used to explain HOW operators work in truth arguments like tessarines and quaternions.

Boolean		Symbolic Logic			Entropy	Topology	
AND	x & y	x ∧ y	Kxy	XAND	i	tetrahedron	z
OR	$x \mid y$	x ∨ y	Jxy	XOR	j	circle	x
NOT	\ x	¬ x	$Ix \mid Nx$	NOTX	t	flat	t
BOTH	x ∥ y				$\hbar$	sphere	y

5.2: Boolean Logic Symbols

This was resolve by accident of technological necessity substituting j for ±. By making ± a unit variable operator, it acquired the logical qualities of Boole's OR, inverting roles (flipping signs) every operation. AND was applied to i, but only inverts in multiples (as with h). To accommodate BOTH as a third solution ($h^2=ij=-1$), negative comes first i=–&+.

Among tessarines and quaternions, k=ij or –k=ij. This is an extremely limiting approach. We need the root $\pm k \equiv h^2 = ij$. The hypercomplex variable can be reached other ways as well, such as $2h^2=i^2+j^2\equiv 2(jx+iy)/z$, etc. Our entropy operators are not just features of a truth table. They show how space and time are constructed.

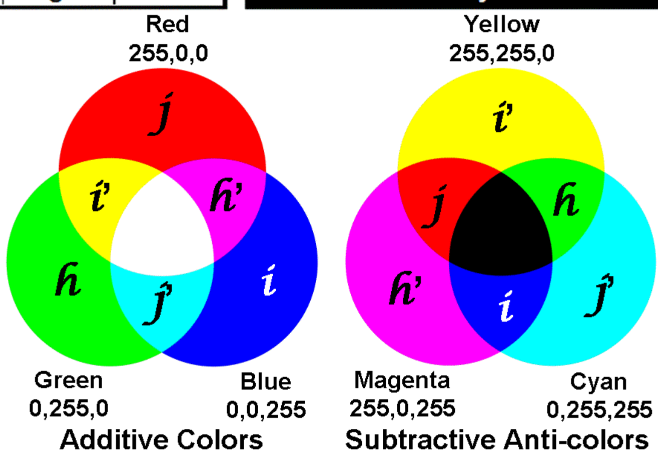
Into Color

Having two more complex operators proved incredibly helpful in a broad range of applications. Everything about these operators is extremely ambiguous, so errors are easy. Fortunately, colors offer a real world analog. Most of how we describe, interpret, and otherwise define reality is fallible. It all goes out the window as soon as our understanding increases. Empirically established facts, however, never change.

Colors are more than just a metaphor for strong interactions. Handled properly, they show us everything we need to know about particle interactions and hadronization. They were selected for QCD due to the qualities they exhibit on the artist's pallet when mixed together. For a quantum truth table, this is a watershed victory because we can show it in the ordinary world and let nature resolve the ambiguities.

COLORS		
Red	r	j
Green	g	i
Blue	b	h
White	rgb	K

ANTI-COLORS			
Anti-red	$\bar{r}$=c	j'	Cyan
Anti-green	$\bar{g}$=m	i'	Magenta
Anti-blue	$\bar{b}$=y	h'	Yellow
Black	cmy	K	



5.3: Octal Color to Change/Charge & Palette

Chromodynamics normally uses colors and anti-colors with the same symbols but with a bar across the top. We will use the subtractive cmy=K colors as anti-colors for purposes of visualization. You do still have to remember the r-c, g-m, and b-y color anti-color relationships.

Color palates show how colors and anti-colors mix with their own kind to produce their opposites.[12] If two colors interact, the nature of their interaction is provided by the anti-color of their intersection. Degree of intersection distinguishes different types of interactions. As such, the color truth table is vital to how all particles are put together.

For readability, additive color only is used in the text. Negative and inversion cause different orientation changes. Orientation is easily confused with the chiral anti-function. The chiral forms are thus shown with a prime: *j*', ν' and μ', etc.

Entropies to **Colors**

×	*j*	*h*	*i*	*j'*	*h'*	*i'*
j	–1	*i'*	*h'*	0	*i*	*h'*²
h	*i'*	–1	*j'*	*i'*	0	*j'*
i	*h'*	*j'*	–1	*h'*²	*j*	0
j'	0	*i'*	*h'*²	+1	*i*	*h'*
h'	*i*	0	*j*	*i*	+1	*j*
i'	*h'*²	*j'*	0	*h'*	*j*	+1

×	r	g	b	c	m	y
r	–1	y	m	0	b	m
g	y	–1	c	y	0	c
b	m	c	–1	m	r	0
c	0	y	m	+1	b	g
m	b	0	r	b	+1	r
y	m	c	0	g	r	+1

5.4: Color/Change Truth Tables

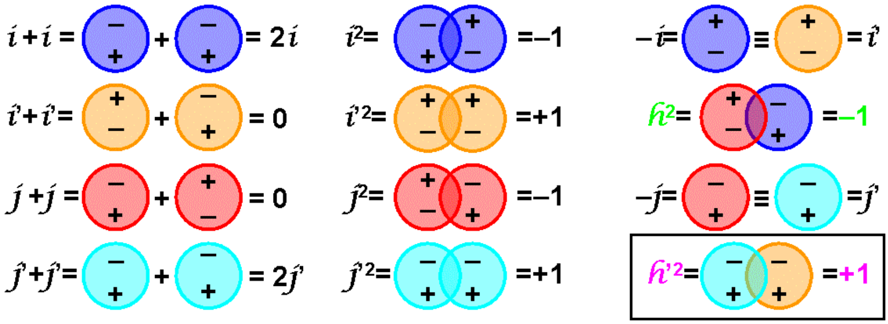
These two tables are symmetrical: *ij*=*ji* (or br=rb). They say exactly the same thing in two different ways. The first uses the entropy containers represented by the mathematical operators. The second uses the colors of chromodynamics. For comparison, all the truth tables in this section are arranged by palate rgb (*jhi*) and cmy (*j'h'i'*).

These tables are much bigger than their predecessors because we have three specific conditions and their chiral forms. In the predecessors we see negative like –j. The analysis showed there are two possible chiral conditions for this variable. In one condition, *j* is simply rotated and looks like *j*' except it isn't *j*'. Rotating alone does not change the identity, hence imperfect mirroring.

Venn Algebra

Venn diagrams[13] are taught in various logic courses like algorithms and symbolic logic. They offer a mechanical way to visualize the concepts of sets, including subset, superset, and the interactions of sets. For now, let us see how our operators function in an applied mathematical way by Venn-like.

Aside from the logical AND, OR, and BOTH features, the operators will invert their signs contextually. Color and anti-color entropies have inverted rules. Where j inverts sign with each operation, j' never inverts (see rule table pg. 87). This is easiest to see in the counter-intuitive $k+k=0$ of j, h', and i'. The opposite for these is also true: $k-k=2k$.



5.5: Color/Change Operation Diagrams

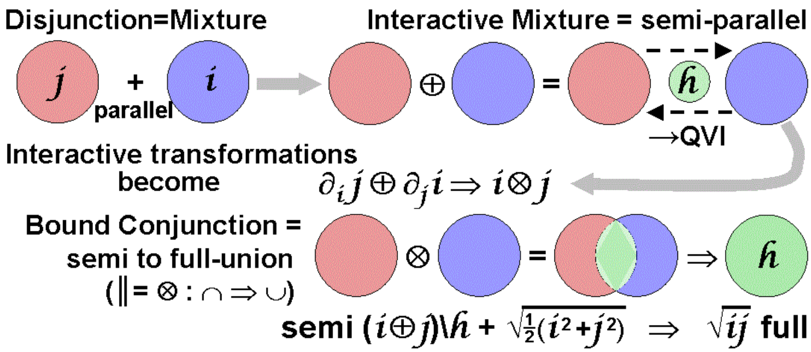
Hypercomplex h is also known as phase entropy. The simplest definition is $h^2=ij$. While simple, this hides the fact that i and j of make up h by being irrational: $h^2=-i/j$. This causes the axis positions of i and j to align as needed to form h. It also rationalizes and provides anti-phase: $h'^2=ij'=-ij=j'/i'$ or

(–|+)/(+&–)=(–|+)(–&+)=(+&|+)
showing $j\equiv 1/j'$; $-h\equiv h'$; $-i\equiv i'$.

For basic algebra, as with chromodynamics, these equivalences can be treated as equal quantum numbers (units). The issue we have with ±k=ij is relative magnitude. Relative to $j=1$, $i=e$. This creates red-blue and cyan-yellow bonding limitations for QCD. To form h practically of one magnitude, i of a lesser magnitude combines with j of the same magnitude.

Phase ($h=e$ to $j\equiv i=1$) is a higher class of change function. It sees unit equivalence allowing a single bond with one (rg, bg, cm, my=Type I Weyl fermions) or both (rgb or cmy=Type II Weyl fermions). Both can only be done simultaneously. We will see later how these combinations define volumes by axial rotations.

The change operator of **order** is j. The change operator of **disorder** and **distribution** is i. At the same magnitude their proportions are 1:e. To interact into phase h, they must be of the same scale (1:1) requiring i to be the next lesser magnitude. This is why fusion discharges so much energy. From their interaction changes emerges the quality of time resisting that interaction.



5.6: Evolving Venn Diagrams (to Hypercomplex)

If we have a mixture of i and j (simple addition=+), the two can interact and pass through the same space. Separately, their axes define surfaces. In degrees of interaction (inner sum), a transient (weak) field cannot distinguish surface from volume and applies value to both. Full bonding interaction results in a **flavour** volume, and the increments of interaction define resistance consistent with time.

$$\int\left(\frac{d(i+j)}{dt} = \frac{d(ij-j)}{dj} + \frac{d(ij-i)}{di}\right)dt \doteq (i+j-2\hbar=0)$$

5.7: Hypercomplex-Time Relationship

The partial derivatives (∂) are j and i transforming into each other. They are smoothing into a common state of proportional (1:e) equilibrium. This is the change root of manifolds smoothing from an anomalous atlas (point distribution[14]). Vector energy follows. The lead is scalar energy adjusting value to equilibrium (2^{nd} Law of Thermodynamics[15]).

The prevailing/dominant entropy condition of a set (e.g. the super set conditions) is its phase identity. This is its ideal distribution (e.g. S=0). Changes to phase identity affect the parts (quantum fluctuation). This is shown as an inner product function. The inner product is like the inner sum. Only parts are involved, while the rest is excluded.

Normally, we apply operators assuming all of each variable participates, like 6×4=24 and 4+5=9. The algebra of Venn logic is ambiguous. Just because you have 6 of one and 4 of another doesn't mean you are going to use all those parts, or necessarily use them in the same ways. It is like baking a cake: in theory you didn't use everything in the kitchen.

When we complete our evolving operation, the total scalar value of $\hbar$ is equal to that of i or j. This leaves half the scalar value of the original parts as excess: $(i+j)\backslash\hbar$ reads the mixture of i and j not (\) in $\hbar$. That NOT feature is a time variable making use of what is not used.

We can change the identities of quantum particles simply by changing their phase identity. Neutrino bands given energy rotate to free value making them relativistic. The information in that energy affects the intrinsic information, swapping phase identity. This is called "oscillation."[16]

Algebraic Logic

In algebra our operators are fairly simple: $(h|i|j)^2=-1$ and $(h'|i'|j')^2=+1$. Color entropies are imaginary ($\sqrt{-A^2}=kA$) and anti-colors are REAL ($\sqrt{A^2}=k'A$). The operators easily disappear into any unit. That means attaining or applying any quantum number, like a unit circle, permeability or permittivity, satisfies a unit operator. Sometimes it is simply hiding in the variables or in the temporal units. If an operator is present, it has profound contextual applications. In algebra, the operators are explicitly stated.

	Primary	Boolean Operator	Secondary	Alternates: Sum	Alternates: Product	Applied: k^2	Applied: $k+k$	Applied: $k-k$	Applied: Relative k^2	Applied: $(x+ky)^2$
h	i	BOTH	j	n	n	–1	$2h$	0	$ij=-i/j \mid i'/j$	$x^2+2hxy-y^2$
i	—	AND	+	n	y	–1	$2i$	0	$-hj=h/j' \mid j/h'$	$x^2+2ixy-y^2$
j	+	OR	—	y	y	–1	0	$2j$	$-hi=h/i' \mid i/h'$	y^2-x^2
h'	j'	BOTH	i'	y	y	+1	0	$2h'$	$-ij=j/i \mid j'/i$	y^2+z^2
i'	+	AND	—	y	n	+1	0	$2i'$	$hj=h'/j \mid j'/h$	x^2+y^2
j'	—	OR	+	n	n	+1	$2j'$	0	$hi=h'/i \mid i'/h$	$x^2+2j'xy+y^2$

5.8: Change Logic Rules Table

All entropies are at least complex operators differing by Boolean function and when they alternate signs. The chiral forms have opposite sign alternating rules. For example, j and h' alternate signs each operation, but j' and h never alternate signs.

$$ax^2+bx+c=0 \qquad \text{if } 4ac>b^2 \text{ then } k=h^2 \text{ else } k=h'^2$$

Multiply through by 4a: $4a(ax^2+bx+c=0)$

$4a^2x^2+4abx+4ac=0$

Isolate 4ac: $4a^2x^2+4abx=-4ac$

Add b^2 to both sides: $4a^2x^2+4abx+b^2=b^2-4ac$

Take root and apply k: $2ax+b=j\sqrt{k}(b^2-4ac)=u$

For $4ac\le b^2$ = r-phase: $=j\sqrt{(b^2-4ac)}$

For $b^2<4ac$ = z-phase: $=j\sqrt{(4ac-b^2)}$

Giving a generic: $x=\dfrac{u-b}{2a}$

5.9: Quadratic j-Change Example

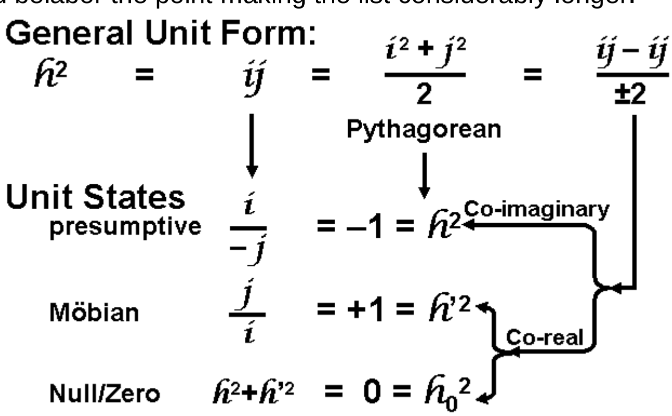
The table shows how these translate algebraically. Some of these qualities make finding the roots of certain functions, like $x^2–y^2$ or x^2+y^2 fairly easy. They can also be used to analyze quadratic functions. This assumes the axes involved are functions of the entropies. Each entropy correlates to and affects a specific axis: $j \rightarrow x$, $i \rightarrow y$, and $\hbar \rightarrow z$. However, a generic $\pm \rightarrow j$.

1. $(A \pm B)^2 = A^2 \pm 2AB + B^2$
2. $(A - jB)^2 = A^2 + 2jAB - B^2$ always $(A + jB)^2 = A^2 - B^2$
3. $(A \pm iB)^2 = A^2 \pm 2iAB - B^2$ $(iA + jB)^2 = -A^2 - B^2$
4. $(A \pm \hbar B)^2 = A^2 \pm 2\hbar AB \mp B^2$
5. $(iA + jB)^2 = (\hbar C)^2 \Rightarrow \hbar^2 = \dfrac{A^2 + B^2}{C^2}$ never $(ABC)^2 = \dfrac{i^2 + j^2}{\hbar^2}$
6. $2\hbar^2 = ij - ij = i^2 + j^2$
7. $2j = j - j = -2i\hbar^2 = -i(i^2 + j^2)$ note $0 = j + j$
8. $\sqrt{j} = \hbar\sqrt{-i} \equiv \sqrt{-i}$ and $\sqrt{i} = \dfrac{\sqrt{-j}}{\hbar} \equiv \sqrt{-j}$

$i = (a + ib)^2$ but $\hbar z = jx + iy \Rightarrow \sqrt{i = \dfrac{x^2 + y^2}{jz^2}} \equiv \sqrt{-j}$

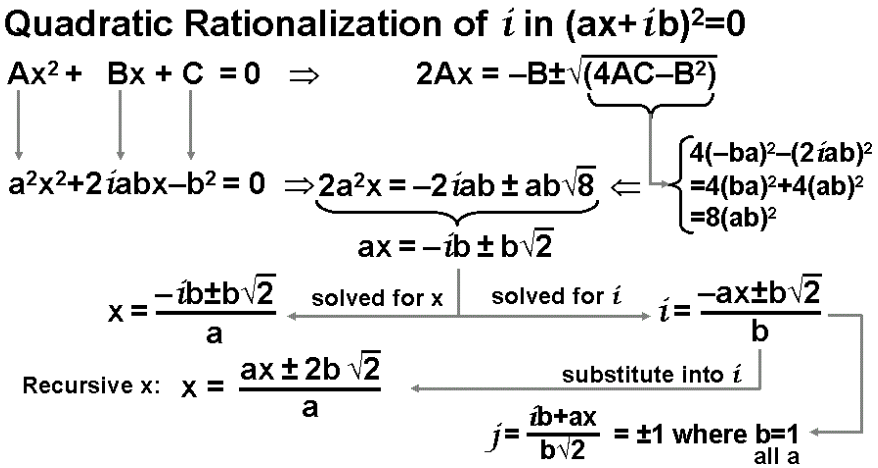
5.10: Imaginary Foils/Roots

The generic foils and roots identities assume we apply the right axes. The most baffling and algebraically useful feature of j, $\hbar'$, and i' is their counter-intuitive zero sums (e.g. $j+j=0$) and doubled differences ($j–j=2j$). We could belabor the point making the list considerably longer.



5.11: Hypercomplex Phase Logic

One of our greatest challenges is finding exactly which operator applies to what. For example, $iA+jB \equiv jA+iB$. In algebra, we are pretty much just going through practice moves, so very likely we don't care. Here we do, so we will get to what exactly these operators can apply to. For algebra, we need to understand how they relate to each other.
We can also use a quadratic approach:



5.12: Quadratic i-j Relationship Example

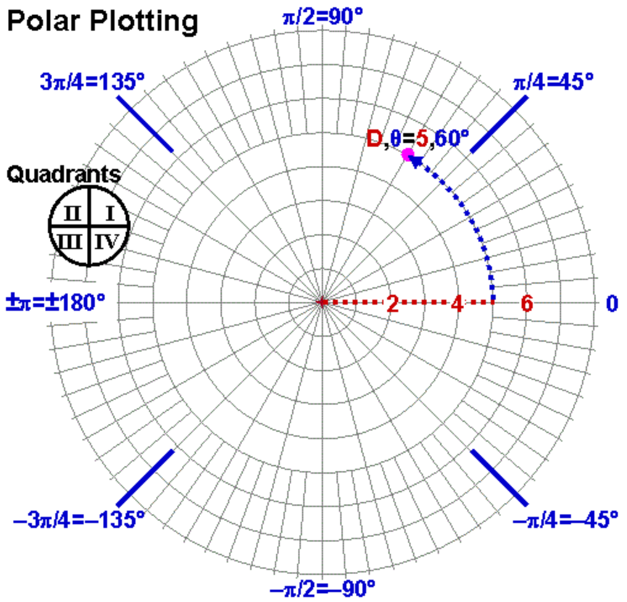
It seems unreasonable to go into too much detail on the anti-entropies at an algebraic level. It is easy enough just following the rules, but perhaps more information than is reasonable without a lot of application. Often such applications are hiding in plain view. Problem is understanding them enough to interpret and make testable predictions.

Polar Refresher

To plot a point (5,60° shown):

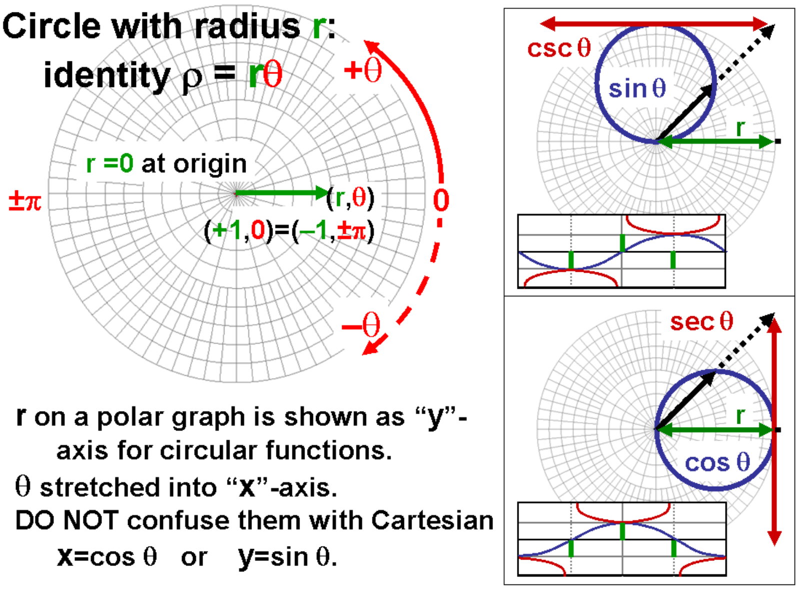
1. Assign length values to the circles.
2. Find the angle (straight lines intersecting the origin). Positive angles are counterclockwise, negative angles are clockwise.
3. Measure the distance from the origin along the straight line relative to the circular distance markers. Positive distance goes toward the angle, negative away from the angle.

The coordinate is represented as a single item by the Greek letter rho (ρ). If the above were ρ=–5,60°, then the point would be in the third quadrant and equal to 5,–120° or 5,240° depending on which direction you go. This is important because trigonometry functions are technically circular and should be plotted in polar coordinates.



5.13: How to Polar Plot

Sine and cosine draw circles (below): sine in quadrants I & II, cosine in I & IV. These circles aren't just drawn once. They are drawn twice in the same places because of the negative values. If we used absolute values of these functions, we would see both circles for each.



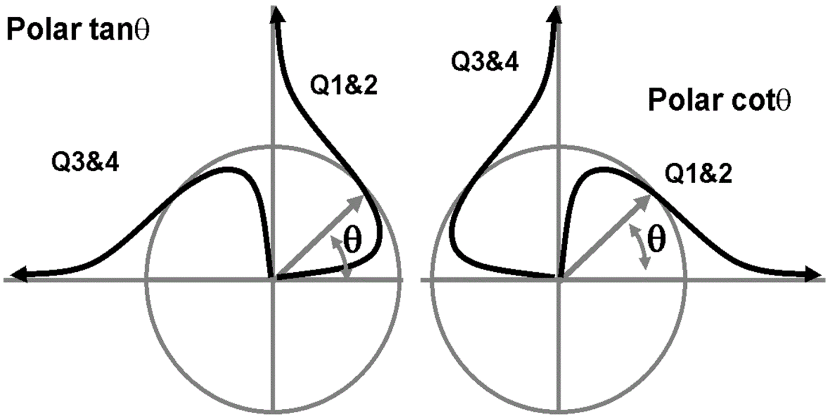
5.14: Circular Function Polar Plotting

The insets of the polar graphs for sine and cosine are the conventional/common way the functions are depicted. As we discussed in Color Geometry, these graphs are useful for measuring related magnitudes of spacetime density.

We also mentioned that the positive radius value (y-axis shown in green) need not have the same magnitude as the negative. Whatever the magnitudes of these are, they a quantified, meaning they have been reduced to a single unit.

The x,y axes of the common depiction are confusing to students. They aren't actually x and y. The x-axis is the angle called the radian (shown in circumference increments of π). Without a radius, the length of this line is technically zero.

Because the radian marks are constant, we use a unit circle (radius=1) and fix the increments of the x-axis. The y axis value is the linear distance from the origin. As with other rectangular systems, you can assign value to the tick marks contextually.

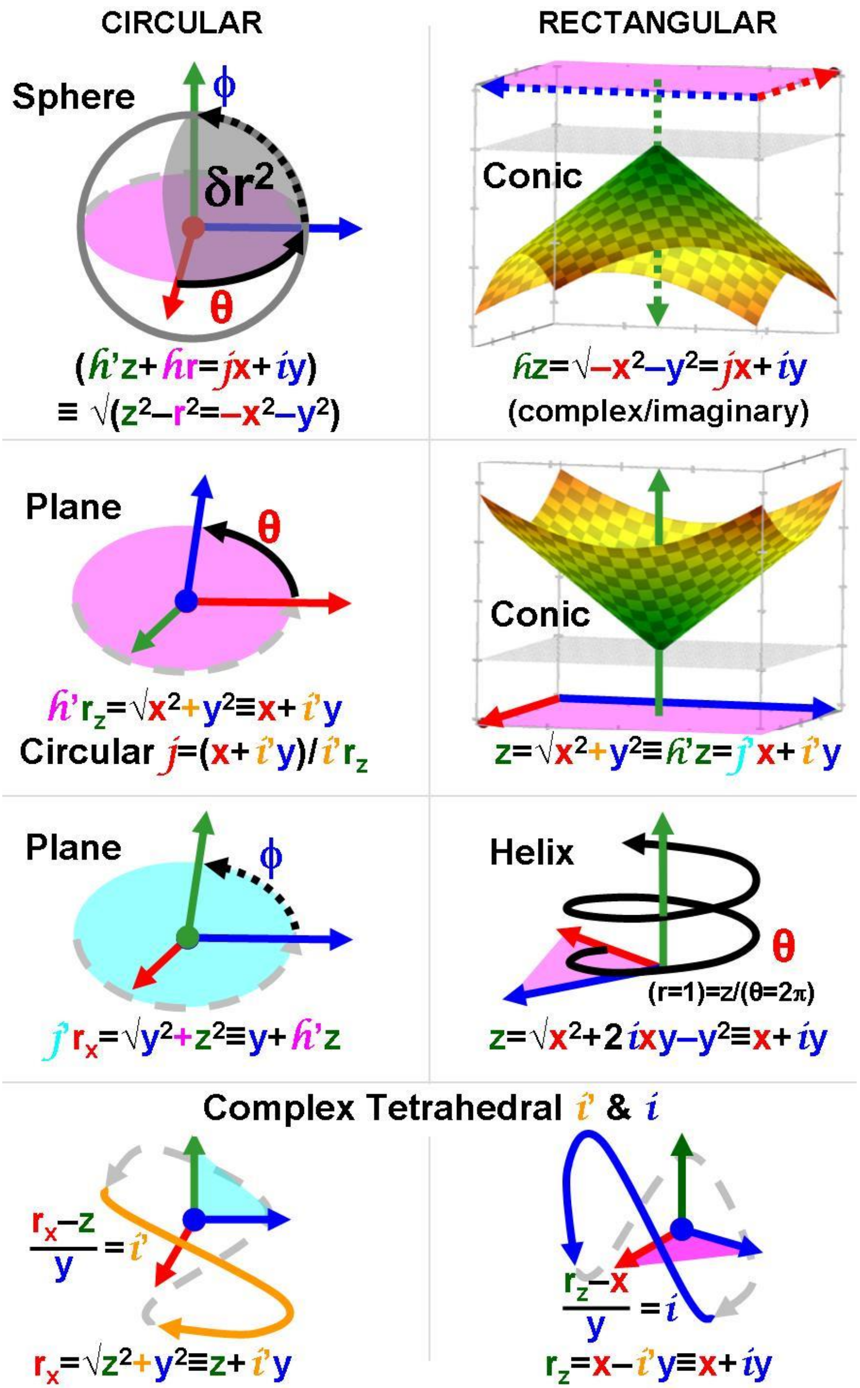


5.15: Tan/Cot Polar Plots

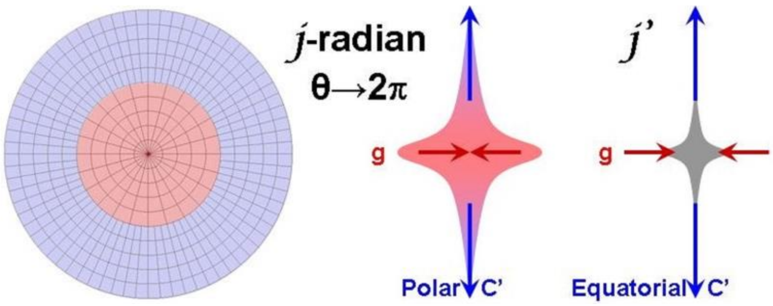
Context Graphs

The graphs below show various ways to apply complex and hypercomplex operators (entropies) to different types of ordinary functions. The second column does things Euler's way: using xyz rectangular/linear axes. The first column recognizes that sometimes a scalar radius occurs instead of a linear axis, or with the linear axes.

Entropies also serve as radians due to change being cyclic. This is how circular planes form from j as flat (shown above as θ) and i as tetrahedral (ω=sinusoidal/S-shaped, lower right of above diagram). Both have the same radian length (2π) and combine to form a spherical radian (shown above as δ) in h of $\theta^2+\omega^2=2\delta\rightarrow 8\pi$.

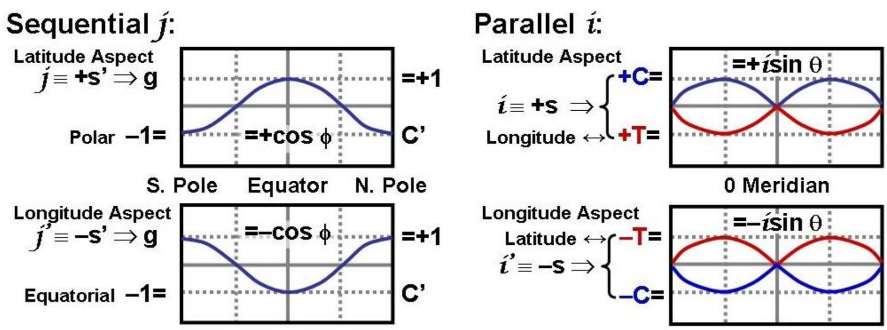


5.16: 3-D Algebraic Context Graphs of Changes



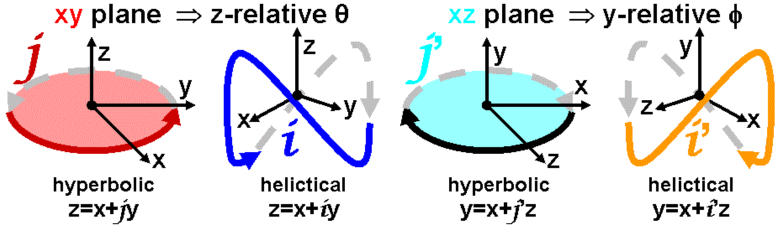
5.17: Flat Radian to Cross-Section Profile

In the polar graph above, red is gravity and the blue centrifugal plane is at a right angle to the red. The result in a cross-section profile appears complex. Gravity is a contracting spacetime (+) and centrifugal is expanding (–). Taken as unit values the conversion from one to the next is cosine.



5.18: Applied Circular Functions to j&i Changes

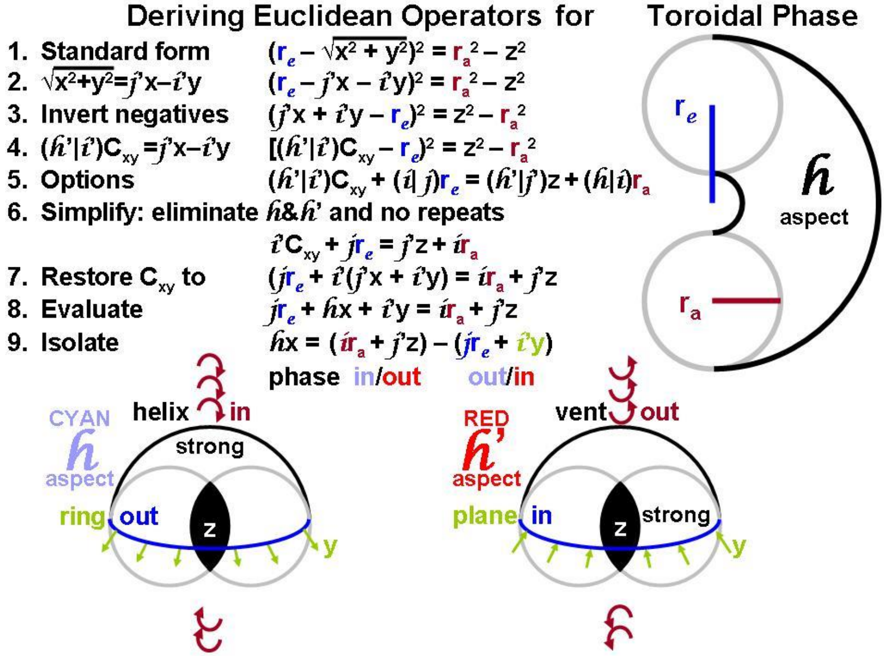
Where *j* vectors are sequential, *i* vectors are simultaneous and working against each other (e.g. left handed). The *i* radian (ω) is only useful for showing these fields forming their plane. It is important to remember the vectors of *i* and *j* are linear and angular, which draws each of these spaces accordingly.



5.19: j&i Change Planes

The *i* and *j* planes are special purpose applying as ideal only in Abstract Phase. That covers every extra-temporal interaction, such as shaping Quantized Vector Interactions (QVI), which corresponds with mapping energy distribution through a microstate sequence, and their application to light.

Light “sees” the discrete plane in profile—or more accurately can’t see it. To it there is an unimpeded space. The propagation is temporal, responding to the shaping of these surfaces coming into phase, and recognizing occupancy. This gives us both gravitational lensing and its related kaleidoscope effect consistent with black hole geometry.



5.20 Complex Black Hole Geometry

When you get used to working with these operators, you start seeing them hiding in plain view. often providing opportunities for special evaluations. A fine example relates the equations of a sphere with torus consistent with perturbing a functional singularity—both types of black hole. Because these are operators not only of simple change but also of transformation into each other, this is process evaluation instead of static.

Endnotes

[1] Vasconcellos, C.A.Z. (editor). (2016). Centennial of General Relativity: A Celebration. New Jersey: World Scientific.
[2] Adler, S.L. (April 27, 1995). Quaternionic Quantum Mechanics and Quantum Fields. Oxford University Press.
[3] Baez, J. C. (2002). The Octonions. Bulletin of the American Mathematical Society. 39, 145-205. https://arxiv.org/abs/math/0105155.
[4] Graydon, M.A. (2011). Quaternions and Quantum Theory. https://uwspace.uwaterloo.ca/bitstream/handle/10012/6168/Graydon_Matthew.pdf;sequence=1.
[5] Zimmer, S. (Jun. 30, 2017). What is a Boolean Operator? Alliant International University Library. library.alliant.edu/screens/boolean.pdf.
[6] Pumplin, J. (2000). Images Real and Virtual. web.pa.msu.edu/courses/2000fall/PHY232/lectures/lenses/images.html
[7] Sachs, R. (2011). Euler's Formula for Complex Exponentials. math.gmu.edu/~rsachs/m116/eulerformula.pdf.
[8] Krishnaswami, G.S. & Sachdev, S. (Jun. 2016). Algebra and Geometry of Hamilton's Quaternions. ias.ac.in/article/fulltext/reso/021/06/0529-0544.
[9] Cockle, J. (1848). On Certain Functions Resembling Quaternions and on a New Imaginary in Algebra. Philosophical Magazine and Journal of Science. pg 436. biodiversitylibrary.org/item/20157#page/450/mode/1up.
[10] Negulescu, V.L. (May 2, 2015) Hyper-Complex Numbers in Physics. http://article.sapub.org/10.5923.j.ijtmp.20150502.03.html.
[11] Norman, J. (Jan. 23, 2018). George Boole Develops Boolean Algebra. www.historyofinformation.com/expanded.php?id=565.
[12] Brown, A. & Feringa, W. (2003). Colour Basics for GIS Users. Harlowe, England: Pearson Education Limited.
[13] Stapel, E. (2017). Venn Diagrams. purplemath.com/modules/venndiag.htm.
[14] Welbourne, E. (Mar. 18, 2017). Atlases and Charts of Smooth Manifolds. http://www.chaos.org.uk/~eddy/math/smooth/atlas.html.
[15] Redner, S. (2006). Equilibrium and the Second Law of Thermodynamics. http://physics.bu.edu/~redner/211-sp06/class-macro-micro/2nd-law.html.
[16] Casper, D. (1998). Neutrino Oscillations. ps.uci.edu/~superk/oscillation.html.

6. Let There Be…

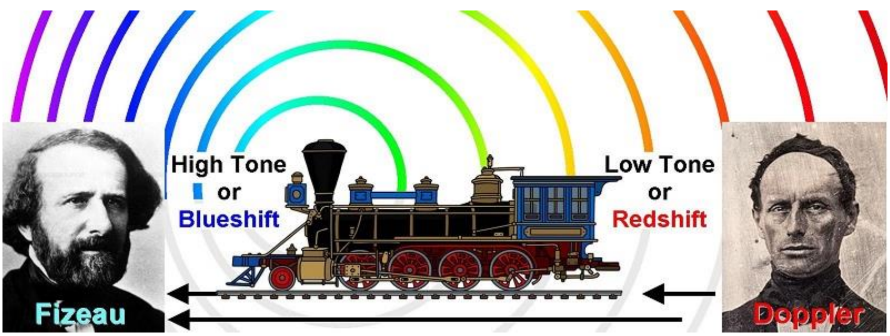
In the cult classic Time Bandits (1981), Evil says, "If I were creating the world I wouldn't mess about with butterflies and daffodils. I would have started with lasers, eight o'clock, Day One!"[1]

Indeed. In that unholy and unsavory way was I raised into doing 20th century physics: lasers, electronics, communications technologies, computers and robots. Motion and mechanics weren't a significant part of anything we did. I was doing and asking how things worked from a quantum perspective before I could read. It was my norm.

The college time warp back to the 17th and 18th centuries was a serious culture shock. I was regrettably unprepared for the change. And worse: modern abstract thinking is very different from concrete classical thinking. So college was like watching a depiction of the siege of Troy complete with starships, aliens, and energy weapons. The surface was right, but all the critical details are lost.

The ways we frame things limit how we look at concepts. On the surface things work simply because the classical physics is established to an engineering level. We stop thinking about mechanisms explaining how and get lost in superficial details. It is far easier to look at mathematical idealizations and assume they just are without bothering to ask how. Every shape and process has a logical concrete mechanism without exception. The mechanism for the fabric of spacetime is light. So let's get on with Evil's plans: "lasers, eight o'clock, Day One!"

Doppler



6.1 Doppler-Fizeau Effect

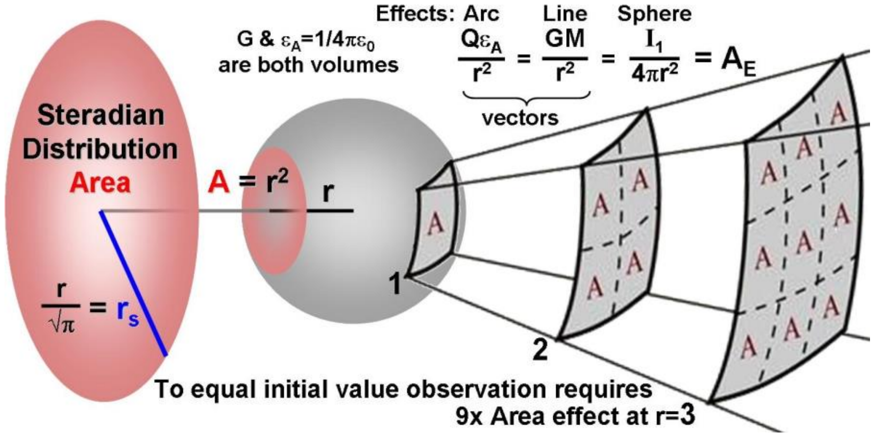
As the architecture of the first chapter shows (see pg. 23), all changes in distribution fall into the same propagation category. Most familiar changes, like conventional motion and intrinsic fields are complex void distributions of propagation. Mechanical waves are discrete and light waves are latent as expected. Doppler was first to significantly trip on their differences.

Austrian physicist Christian Doppler introduced and developed the idea of motion distorting sound waves. He observed tone is lower when a subject is departing and higher when the subject is approaching. He surmised, incorrectly, that this would be seen in light as a change in color, thinking an approaching object would appear more blue. This was later corrected and adapted to spectral shift by Hippolyte Fizeau.[2] For this reason the effect is often called the Doppler-Fizeau effect.

In common use, Doppler is generally used to describe a radar system that maps a distribution of surface velocities and their directions (vectors). As the National Weather Service puts it:

> The basics of radars is that a beam of energy, called radio waves, is emitted from an antenna. As they strike objects in the atmosphere, the energy is scattered in all directions with some of the energy reflected directly back to the radar.
> The larger the object, the greater the amount of energy that is returned to the radar. That provides us with the ability to "see" rain drops in the atmosphere. In addition, the time it takes for the beam of energy to be transmitted and returned to the radar also provides … the distance to that object.[3]

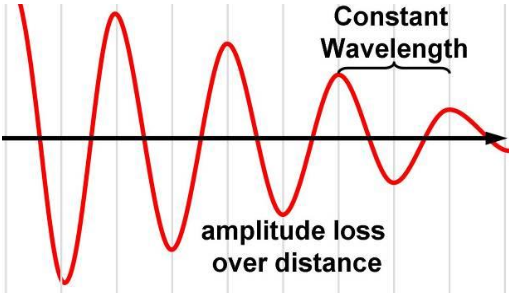
Velocity and distance variables are separated because, at close range, the changes reflect the vector field (velocity) almost exclusively. With propagation the change in energy distribution follows inverse square law.[4]



6.2 Steradian Distribution and Inverse Square Law

Mechanically, $v_x=\lambda\nu$ relates velocity (v_x) to frequency (ν) and wavelength (λ). For light, v_x=c. I use x because it is the traditional axis assigning a forward direction to a subject. Change in x is a change in distributed position. It also prevents confusing the velocity and frequency symbols. When the observer is moving (v_o), it is a “radial velocity” problem (v_r'$=v_x \pm v_o = \lambda\nu$') better handled with relative reference frames.

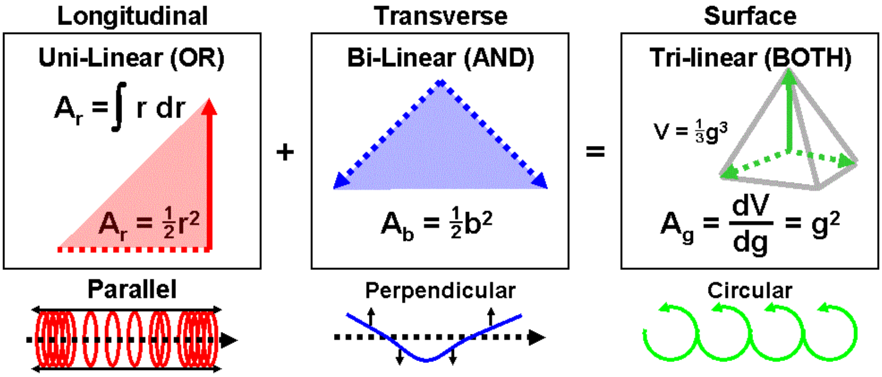
The frequency-wavelength function is classical mechanics with very little wiggle room, especially when speeds (relative constants) are involved instead of velocity (variable motion). The wiggle room is hiding in the variable details. Wavelength has no detail. It is simply what it says. Frequency contains a unitless wave function (cycle) with an amplitude, and the temporal element is subject to dilation.



6.3 Reducing Amplitude ***not*** *Length*

For wavelength and speed to be held constant, any change in amplitude requires a proportional change in dilation. The change in dilation here is the distribution going out of focus converting into heat. The kinetic (heat) energy and pressure are dilation factors that affects speed.[5]

Velocity reflects directly on mechanical wave frequency which changes the energy ($E=h\nu$) giving amplitude to the wave. Amplitude “loss” is energy distribution. All the energy is still there, it is just spread over a larger space as it changes form. Wavelength remains constant, factoring out to make frequency change velocity dependent and vice-versa ($v'\nu=\nu'v$),[6] giving the z-degree of distribution: $z\nu_x=\nu_x - \nu_o$.



6.4 Wave Types

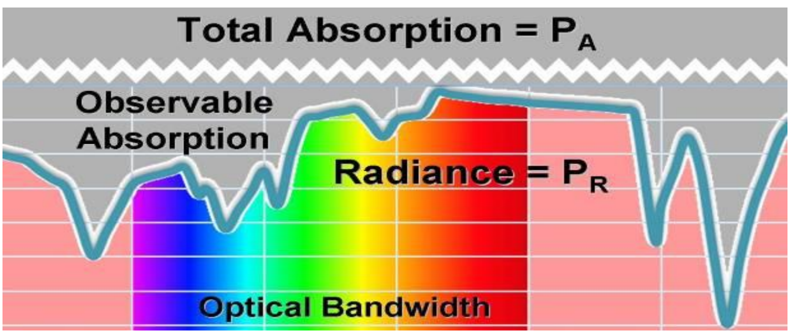
Doppler's shift ($z=(E_1-E_2)/E_2$) is the ratio of energy change (luminosity) to observation. It also reflects resistance to the change in symmetry. A large z value (>1) is changing symmetry rapidly, whereas z<1 is almost imperceptible. Symmetry is very different between longitudinal and transverse waves. Mechanical waves are generally longitudinal, conveying a pressure hypersurface ($\jmath'$) displacing parallel to the path in or out of focus.[7] Going in or out of focus enhanced by anomaly provides the basic mechanism.

Sound is basically a pressure surface unfolding and forcing volume to enfold like electrical current the opposite direction. The change in volume is what acts on your eardrum for you to hear. Unfolding pressure like sound ultimately converts to $\imath'$, an enfolding heat distribution $P \rightarrow V$.[8] The energy doesn't necessarily leave the space, it simply changes roles.

Conversely, light is a transverse wave, displacing to the sides, perpendicular to the path of propagation. As unfolding volume ($\imath$) it forces an enfolding pressure ($\jmath$) hypersurface. Your perspective is looking straight into the source, which is where the light will come into focus, but not from the direct path in front of you. It is coming into focus by means of the hypersurface. As such, the larger your observational surface and the longer the observation, the more of the converted energy you can observe.

Tolman Effect

Light information generalizes into an oscillatory effect on matter, but is far more intricate because it defines simply connected spacetime. A cycle is a scalar value distribution along a wave (ψ). The wavelength of space (λ) distributes across a unit of time ($\upsilon=\psi/t$). The composite is a length of spacetime ($c=\upsilon\lambda=\psi\lambda/t$) consistent with a zero-sphere.

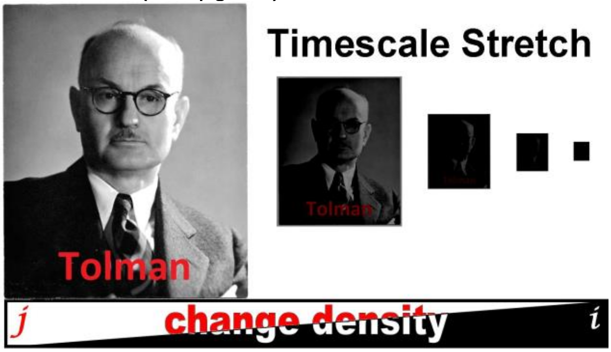


6.5 Absorption Graph Against Optical Bandwidth

In basic terms, this scalar wave is the spectrum distribution we observe the information of light in. We typically only observe a narrow bandwidth of light. Doppler had no idea of this. He assumed the observed bandwidth was the whole thing. If it were, as it is with mechanical waves, a shift would do as he suggested and change the color. Instead, a shift simply adjusts which part of the spectrum is in that observational bandwidth.

For light, the shift is unfolding volume ($\imath$ as opposed to enfolding $\imath'$) into a pressure hypersurface coming into focus (enfolding=$\jmath$) rather than unfolding (=$\jmath'$). Change operators are complex entropy (dS) defining features.[9] Where $\imath$ distributes away from the source, $\imath'$ distributes toward the source. The difference in entropy state (TdS) is observed as "negative temperature."[10]

The way light works is simple. The heat energy is the latent energy function unfolding out of focus with distance from the source. Motion is a discrete energy function applying to the pressure effect. With light the role is inverted, so the effects of motion on redshift systematically go out of focus as the volume transformation becomes the dominant feature. It is a simple circular function (see pg. 50).



6.6 Role not Energy Change

Let's not forget that any such transformation (dt=$\delta\jmath+\delta\imath$) is resisted by time requiring inclusion of dilation factors like redshift. Increased redshift is thus increased distance, and that distance is a distribution in spacetime. This is very easily proven by how distant light is observed and the so-called tired light hypothesis.

Richard C. Tolman (1881 – 1948) published an array of articles from 1910 – 1949.[11] His articles clearly support an oscillating cosmology of expansion then contraction. We are showing these as simultaneous for exactly the reasons he argued against tired light.

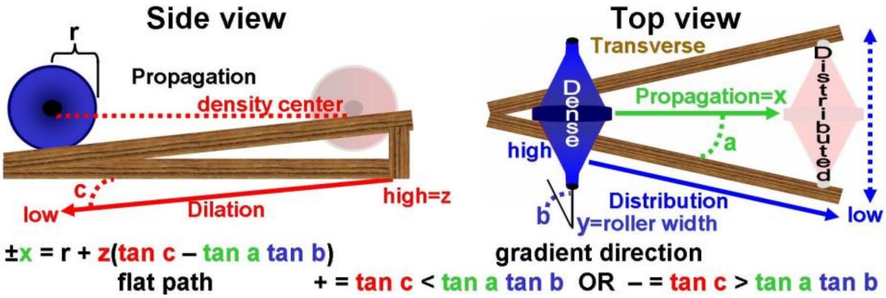
Tolman's conditions for proof were simple and rational. The optical area of objects gets smaller with distance while the wavelength gets longer with redshift. This makes the wave front of distribution larger and requires greater duration and surface area to observe the same amount of energy. Barring shadowing by matter between absorbing scalar value from the propagation, the total scalar value across the surface remains constant.[12]

The observational surface and duration allows enfolding pressure to come into focus as volume. It doesn't diverge away from the observation, but rather focuses into it. This of course assumes the unfolding and enfolding wave features haven't reached their zero point where the cycle cancels and loses its identity. That brings us to a literal textbook identity called the d'Alembertian that predicted all of this two centuries earlier.

On a Roll

To see how Euler's solution for propagation works, we first need a concrete understanding of the mechanism. From this we can begin to derive the shape changes needed for conservation. The mechanism traces back to what many would consider a parlor trick invented by William Leybourn and appearing in his 1694 book "Pleasure with Profit."[13]

His roller (below) is a mechanical shaping of space. It consists of two cones interacting with diverging tracks. Gravity is doing the work and the propagation is flat with transverse distribution (widening to the sides). Without a stopper on the end, the roller ultimately falls off the track. It cannot be put into a repeating loop.



6.7 Leybourn Roller and Propagation

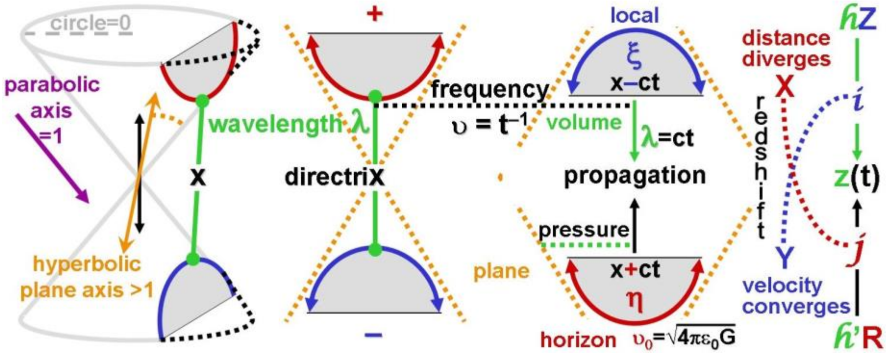
The variables are simplified to coordinate with motion. The path=x corresponding with the half-angle (a) of track divergence relative to that path. Roller width (y=2cos b) is the combined heights of the cones with radius (r=sin b) corresponding to the half angle of the cone (b). The width is relevant to where the cone falls between the diverging tracks. Track height=z corresponds with c=the angle of inclination.

The density center in the diagram appears level, but it is just barely lower at the end of the roll than at the beginning.[14] Direction can be reversed with a gradient of tan c>tan a tan b. Changes in gradient naturally affect the rate of propagation and can equalize to relatively stable consistent with perturbation of matter. While the functions of this general effect are circular, the tracks and roller are infinitely scalable hyperbolic values constrained within these asymptotic shapes.

The action of light is its enfolding hypersurface acting as low potential for the high potential volume to flow into. Propagation is drawn by spacetime pressure more fundamental than ordinary gravity. To find this we need to locate something that connects local objects to the light horizon independent of time. It needs to be independent because it is propagating from the horizon as weft (pressure), not to it as warp (volume). Lucky for us there is an easy answer in the definitions of hyperbolas that reminds us that a thing includes all its points simultaneously (e.g. Quantum Shade).

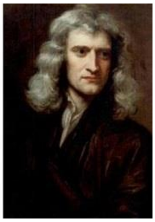
A hyperbola (below) is a conic section made by slicing a plane within a quarter angle (45°) of the height axis. When the cones are stacked, this is the only conic section that slices through more than one cone. Naturally we assume these cones are stacked immediately from one to the next. NEVER assume. The directrix here is shown at the origin, but can be shifted such that each hyperbolic arc has its own directrix. The directrices can then be oriented to their own axes and relative to logical zero-points.

For propagation, the logical zero points are a sphere's geometric origin and its terminal surface. The frequency horizon is one unit short of the terminal surface ($\upsilon_0=\sqrt{4\pi\varepsilon_0 G}$=1.72707E-17Hz) relative to any point of origin. The most observable form of this is the optical horizon at 46.85 Gly set by the most massive objects in the universe. All we need to do is connect one directrix to the origin and another to the surface. They orient toward each other and satisfy Euler's expanded solution for the d'Alembertian.[15]



6.8 Hyperbolic Orientations

Ideally, laws in physics are empirically confirmed interpretations of mathematical identities. Like theory, they are conceptual tools giving order to a subject. As we saw with Thermodynamics, sometimes the laws in circulation are incomplete or not fully represented despite all the empirically confirmed elements and identities being accounted for. Sometimes no one bothers to think it is necessary.


1. Every object persists in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed on it.
2. Force is equal to the change in momentum (mV) per change in time. For a constant mass, force equals mass times acceleration.
3. For every action, there is an equal and opposite re-action.

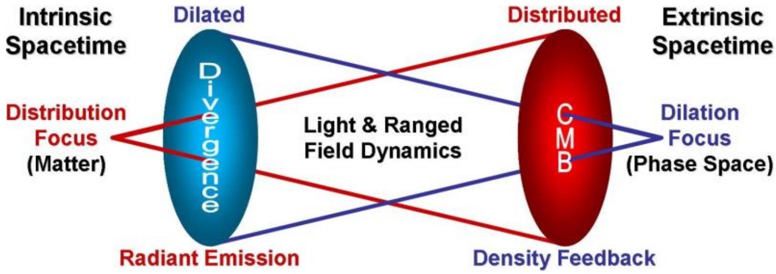
6.9 Newton's Laws of Motion

Newton's laws of motion[16] and adapting the transformative Lorentz factor gives order to propagation. Two points only connects a line, but three makes a pattern. We observe a pattern emerge connecting the laws of motion, propagation, and Thermodynamics. The laws consistently follow the pattern: conservation/uniformity, flow, balance, transformation, and finally sequence.

1. d'Alembert-Euler's Law

The laws of propagation follow the variable sequence $\mathbf{c^2\psi\nabla^2 = \upsilon^2}$. Uniformity is the consistency of c (1) as represented by the directional scalar wave function (2) applied to a coordinate independent space (3) resulting in a relativistic system of dilation and transformative resistance (4). d'Alembert-Euler's Law puts this together:

Propagation ($c^2\psi\nabla^2 = \upsilon^2$) consistently expands to (x_0–D=ξ) or contracts from (x_0+D=η) a horizon relative to its radial source (x_0) until interaction or conversion.



6.10 Reciprocal Propagation

The first law of propagation summarizes Thermodynamics defining spacetime. **The entropy state of the scalar value (TdS) defines the degree to which pressure and/or volume of spacetime are defined (PdV).** This is accomplished by following elementary gas laws swapping the molecular metric for a temporal metric:

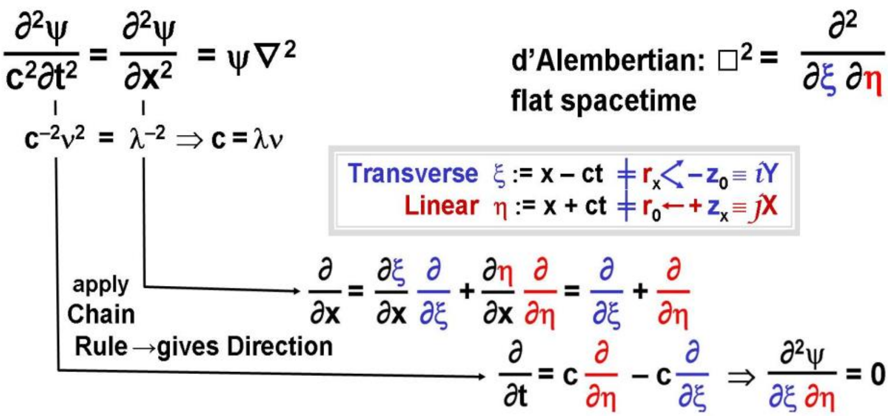
- **Ideal Gas Law** (PV=nRT)—pressure and volume are proportional to the energy applied to a number of molecules given proportional scale by the ideal gas constant (R).
- **Boyle's Law** (PV=E)—in a system of constant energy, pressure and volume are inversely related through change.
- **Avogadro's Law** ($n\alpha V$)—At constant temperature and pressure, the volume is proportional to the number of molecules (n).
- **Charles' Law** ($T\alpha V$)—a constant pressure system increases volume.
- **Amonton's Law** ($T\alpha P$)—a constant volume system increases pressure.[17]
- **Fundamental Theorem** (dU=TdS–PdV╫δQ–δW)—change in energy is equal to energy added (Q) minus the work performed (W).[18] As a matter of conservation, dU is constant such that change in state of energy (TdS) proportionally defines the pressure and volume (PdV).[19]

Following the ideal gas lead, we can use the Boltzmann constant to convert E=kT=PV. The role of time is thus resisting the flow of change in application. This specific pressure (dilation density) is the temporal metric of space. Without it, space is a non-functional void.

The first law of propagation shows spacetime gets volume (expands) and is made functional with density (contracts). The change interaction at

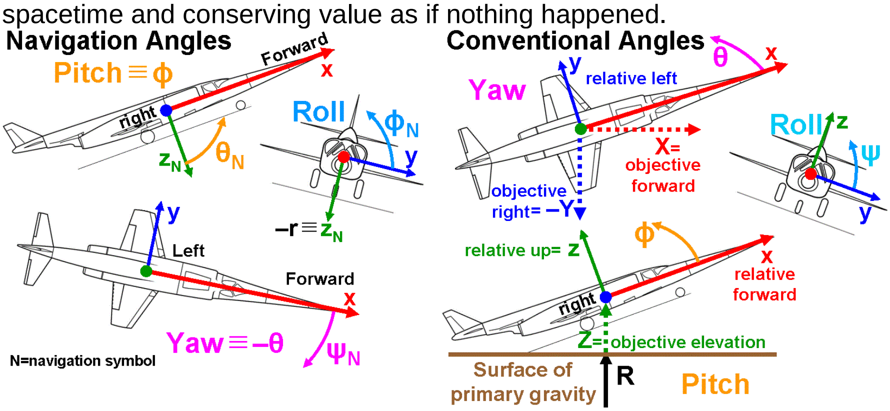
CMB changes the diffuse expansion into contraction and neutralizes the directional quality of density (free space). These combine into contextual function allowing light to propagate any direction and the phase space environment to add a contextual field surface to any intrinsic field.

The equivalents distinguish the spaces and changes into circular functions. Sinusoidal functions link the d'Alembertian to Fourier's law for the scalar wave function (ψ). Backing up to the beginning of Euler's breakdown, I added the practical equivalents with frequency (υ) and wavelength (λ). This diagram uses the traditional symbols, which sometimes leads to conflicts. Nu (ν) is used for too many things, so we often replace it with something close like υ for frequency.



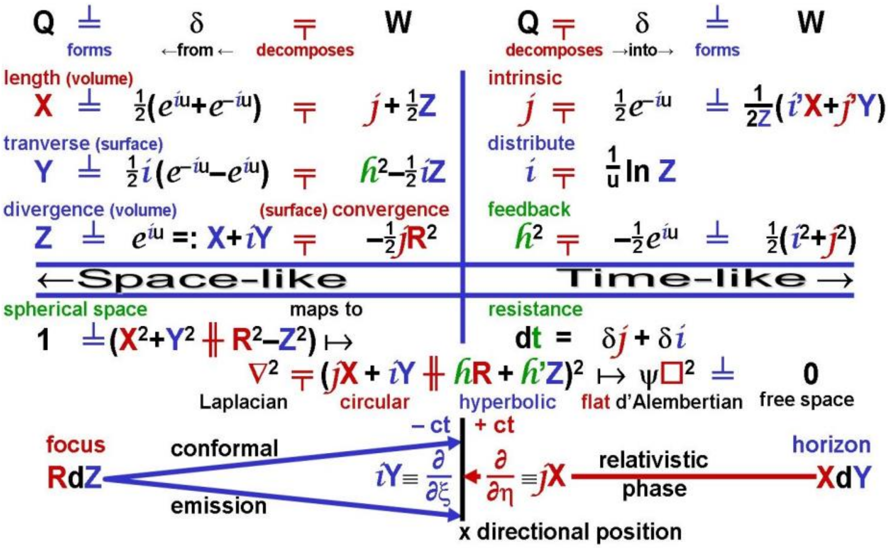
6.11 d'Alembert-Euler 1-D Wave Solution

Euler's expansion[20] describes the asymptotes ($x \pm ct = 0$) which have no intrinsic value. The discrete RdZ is hyperbolic (interactive) and opposite to latent XdY. Navigational axis[21] asymptotes thus define the functional space of propagation. They are assigned (:=) to Euler's operators ξ and η. Following the chain rule ultimately leads to propagation defining flat spacetime and conserving value as if nothing happened.



6.12 Navigational Axes

To help clarify, the original x±ct is relabeled r±z, where r is a local radial position fitting geometric origin and z is the terminal surface. A subset 0 shows an origin where a subset x indicates current position relative to that origin. These are two ways to say the same thing (x±ct╪r±z) and equivalent to hyperspace change functions (ȷ́X and ı́Y). We can even decompose this into a logical Thermodynamics argument.



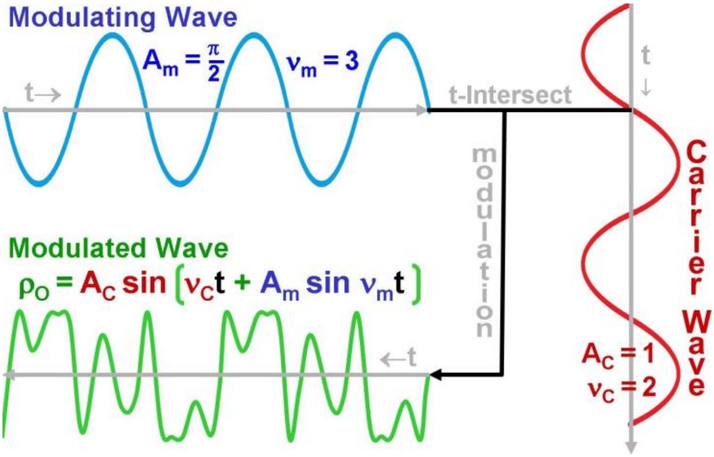
6.13 Modal Spacetime Logic

2. Fourier's Law

The scalar wave of propagation (ψ) is a Fourier series combining axes of pressure density channels (P) and heat volume (dV) into a constant rate applying a fixed pattern (modal signature) into a flux surface.

Newton's second law of motion states "Force is equal to the change in momentum (mv) per change in time. For a constant mass, force equals mass times acceleration" (F=ma). The variable rate of motion (velocity) is necessitated by Lorentz factor (entropic resistance as fourth law here). The variable of classical force uses the Newton unit where 1N=1kg m/s^2.

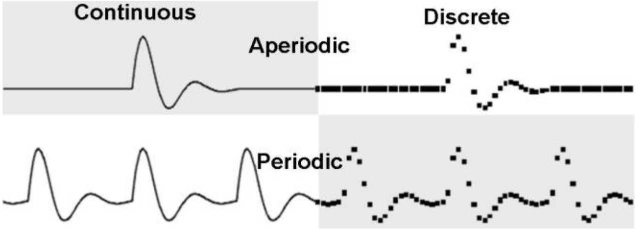
Newton's force magnitude converts to its light analog by the **apparent** momentum of light with constant speed. Its generic form is the wave function of the scalar that follows Fourier's 1807 solution for heat propagation in a metal plate.[22] This solution introduced his series as a sequence of orthogonal axes defined by trigonometry functions (x=cosine, y=sine).[23] Carrier waves are given information by modulation wave interference.



6.14 Modulated Wave Function

This is typically shown by a continuous wave modulation along a timeline (above). Absorption is discrete (below), meaning segments of value are "neutralized" completely or in degrees. By neutralized we mean converted to pressure potential. This is often described as split up into information or separated into a finite data sequence.[24] In the simplest possible language, it isn't there, like a channel providing passage. What passes is density (pressure) going the opposite direction and scaling the cycle into frequency as needed to propagate.

In spatial terms, heat directly values volume. To convey as light, heat is converted into a wave surface by applying a Fourier series[25] of density channels. The radiating heat and density channels are at right angles to each other (orthogonal), providing a feedback system consistent with electromagnetism and creating the field equivalent of Leybourn's roller. The pattern of density channels appearing as **discrete** absorption lines is a specific identifying signature.



6.15 Continuous/Discrete Wave Periods

Radiance (P_R) and density (P_A) are proportionally shaped by Hubble's constant into directional flux shifting the spectrum: $\mathbf{S_P = zH_Z(P_A^2 + P_R^2 = \psi)}$. Density channels appear as absorption breaking up the radiant surface into a discrete function. Channel distribution is modal, meaning this segment of the propagation function is treated like a standing wave. Alone, it remains stationary and unchanging. Put into context, dilation shifts (z) the flux (H_Z) as a unit (Fizeau's adaptation of Doppler effect).[26]

Another feature of this combination is contextual versatility. Put into context for observation this gives light an apparent momentum ($pc=h\upsilon$). The mass here is latent (virtual), deriving from luminous energy ($E_L=m_Lc^2=h\upsilon$). It artificially accounts for what is there but not observable in its current state. **Latent mass** resists the acceleration of redshift, the light analog resistance to acceleration.

The density channels provide a pressure function whose units are kg/m s^2. Application of heat volume to this translates as the energy of light $kT=PV=h\upsilon$ easily deriving into its frequency. This significantly shows that mechanical action and field propagation are analogs with parallel requirements and mirrored qualities.

While adaptation provides some challenges, the quantum "mechanics" or propagation are well-established even if the concepts were not adequately conveyed. The key difference is in the passive or active nature of spacetime application. Where spacetime is just a passive place, classical mechanics applies. Relativistic conditions show the active quantum role of propagation defining spacetime.

Another point of significance is impermanence negating the so-called "information paradox." There is no paradox because information cannot be conserved in a working system. Fourier-defined information is constant with the first law of Thermodynamics. It is conserved **until** interaction or conversion. The Fourier definition provides the vital pressure potentials for propagation making Interaction and conversion factual inevitabilities.

Electromagnetic fields consist of opposite and complementary functions. These can be simplified down to two scalars applied in a series of complex to hypercomplex roles described by

- John Ambrose Fleming's rules[27] show density inertia converts into a flow of force. The left handed engine converts force into inertial work (volume). This system of scalar transformations derives from
- Faraday's Law of Induction (right hand creating)
- Lorentz Force (left hand doing $F=qE+qv\times B$)—the electromotive force is the sum of the charge (q) of the electric field (E) and the charge effect on relativistic velocity (v) as a function of the magnetic field (B).[28]
- Maxwell's quaternionic solutions[29] pointing to
- Complex entropy (dS) defines how thermal energy applies ($\delta Q\equiv TdS$) to work as pressure and/or volume ($\delta W\equiv PdV$).[30]

Each scalar has a generalized role identified by a "spin." The spin is really just the compounded scalar value as a unitless cycle. The cycle propagating in time is a frequency. While the spins are complex, they combine into both hypercomplex (PdV=spacetime) and real cycle-scalar forms. The hypercomplex break down into the linear-angular, length-volume contextual roles.

Context controls direction and role. The observational context defines observation and affects the observed. Despite control limitations, propagation is a directional value making it an ambiguous scalar. As $r'=rc^2$

and $y=xc^2$ suggest, you can strategically put any of these variables into a context that dramatically alters how the other variables apply.

The complex analysis leading to polarization features and the Tolman effect provides sinusoidal elements of the wave function. These apply specifically to complex entropy functions in the fourth Lorentz-Fizeau law.

Endnotes

[1] IMDB. (ret. Sep. 23, 2018). Time Bandits: Quotes. https://www.imdb.com/title/tt0081633/quotes.

[2] Hujer, K. (Aug. 1963). Christian Doppler in Prague. Journal of the Royal Astronomical Society of Canada, Vol. 57, pp.177-180. adsabs.harvard.edu/full/1963JRASC..57..177H.

[3] (ret. Jan. 26, 2019). How radar works. weather.gov/jetstream/how.

[4] Nave, R. (2017). Inverse Square Law. University of Georgia. hyperphysics.phy-astr.gsu.edu/hbase/Forces/isq.html.

[5] Hall, N. (Mar. 23, 2018). Speed of Sound. www.grc.nasa.gov/www/k-12/airplane/sound.html.

[6] Gupta, R. et al. (ret. Sep. 23, 2018). Doppler Effect. brilliant.org/wiki/doppler-effect/.

[7] Staroscik, A. (ret. Sep. 24, 2018). Types of Waves. scienceprimer.com/types-of-waves.

[8] Baiurd, C.S. (Nov. 5, 2015). Can Sound Waves Generate Heat? wtamu.edu/~cbaird/sq/2015/11/05/can-sound-waves-generate-heat/.

[9] Mosquera, M.E., O. Civitarese, & M. Gadella. (Aug. 2017). Complex entropy and the thermodynamics of micro-black holes. mathphys.uva.es/files/2017/08/complex_entropy.pdf.

[10] Braun, S. et al. (Jan. 4, 2013). Negative Absolute Temperature for Motional Degrees of Freedom. science.sciencemag.org/content/339/6115/52?ijkey=kXamUlcWliV0M&keytype=ref&siteid=sci.

[11] Tolman articles: academictree.org/physics/publications.php?pid=52627.

[12] Evans, R.H. (Mar. 22, 2016). Surface brightness, the Tolman effect and school-boy errors. thecuriousastronomer.wordpress.com/2016/03/22/surface-brightness-the-tolman-effect-and-school-boy-errors/.

[13] Havil, J. (Sep. 1, 2006). Defying gravity: The uphill roller. https://plus.maths.org/content/os/issue40/features/uphill/index.

[14] Wood, M., Smith, W., & Jackson, M. (May 2, 2014). 1J11.50 - Cone Rolling Uphill. University of Michigan. youtube.com/watch?v=iTNsuP2aakk.

[15] Weisstein, E.W. (ret. Oct 16, 2018). d'Alembert's Solution. http://mathworld.wolfram.com/dAlembertsSolution.html.

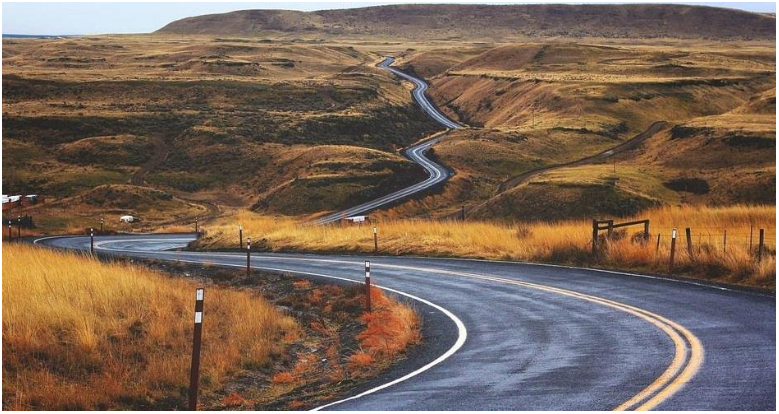
[16] Hall, N. (May 5, 2015). Newton's Laws of Motion. https://www.grc.nasa.gov/www/k-12/airplane/newton.html.

[17] Flowers, P. et al. (ret. Oct. 13, 2018). Relating Pressure, Volume, Amount, and Temperature. https://opentextbc.ca/chemistry/chapter/9-2-relating-pressure-volume-amount-and-temperature-the-ideal-gas-law/.

[18] Nave, R. (2017). First Law of Thermodynamics. University of Georgia. hyperphysics.phy-astr.gsu.edu/hbase/thermo/firlaw.html.
[19] Lucas, J. (May 19, 2015). What Is the First Law of Thermodynamics? https://www.livescience.com/50881-first-law-thermodynamics.html.
[20] Weisstein, E.W. (ret. Oct 16, 2018). d'Alembert's Solution. http://mathworld.wolfram.com/dAlembertsSolution.html.
Weisstein, E.W. (ret. Oct. 16, 2018). Wave Equation--1-Dimensional.mathworld.wolfram.com/WaveEquation1-Dimensional.html.
Akylas, T.R. & Mei, C.C. (2001). Waves in Fluids: "One-Dimensional Propagation." web.mit.edu/fluids-modules/waves/www/material/chap-2.pdf.
[21] Abraham, S. (2017). Rotations and Orientation. cs.utexas.edu/~theshark /courses/cs354/lectures/cs354-14.pdf.
Hall, N. (May 5, 2015). Aircraft Rotations. grc.nasa.gov/WWW/K-12/airplane/rotations.html.
[22] Dominguez, A. (Jan. 25, 2016). Highlights in the History of the Fourier Transform. https://pulse.embs.org/january-2016/highlights-in-the-history-of-the-fourier-transform/.
[23] Fourier, J.J. (1878). The Analytical Theory of Heat. trans. Freeman, A. https://www3.nd.edu/~powers/ame.20231/fourier1878.pdf.
[24] Roberts, S. (2003). Signal Processing & Filter Design. "The Discrete Fourier Transform." www.robots.ox.ac.uk/~sjrob/Teaching/SP/l7.pdf.
[25] Weisstein, E.W. (ret. Oct. 23, 2018). Fourier Series. http://mathworld.wolfram.com/ FourierSeries.html.
[26] Hujer, K. (Aug. 1963). Christian Doppler in Prague. Journal of the Royal Astronomical Society of Canada, Vol. 57, pp.177-180. adsabs.harvard.edu/ full/1963JRASC..57..177H.
[27] Daware, K. (2014). Fleming's Left Hand Rule And Right Hand Rule. electricaleasy.com/2014/03/flemings-left-and-right-hand-rule.html.
[28] Nave, R. (2017). Lorentz Force Law. phy-astr.gsu.edu/hbase/ magnetic/magfor.html.
[29] Huray, P.G. (Nov. 4, 2011). Maxwell's Equations. Hoboken, NJ: John Wiley & Sons.
[30] Adler, S.L. (1986). Quaternionic Quantum Field Theory. https://projecteuclid.org/download/pdf_1/euclid.cmp/1104115172.
… (1995). Quaternionic Quantum Mechanics and Quantum Field Theory. Oxford University Press.
CERN. Quaternion QM. cds.cern.ch/record/384318/files/9904067.pdf.
Graydon, M.A. (2011). Quaternions and Quantum Theory. uwspace. uwaterloo.ca/bitstream/handle/10012/6168/Graydon_Matthew.pdf.

7. The Path of Light

The laws of propagation are analogous with the laws of motion and Thermodynamics. The first law is conservation describing a continuity of identity process. The second law is the scalar value shape, an intrinsic sense of geometry more consistent with information than shape. The third law describes spatial reasoning as a conversion sequence, while the fourth explains the twist causal of conversion, and fifth gives sequence. They basically batch into two groups of identity and path of transformation.

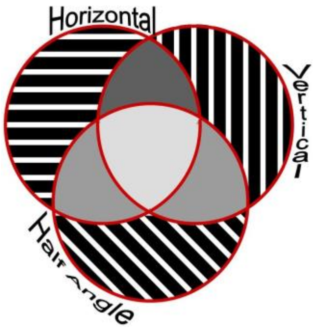


7.1 Propagation Like a Winding Road

Where discrete spaces converge into a geometry, the latent spaces of light diverge (e.g. drift[1]). Put simply, matter controls its spaces, light does not. The rate of divergence is resisted by luminosity. The more energetic the light, the straighter its path as it resists the effects of gravitational lensing and other interfering effects like CMB. The more winding the path, the greater the impact on the Hubble parameter (see pg. 74), expediting conversion by Perkins' Law (rotating one axis into another).

Causes of Change

Because light does not control its spaces, it acts similar to motion. Something has to apply for a change to occur. The effects of the changes are intrinsic to light changing it opportunities for interaction, but the causes of the changes are extrinsic. In other words, the more available interference, the faster the redshift and more exaggerated the Hubble parameter (see pg. 74). This means radial distance (r) is a relativistic distance affected by spacetime density interference, not a true distance independent of interference.



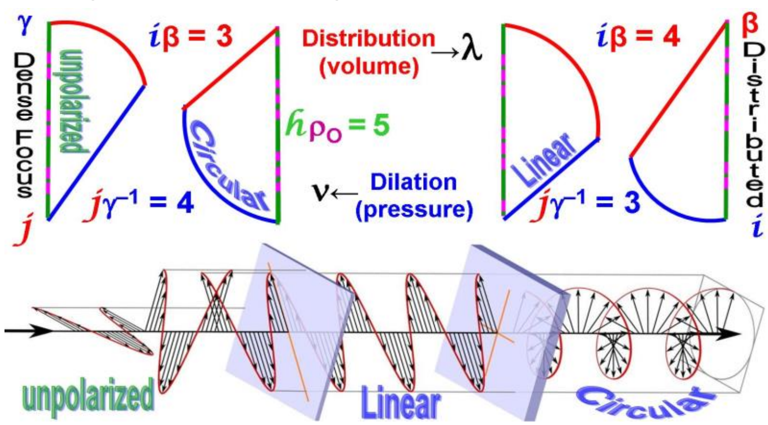
7.2 Tri-Phase Filtering Paradox

One of the great challenges with light is the separation of variables. Loss of energy and distribution of energy both register as redshift. Energy loss (absorption) cannot be compensated for by increasing observational duration and surface. The tri-phase filtering paradox[2] helps illustrate this problem. A series of filters is stacked, each rotated relative to the others. The more filters stacked and rotated to lesser degrees, the easier it is for light to find an unobstructed path through.

Lorentz Effects

Dilation and z are related by complex velocity ($\beta=v_j/c$) and $\gamma=(z+1)$. They form an axis with three contextual light effects:

Hypercomplex shaping ($j\gamma^{-1}+i\beta=\hbar\rho_O$)—describes the full range of polarization to include the complex role, shape modulation (shifting). Topological osculation (ρ_O) means shapes intersect into a common tangent.[3] This simplifies to just roles $\gamma^{-2}+\beta^2=\rho_O{}^2$ by confining (hiding) the complex elements of shape.



7.3 Topological Osculation & Polarization

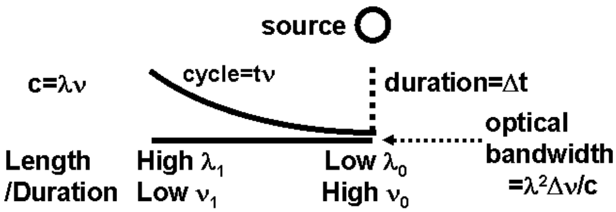
Circular conversion ($\gamma^{-2}+\beta^2=1$)—accounts for proximal angular scale difference. In English, things that are far away appear to be smaller.

Helical projection ($\gamma^{-1}+\acute{\imath}\beta=e^{\acute{\imath}u}$)—the consistent effect of distribution on brightness accommodated for by altering observational variables. This is the Tolman effect. Simplification shows consistency as a functional constant $1+2\acute{\imath}+2\acute{h}=e^{2\acute{\imath}u}$. This is a role change function. The function of energy value $f(u)=e^{2\acute{\imath}u}$ remains constant with distribution ($\acute{\imath}$) to the hypersurface ($\acute{h}$). This is also seen with the unpolarized shape…

The loss or distribution of energy affects luminosity as a function of topological osculation ($\acute{h}\rho_O=\acute{\jmath}\gamma^{-1}+\acute{\imath}\beta$). This is where value types (linear or angular) act as triangulating axes with spin. This geometry is specific to the scalar wave function. The axis describing the unfolding volume also defines the polarization shape easily changed with a filter.

The circular twist you see applied to the unfolding scalar does not itself rotate axes. It is the shape of the scalar axis unfolding. That shape affects the propagation's ability to navigate obstacles, and the degree it will interact with a space (permeability). To put it a different way, the scalar shape affects the degree to which a type of interference applies.

The tighter the angle (α) between the linear and unpolarized (spin) scalar axes, the more exaggerated the arc of the angular axis. Dilation: ($\gamma=Xr/Y^2= \tan^2 \alpha$) is the square of the tangent to that angle. As the angle increases, the curve of the angular axis flattens, no matter its role. This flattening effect is the rotation of the axes from unfolding volume (X) into enfolding pressure (Y).

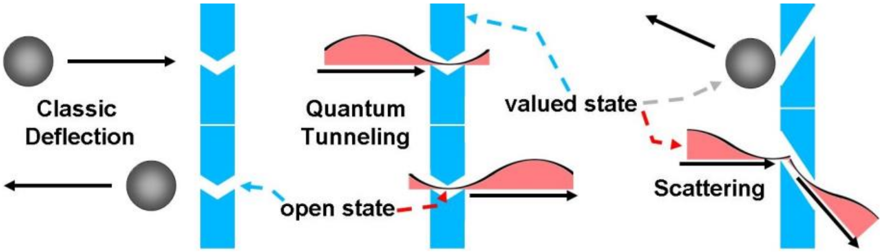


7.4: Optical Bandwidth

Initial energy diverging by propagation stretches the wavelength (λ) widening the optical bandwidth ($\Delta\lambda=\lambda\Delta\upsilon/c$).[4] Optical bandwidth describes the surface of the wave passing through larger openings and around smaller obstacles.

One of the challenges comprehending light is recognizing it as a complex value range (bandwidth) beyond the optical. This was Doppler's mistake, conflating light with material propagation. Conventional particles have occupied volumes that bounce off other volumes. They are subject to exclusion. They can cheat by quantum tunneling between microstates of occupation.[5]

All non-baryonic matter has the potential to quantum tunnel, not to mention easily perturb into or out of identity. Quantum tunneling is easier with fewer defined volumes and fewer defined spaces generally. In other words, the simpler the particle, the more Bose-Einstein statistics apply and easier it is to quantum tunnel. For quantum tunneling, light is analyzed in the discrete form of a photon either diverging into light or converging into material processes.

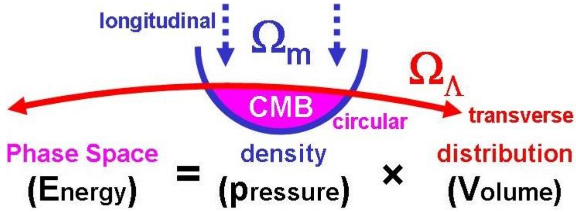


7.5 Deflection, Tunneling, & Scattering

This is relevant because light takes all available paths of low potential. While some will pass through, some will pass around, some will deflect taking another direction, and some will get trapped in material processes. The energy will follow every possible opportunity to some degree because it is a broad range of value potentially spanning the entire spectrum.

CMB & CNB

Let us define CMB as the: "**anomaly in the fabric of spacetime unfolding as spherical wavefronts of distribution and dilation wave interference appearing in cross section as a gradient.**"



7.6: CMB Interference as Phase Space Energy

Functionally speaking using ΛCDM symbols, it is the interference of unfolding volume (Ω_Λ light) with its pressure mechanism (Ω_m) defining "free" flat phase space ($\Omega_k=\Omega_m+i\Omega_\Lambda$) approaching light horizon. Distribution is a key role of i, as with generator symmetry $M_{mn} = i(x_m\partial_n - x_n\partial_m)$.[6] The distribution is a circular complex plane rotating along the i-operator to create the volume ($z=x+iy \equiv \Omega_k$) of space.[7] Phase means the moment, giving spacetime a basic functioning metric and being the spacetime equivalent of friction on the road.

The light horizon is at ~46.85 Gly. The average CMB value by its degree of distribution occurs at ~14 billion parsecs or 45.66 Gly (billion light years).[8] This energy "sea level" is the smoothed radius of our active phase space manifold. The volume is then simply $V=\frac{4}{3}\pi r^3$. Pressure of the mass density (in kg/m s^2) is then easily derived from p=E/V.

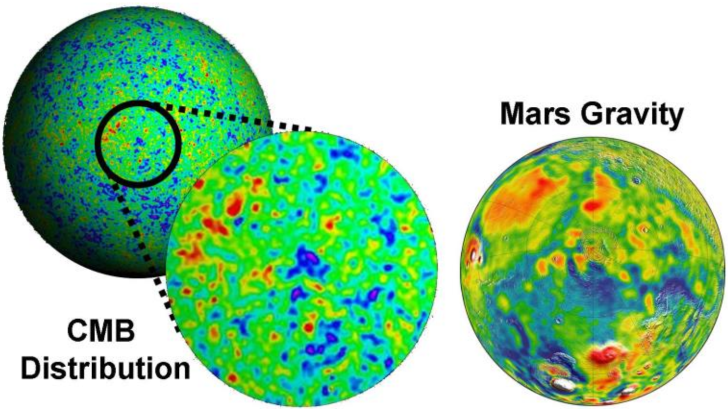
For a field to work, its high and low potentials need to be simultaneously defined. CMB shows that at any point of spacetime, there is anomaly satisfying the mechanism needed for this complex space law. It is the subtle Möbian twist in the architecture—the same twist in Perkin's ice machine reflected in Fleming's rules.

CMB being at the very bottom of the spectrum, is the spacetime equivalent of friction on the road. It picks away at the lowest frequencies, taking the edge off and subtly adding rotation forcing conversion from angular to linear axes. CMB also offers opportunity for focusing energy interference and perturbing a variety of particles. Most of these perturbations are too small to quantize as proper particles.

The exception is neutrinos (**CNB**). Neutrino identities don't quantize. They only need to have a non-zero energy value. Their relevance is greatly exaggerated and misplaced in modern cosmology due to a failure to apply field and Gauge theory to understanding how light, spacetime, and focus into perturbation work. Neutrinos are the next easiest thing in the universe to create after photons and gluons, and neutrinos hold their form better.

CMB is the relevant player nipping away at the low energy end of the spectrum. These nips are opportunities to create photons (ambient heat of the universe), gluons (that annihilate and also contribute to the heat), and neutrinos. The particles are the least of its relevant effects, creating a highly distracting misperception of time echoed in Dr. Who.

> People assume that time is a strict progression of cause to effect, but actually — from a non-linear, non-subjective viewpoint — it's more like a big ball of wibbly-wobbly... Timey-wimey... Stuff.[9]



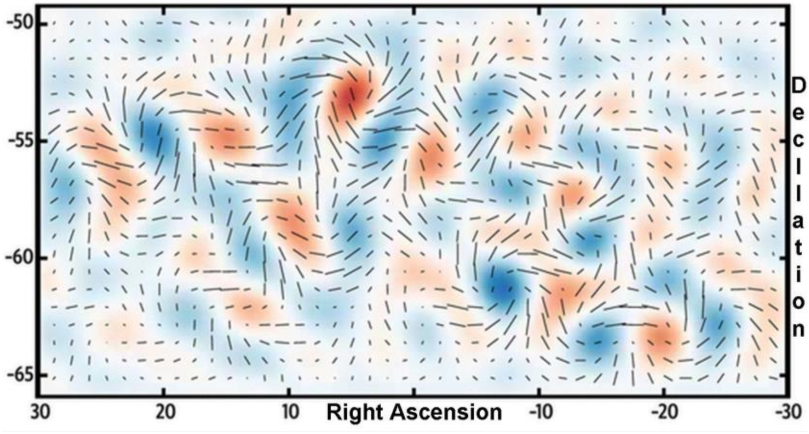
7.7: Density Anomalies Compared

The most relevant effects are defining the fabric of spacetime, the mechanism for the propagation of light, and in that same action the mechanism for the transformation of unfolding volume into enfolding pressure. The easiest way to look at it is as density anomaly in spacetime.[10] If you are thinking of the path of light being on a road, the anomaly gives texture that both resists transit and steers direction.

This "texturing" is described to fit Big Bang cosmology as "dark matter halos, which launched spherical wavefronts driven by radiation pressure from the compressed plasma."[11] We can be more humbling with this because "compressed plasma" translates simply into matter as confined energy, and the radiation as light. "Dark matter halos" are simply where pressure, and the "spherical wavefronts" are where Euler's solution to the d'Alembertian completes its conserved operation.

CMB has no absorption lines[12] for the very simple reason that the light emerging in this process (the ambient cosmic heat) was induced by the process of cosmic spacetime, not discrete material processes. Discrete material processes have systems derivative of microstates that leave distinctive absorption lines. The so-called "dark matter" exhibited in CMB is further show in the BICEP-2 project[13] to be polarized showing a recognizable pattern clearly mirroring a cluster of galaxies.

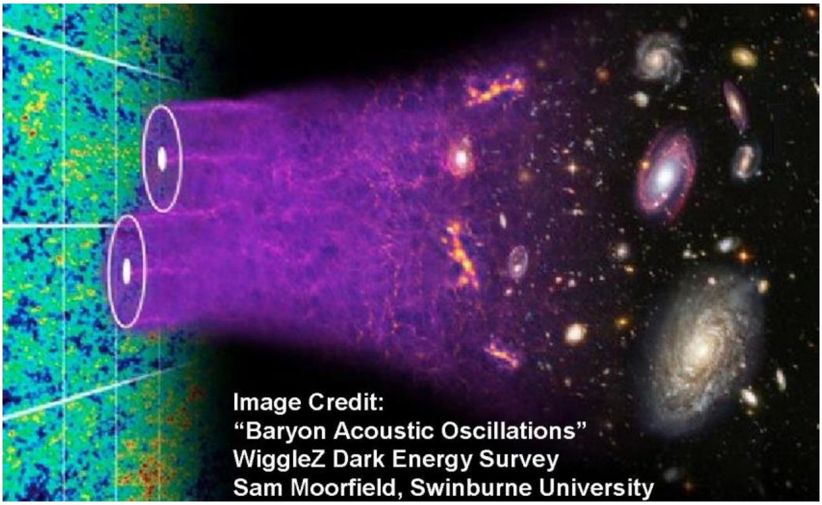
Imagine directly observing the surface of spacetime without seeing light reflected or emitted by the objects distorting it. This mirroring effect matches the hyperbolic analysis provided for Euler's solution to the d'Alembertian (see pg. 103). This is the pressure condition (gravity waves) on the fabric of spacetime, hence the so-called "dark matter halos."



7.8 BICEP-2 CMB "Polarization" Gradient

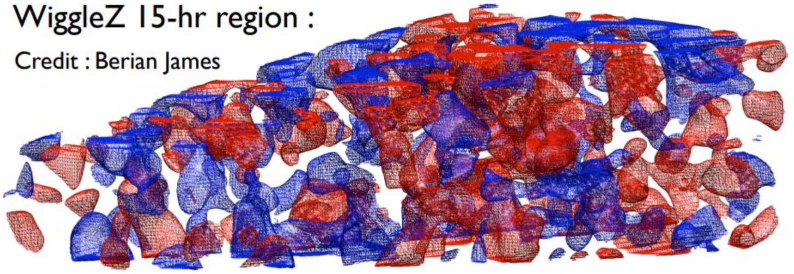
These pressures are also called "baryonic acoustic oscillations" (BAO).[14] BAO are described as: "regular, periodic fluctuations in the density of the visible baryonic matter (normal matter) of the universe."[15] This is conventional matter clustering into density, a way to observe dilation. Optical surveys of local galaxies (0.16<z<0.47) have used BAO to standardize measure (~490Mly).[16]

There is no mystery about their sources or flatness at all,[17] simply understanding how the math works. Pressure sources are relatively constant, whereas emissions unfold less reliably. We get baffled by this because we expect simple connection in space (e.g. emission), whereas hyperbolic pressure focal points are connected simultaneous in time from multiple locations in space.



7.9 Galactic Reflection in CMB

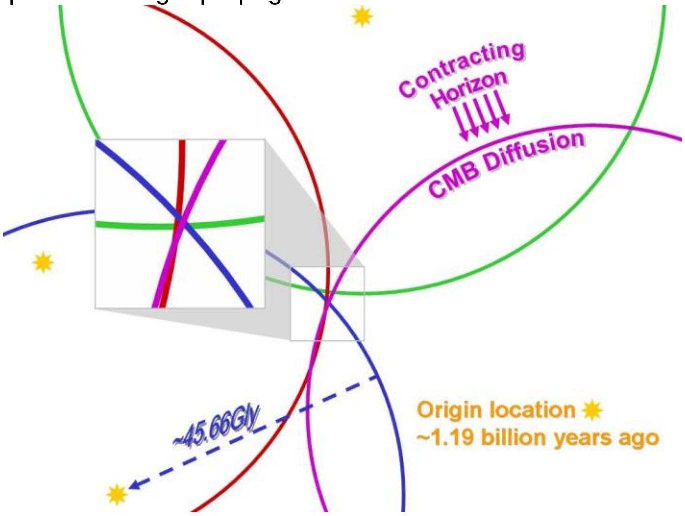
The pattern is called a gradient because it shows vector directions of a three dimensional system (shown in profile below[14]) on a flat surface. It is like a topographical map showing the curves and dips in the road for light propagating across this surface—certainly easier to imagine than through it. As light passes through, the parts of the radiant spectrum that can interact on this level, do interact. The interaction is the causal mechanism not only enabling propagation of light, but its transformation.



7.10 3-D Density Profile

The pattern is called a gradient because it shows vector directions of a three dimensional system (shown in profile below[14]) on a flat surface. It is like a topographical map showing the curves and dips in the road for light propagating across this surface—certainly easier to imagine than through it. As light passes through, the parts of the radiant spectrum that can interact on this level, do interact. The interaction is the causal mechanism not only enabling propagation of light, but its transformation.

One of the toughest parts of this process to understand is the disconnect between causal pressure and emission. This is particularly difficult when you are looking close at CMB, where redshift is so extreme that unfolding volume does immediately become causal pressure. The causal pressure is that of "free space" whose density has already propagated an average of ~1.19Gly. Meanwhile, and average of ~45.66Gly has transpired while light propagated to that horizon.



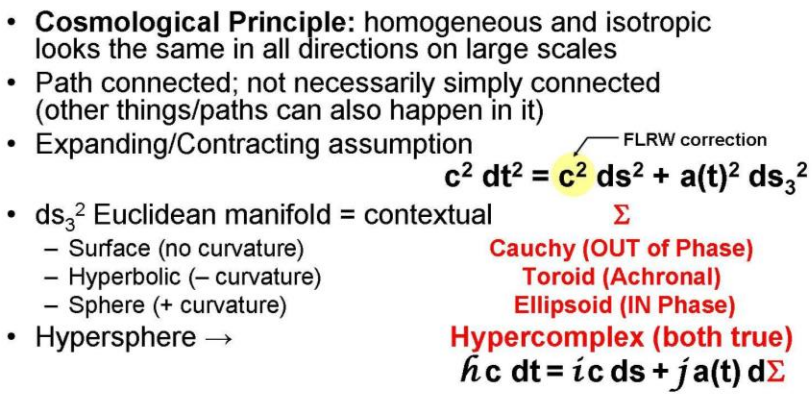
7.11 Intersecting Horizons

Generally speaking, however, you need to remember the causal mechanism comes first. That means the causal mechanism for the propagation of light here is at another light horizon. Heisenberg uncertainty applies: you can observe the pressure energy or emission position, but not both for the same thing at the same time.

FLRW Metric

Redshift was originally attributed to "radial velocity," a term recognizing all bodies are in motion relative to each other. Hubble's observations noticed that redshift is more than motion, with an increasing role of distance. He referred to this as "apparent velocity" because it wasn't simple as Lemaître was trying to claim.

Hubble and other scientists were unwilling to commit to any simple interpretation. Instead of directly protesting, Hubble proved the cosmological principle making expansion theory impossible. Despite impossibility and practical engineering as with Doppler radar, modern astronomy still insists on the expansion interpretation. They regularly cite the incomplete Friedmann equations[18] as a solution to relativistic field equations against the protests of Einstein who authored said equations.



7.12 Friedmann's (Lemaître) Robertson-Walker (FLRW) Metric

The problem is that protests without definitive substance don't stand a chance when a simpler answer is provided. One thing Einstein, Hubble, and all the other protests to Lemaître failed to do was offer a better explanation. They tried, but always came short of addressing the real problem. The challenge of addressing that problem is convincing the community to take another step forward to see how each perspective applies correctly.

To see how the perspectives apply in specific contexts, we first distinguish discrete or latent objects as open or closed systems from complex distributions. We simply apply the first law of Thermodynamics: conservation. Lemaître's "hyperbolic" interpretation is of an open discrete system. Einstein's "static" interpretation is of a closed latent system, although he failed to explain the simultaneity as we have done here.

Tolman belonged to yet another school where the system oscillates in sequence consistent with matter interacting with a complex environment. These interpretations are all correct given the right context. None are correct in every context. The FLRW Metric is not just simple like a surface, or just complex like a basic change operator providing states of matter or transformation of light.

The FLRW Metric is hypercomplex. It applies each way differently, just as the Pythagorean theorem applies in many ways including in the FLRW. FLRW includes all the above in one contained (closed) system. That contained system consists of multiply connected open systems and interacting in latent simply connected time.

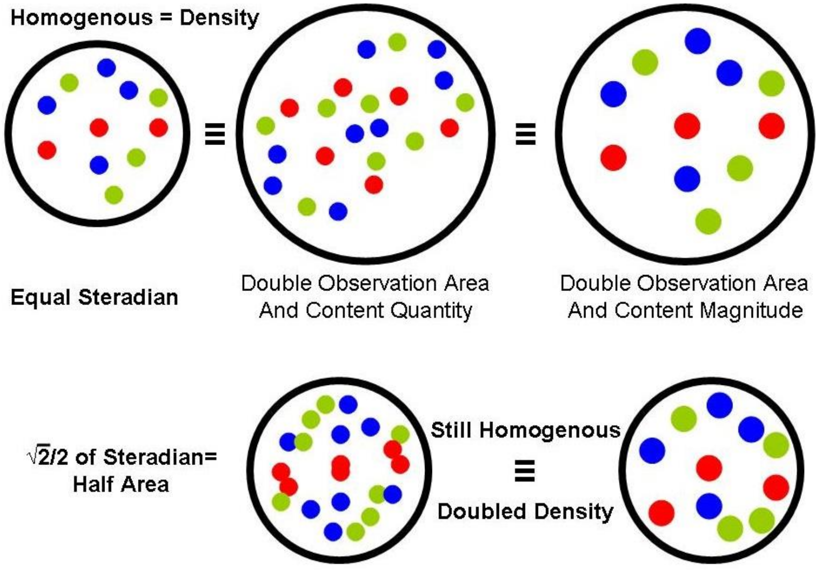
Causation in such a hypercomplex ranges from direct to abstract. In human terms it is as simple as employees of one company buying the products of other companies that sustains their employees who buy products of other companies. They don't spend that money the instant they receive it, just as they aren't paid in real time with the services rendered. The universe is simply a less familiar type of economy (linear distribution).

Hubble's Law Misnamed

The original Hubble's Law should be named Lemaître's Law. Lemaître created it and used Hubble's name despite his protests and refutations of the interpretation.[19] With the Hooker Telescope (1922–23), Hubble used Cepheid variables to show galaxies beyond the Milky Way, statistically showing average distribution and the flux parameter in redshift.[20]

In 1929 he explored radial velocity (redshift), seeing the need to adapt for a difference in field depth.[21] Most of complex velocity is one giant unknowable due to insufficient data. Radial velocity was the common term when Hubble started, fitting the issue of comovement. Hubble evolved his language to "apparent velocity" in a 1931 letter to de Sitter.[22]

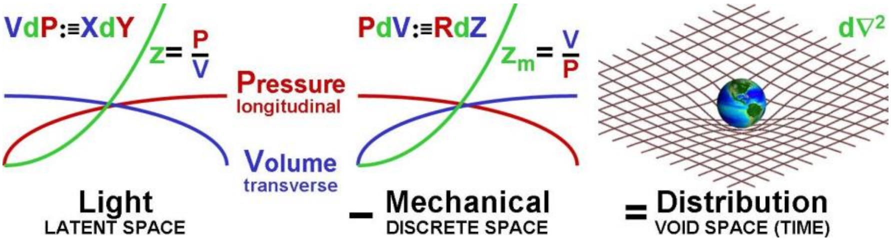
Hubble realized then that redshift couldn't be equal to velocity. Hubble proved this with the Cosmological Principle, showing the surface of distribution is consistent at all distances and despite local variation, the universe is consistent on large scales. This can be used to more accurately estimate distance than redshift alone. He showed galaxies are spaced on average of about 2Mly—the surface of observation is NOT expanding. He was ignored as it did not agree with Lemaître's popular interpretation.[23]



7.13 Homogenous Data Point Density

Modern observers trying to fit the elephant in the matchbox adjust the volume and/or omit the fact that all the densities change together. Of course the density increased if you decreased the volume. The name for this is confirmation bias. Never adjust facts to fit theory or hypothesis. You don't break something to fit it into a box. You adjust the box.

FLRW has applications in each of the three groupings of complex space we used to analyze waves. The latent and discrete forms show conversion from volume to pressure and pressure to volume. The distribution provides means to map these spaces and account for redistribution waves like gravity waves. This complex space law is interested in the six variants of simple and complex spaces whose interactive results are hypercomplex distribution.



7.14 Elements of Complex Space

The simple spaces are the manifolds of hypersurface (R and Y) and hypervolume (X and Z). They are simple so long as change does not apply. The complex spaces are where these manifolds interact in discrete and latent forms (RdZ and XdY) as types of glome. Glomes are distribution-dependent.

Glomes can be static or dynamic. A discrete static glome is contained in a way that the two spaces proportionally transform into each other. The FLRW Metric is a form of Einstein's geodesic field equation. It is an equation of a static glome consisting of surface and volume. **If** they are interacting (mingled/interwoven), then they satisfy the requirements for surface gravity.

Black holes and field perturbations are types of dynamic glome transforming between discrete and latent types of space. A perturbation forms a discrete identity from latent values. A black hole's strong interaction forces annihilation to propagate in the volume confined by the singularity. Transformative waves like light dynamically convert between pressure and volume. Dynamic glomes are less about geometry than function from which geometry derives.

3. Hubble's Complex Space Law

The nature of spatial exchange and effect evolves in temporal nature across a sequence of six states (the reference frame continuum) **ranging from confined ground state to "free space."**

The entire process divides neatly into discrete and latent functions consistent with spatial emphases: R→RdZ→Z ⇒ X→XdY→Y. They imperfectly mirror each other. Unlike the discrete, latent propagation is on a path of opportunistic transformation. If no other opportunity prevails, it converts into its own causal mechanisms.

The third law's spatial reasoning depends on the fourth law governing the temporal functions from dilation's Lorentz factor to Fizeaus' redshift (z-factor=β), leading into Fleming's hierarchy. This is obfuscated by complex variable entropy conversions from intrinsic ($\jmath$) to distributed ($\imath$) by hypercomplex means ($\hbar$):

1. **Confinement (Convergence in R)—**In Chromodynamics, radiant energy accumulates on an available change surface. Time derives from these change functions. Their atemporal nature is critical to the strong interaction and confinement. This basic form of color confinement is how electrons form photons, how gluons and quarks multiply, etc.
2. **Oscillation (RdZ)—**The intrinsic spaces of matter are sequentially subject to linear thermal expansion. Value accumulates from the largest available surface in and radiates back out. While traditionally treated as expansion, it also leads to emission or transformation of identity—hence oscillation instead of expansion.

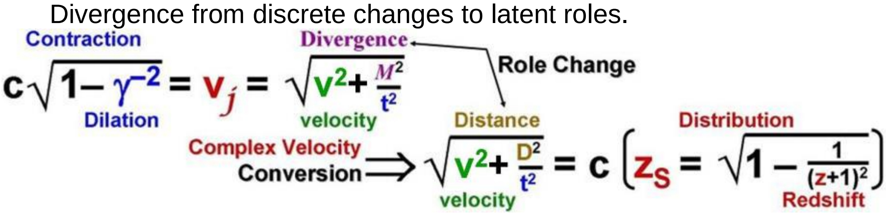
Expansion is largely resisted in atoms by the latent spaces of electrons. Because their degenerate pressures contract with increased value, the excess energy becomes available for interaction among atoms. The effect per identity is measured by an expansion coefficient, and the resulting states (solid, liquid, gas) are separated by cumulative enthalpy constants (formation and vaporization).[24]

3. **Contact Action (divergent Z)—**this is the most familiar form of energy conveyance that includes surfaces transferring or sharing value and group behavior consistent with radial velocity. Energy added increases momentum and affects the state of cohesion among the parts.

As a matter of spatial reasoning, the position of the discrete pattern of absorption lines has an initial position that shifts along the 1.83 Gly (**λ_Ω=1.73584180885613E+25m**$=c/\sqrt{\hbar\varepsilon_V}$) possible wavelength of light as a temporal function of complex velocity. The length is considerably less than the terminal horizon due to complex velocity (z) resisting shift.

The change in position of radial velocity (x_v) appears in complex velocity proportional with distance: $t^2v_j^2=x_v^2 + D^2$. It is hard to discern the two variables, but they are definitively no more equal than are the sides of every right triangle. Low redshift corresponds with velocity and high redshift with distance having a significant barrier in…

4. **Divergence (latent X)—**Lorentz factor is relevant throughout the processes of matter, reducing the ability of matter to accumulate or store energy by contracting the change functions defining the metrics. Divergence from discrete changes to latent roles.



7.15 Divergence-Distance Role Change

The effect includes exposing the energy of its own identity as a particle beam.[25] At this point, complex velocity includes an element of the beam length as a generic manifold (M): $t^2v_j^2=x_v^2 + M^2$. This established process of annihilation sets the boundary to actual velocity (contact action state). Anything beyond that is distance. There are few ways to distinguish motion from distance, even past z=1. One of which is using Hubble's 2Mly average distribution as a metric among clusters of distant galaxies.

5. **Distribution (XdY)—**The hypersurface of distribution and its shape are related to the temporal functions like the Tolman effect. These and dilation are the ambiguity of the fourth Lorentz-Fizeau law.

A hypersurface is a surface in ambient expected n-1 dimensions.[26] Here the ambient expected dimensions are reduced to a scalar making the hypersurface a potential for surface interaction. It is inactive without an activating application like interference at CMB.

Distribution unfolds angular volume or enfolds linear pressure-density. The latter is popularly known in the effect of displacement resulting in microgravity and in gravitational waves. These are longitudinal fluctuations in the fabric of spacetime enabling conversion into focus.

When we think propagation, we generally think of radiant light. The value unfolds a volume as an temporal angular surface flow (Area×time) consistent with viscosity (η=(F/A)/(dv/dz) =shearing stress in area per velocity gradient=time).[27] A physical quantity flowing in time is a current (I=dq/dt) whose density is j=I/A= scalar/Area×time.[28]

This action is restrained by a form of kinematic viscosity.[29] A small amount of the magnitude is lost to this action of unfolding as fits thermodynamic inefficiency. In electronics this is voltage defined as resisted current ($IR=V=J/C=5E6m^2/s$).[30] For light, the Hubble Parameter provides the flux parameter of transformation in redshift (see pg. 74).

6. **Free Space (Y)—**the d'Alembertian is where opposite propagations interact to conserve forming a "circular" wave and "canceling."

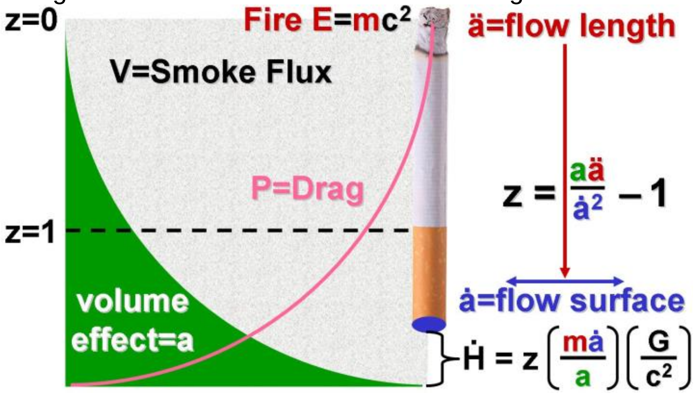
The effect is functional phase space affecting field surfaces, smoothing, and boundary conditions. As "free space" the affect on the path of light is minimal, mostly acting as the mechanism for the change from unfolding volume to enfolding pressure.

4. Lorentz-Fizeau Law

Time unfolds while space enfolds. Redshift (z) accelerates the flux effect (H^2) of linear entropy transforming volume unfolding into enfolding pressure to work as relatively "free" phase space.

Axes rotate one into the other by extended distribution and interference. It is the way the variables are defined in Hubble's parameter that accounts for both. The path of light is directly flat (inertial). Spacetime densities create a curving topography—the volume effect (a). The path length through that topography (ä) is a non-inertial reference frame. The effect of the non-inertial path on inertial light is transformation.

Nothing inspires innovation like trying to explain a highly abstract advanced concept to someone with zero background to work with. As I sat contemplating how I would explain this to a friend, he quietly smoked with his own thoughts and it dawned on me to use the cigarette as the example.



7.16 Flux of a Cigarette

Like light, to increase the effect you increase drag by enlarging the observational surface (lungs) over a longer duration (=m²/s flux). The Hubble parameter U(Ḣ=zH²) is the scalar rate of flux, accounting for the graphs going past the cigarette end. Its units are U=100 km/s/Mpc= 3.08567758128E+25 m²/s. Leaving the system completes the volume and pressure (VdP) effects consistent with "free" phase space distribution.

The relative flow volume (a=X³), surface (ȧ=Y²), and length (ä=r) are constricted by interference. The interference is Lorentz factor dilation (aä/ȧ²=γ). For the cigarette it is the packing of tobacco up to z=1 at the filter, where the effect of drag (pressure) exceeds the effect of smoke. Filtration limits the space through which particles can pass, and differences that affect particle arrangement and composition. The filter has greatest effect on the tar in the smoke.

For light, tar would be the equivalent of simple velocity. You get the entire tar effect at z=0 where fire (E=mc²) is creating the smoke. We need to insert a caveat here because we are assuming the Energy-mass value of the effect is enough to convey through the entire cigarette. We show z=1 at a point based on the assumption of energy being enough to complete the entire path. Lesser or greater energy values adjust the position of z=1/

At z=1, the filter specifically targets the tar. For light, filtering is anything directly robbing light of its energy or rotates its axes to transform its nature, such as atmosphere or other material surfaces absorbing energy, or circular waves (CMB) converting it. A flashlight on the surface of the Earth, as an example, is like cutting the white part of the cigarette down near the filter before lighting it.

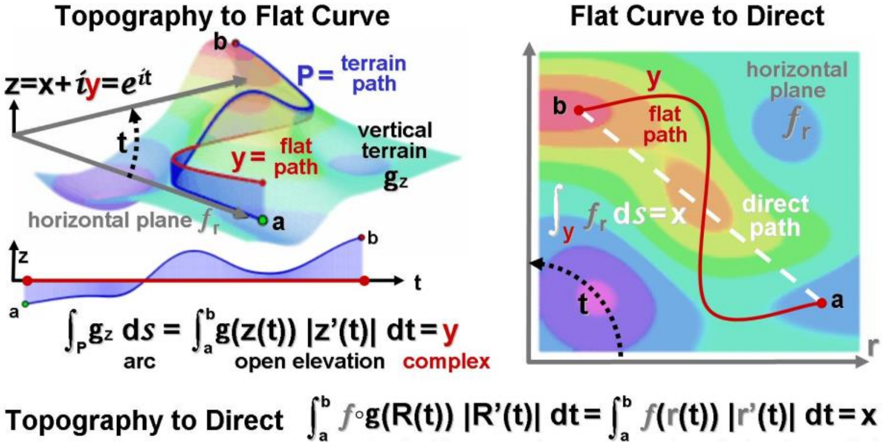
In cosmic space, the initial redshift is set by Lorentz factor as a function of the source's relative velocity (comovement includes motion of observer). This is like the initial tar value in smoke giving a mass density to the volume (m/a). The carbon monoxide (oversimplifying smoke composition for the example) is the absorption spectrum (e.g. absence of value). The rest of redshift follows the complex ratio (β=v/c) of tar (velocity) to carbon monoxide (constant) measuring the effect of interference changing the role of light from unfolding volume (V=smoke) to enfolding pressure (P=drag surface).

Path Integral

The path of light is a straight line up interference. Interference makes the terrain path longer than the objective distance (direct path). An objective distance would be like holding up a ruler and simply ignoring all the variations in spacetime density along the way—like a path integral.

A path (line) integral adjusts the observation to fit a more generic working perspective (the path is doing something)[31] by applying "curvature" parameters.[32] This is typically depicted by drawing a path over a terrain, ideally with an animation,[33] then reducing the terrain to a gradient surface across the remaining curved path is drawn.

You can then reduce again to find a direct length (line) or ideal path. The ideal path is like a flight path. The labeling here is consistent with topology and navigation standards. Forward direction is x, y is transverse (yaw) to that forward motion, and z is elevation relative to the plane.

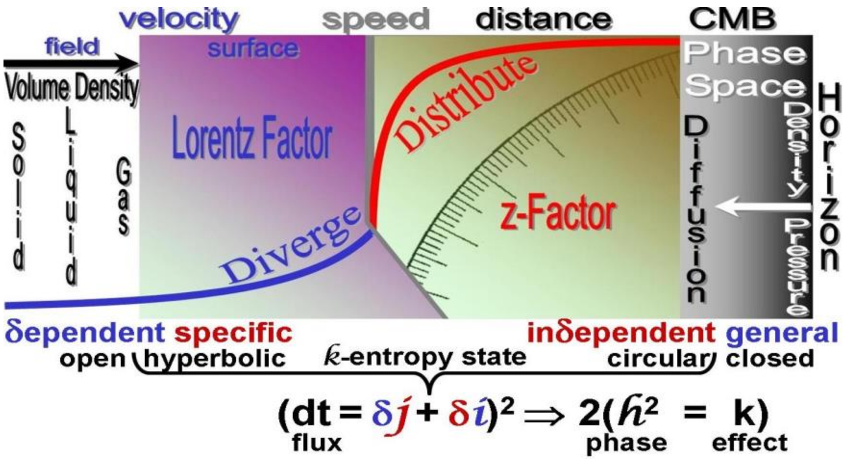


7.17 Path Integral

The first integral can be read: "Remove the area of the curve (ds) in the g-terrain under P to show the unobstructed path (y) if it were flat." The unobstructed path is still not entirely straight unless you accounted for it in the original function definition. Basically speaking, the path integral is like converting your experience on a road to a flat map.

Let us belabor our cigarette analogy more. The chemical composition of the tobacco consists of biologically useful carbon chains. The discrete process begins with forming the biomass (R), killing and drying it (RdZ), then destroying it (Z). For the chemicals, atomic identities and the energy of interactions provide a discrete mass value converting into latent.

Energy (E) and spacetime are synonymous in Thermodynamics and proportioned in Relativity.[34] In chromodynamics, formation is confinement of light value into a change identity.[35] From a latent perspective, despite color charge, discrete functions are circular focus=j-operator. Formation is followed by evolving through Lorentz factor and diverging into a beam.[36]



7.18 Complex Velocity and Redshift

The key difference between Z and X is perspective. Z may be diverging, but it balances itself with converging R (1:e). X is the latent perspective, unfolding into balance with Y instead out of focus rather than R in focus. Destroying the biomass at Z converts it into a volume of toxic wastes (X). This volume is subjected to propagation (XdY), where it endures a complex and transformative path. Eventually it applies to the lungs as observational surface (Y).

Redshift follows conversion out of focus. Despite linear elements, the latent process out of focus unfolds helically/sinusoidally as the i-change operator. The transformation is hypercomplex ($\hbar$) consistent with the spherical wavefronts of CMB, resisted by time (t). It ultimately neutralizes through conversion into proportional (1:e) balance. Where that balance is achieved, spacetime is free of direction.

Coming into that balance, however, is the CMB and related processes giving phase space basic non-zero metrics for temperature and pressure. These metrics and related hypercomplex operator provide a generic low-value field. This field is the background of the universe acting subtly on things in a variety of ways. It is also responsible for setting a baseline to all metrics and constants in the universe.

Endnotes

[1] Rajaraman, R. (2010). Antennas & Propagation. NE University. ccs.neu.edu/home/rraj/Courses/6710/S10/Lectures/AntennasPropagation.pdf.
[2] Wendell, R.A. (Mar. 24, 2004). The Polarization Puzzle. rogerwendell.com/text/science/science_triple_phasor_paradox.txt
... (Jul. 17, 2010). Triple Phasor Paradox - The Polarization Puzzle. https://www.youtube.com/watch?v=F5GqoV9wVh4.
[3] (ret. Oct. 9. 2018) Oxford English Dictionary: "Osculate." https://en.oxforddictionaries.com/definition/osculate.
[4] Paschotta, R. (2007). RP Photonics Encyclopedia: Bandwidth. Germany: RP Photonics Consulting. https://www.rp-photonics.com/bandwidth.html.
[5] Souter, W. (May 15, 2012). An Introduction to Quantum Tunneling. https://www.azoquantum.com/Article.aspx?ArticleID=12.
[6] Di Francesco, P.; Mathieu, P; & Sénéchal, D. (1997). Conformal field theory. Graduate texts in contemporary physics. Springer.
[7] Earl, R. (Nov. 2003). Complex Numbers. maths.ox.ac.uk/system/files/attachments/complex%20%281%29.pdf.
[8] Gott III, J. et al. 2005. A Map of the Universe. The Astrophysical Journal. 624 (2): 463–484. http://www.astro.princeton.edu/universe/ms.pdf.
[9] Moffat, S. (2006). Dr. Who: "Blink." BBC.
[10] For current CMB maps and details visit https://map.gsfc.nasa.gov/.
Rajendran, V. (Mar. 24, 2016). A phenomenal Gravity Map of Mars. http://geoawesomeness.com/a-phenomenal-gravity-map-of-mars-a-bedrock-for-further-exploration-and-findings/.
[11] (ret. Oct. 6, 2018). Baryonic Acoustic Oscillations. astronomy.swin.edu.au/cosmos/B/Baryonic+Acoustic+Oscillations.
[12] Evans, R.H. (Jan. 1, 2015). How do we know that the CMB is from a hot, early Universe? thecuriousastronomer.wordpress.com/2015/09/01/how-do-we-know-that-the-cmb-is-from-a-hot-early-universe/.
[13] (Mar. 17, 2014). NSF-funded researchers say Antarctic telescope may have provided the first direct evidence of cosmic inflation and the origins of the universe. https://www.nsf.gov/news/news_summ.jsp?cntn_id=130760.
[14] Blake, C. (ret. Oct. 4, 2018). Testing cosmological models with WiggleZ. astronomy.swin.edu.au/~cblake/Blake_ASA2010.pdf.
[15] Eicher, D.J. (Dec. 3, 2015). The New Cosmos: Answering Astronomy's Big Questions. Cambridge University Press.
[16] Eisenstein, D.J. et al. (Jan. 10, 2005). Detection of the Baryon Acoustic Peak in the Large-Scale Correlation Function of SDSS Luminous Red Galaxies. https://arxiv.org/abs/astro-ph/0501171.
[17] Hinton, S.R. et al. (Feb. 1, 2017). Measuring the 2D baryon acoustic oscillation signal of galaxies in WiggleZ: cosmological constraints. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5210023/.
[18] Kay, B. (2011). The Fate of the Universe. PHY 495 Senior Project. https://uncw.edu/phy/documents/TheFriedmannEquations.pdf.
[19] Upton, E. (Feb. 4, 2014) Why Hubble has a Telescope Named After Him. todayifoundout.com/index.php/2014/02/hubble-telescope-named/.

[20] Hubble, E. (Nov. 23, 1924). Finds Spiral Nebulae are Stellar Systems. The New York Times. nytimes.com/1924/11/23/archives/finds-spiral-nebulae-are-stellar-systems-dr-hubbell-confirms-view.html.
[21] Hubble, Edwin (Jan. 17, 1929). A relation between distance and radial velocity among extra-galactic nebulae. www.pnas.org/cgi/reprint/15/3/168.
Robert P.K. (Jan. 6, 2004). Hubble's diagram and cosmic expansion. PNAS. http://www.pnas.org/content/101/1/8.full.pdf+html.
[22] Sandage, A. (Dec. 1989). Edwin Hubble 1889–1953. apod.nasa.gov/diamond_jubilee/1996/sandage_hubble.html.
[23] Harnisch, L. (Dec. 31, 2011). Hubble: No Evidence of 'Big Bang' Theory. ladailymirror.com/2011/12/31/hubble-no-evidence-of-big-bang-theory/.
[24] Elert, G. (2018). The Physics Hypertextbook: "Thermal Expansion." physics.info/expansion/.
[25] CERN. (Sep. 23, 2018). How an accelerator works. https://home.cern/about/how-accelerator-works.
[26] Rowland, T. & Weisstein, E.W. (ret. Oct. 15, 2018). Hypersurface. http://mathworld.wolfram.com/Hypersurface.html.
[27] Elert, G. (2018). The Physics Hypertextbook: "Viscosity." https://physics.info/viscosity/.
[28] (2012). Electric Current Density. maxwells-equations.com/density/current.php.
[29] (ret. Oct. 18, 2018). Kinematic Viscosity Formula. softschools.com/formulas/physics/kinematic_viscosity_formula/472/.
[30] Nave, R. (2017). Electric Current. hyperphysics.phy-astr.gsu.edu/hbase/electric/elecur.html#c2.
[31] Svirin, A. (2018). Physical Applications of Line Integrals. https://www.math24.net/physical-applications-line-integrals/.
Guichard, D. (Oct. 30, 2018). Calculus: 16.2 Line Integrals. https://www.whitman.edu/mathematics/calculus_online/section16.02.html.
(2016). Line integrals in a vector field. khanacademy.org/math/multivariable-calculus/integrating-multivariable-functions/line-integrals-in-vector-fields-articles/a/line-integrals-in-a-vector-field.
[32] Dawkins, P. (June 1, 2018). Calculus III: "Section 5-2 : Line Integrals - Part I." tutorial.math.lamar.edu/Classes/CalcIII/LineIntegralsPtI.aspx.
[33] Barbosa, L.V. (ret. Oct. 30, 2018). Line Integral. https://en.wikipedia.org/wiki/Line_integral.
[34] Lucas, J. (May 19, 2015). What Is the First Law of Thermodynamics? https://www.livescience.com/50881-first-law-thermodynamics.html.
[35] Sebastian Anthony, S. (May 20, 2014). Scientists work out how create matter from light, to finally prove Einstein's E=mc2. https://www.extremetech.com/extreme/182701-scientists-work-out-how-create-matter-from-light-finally-proving-einsteins-emc2.
[36] Wolfe, J. (ret. Sep. 24, 2018). Relativity: The original references - and some caveats and conventions. University of New South Wales. https://newt.phys.unsw.edu.au/einsteinlight/jw/module1_references.htm.
Nave, R. (2017). Length Contraction. Georgia State University. hyperphysics.phy-astr.gsu.edu/hbase/Relativ/tdil.html.

8. Latent Fundamentals

Fundamental things transform within their categories, but are not created or destroyed and they don't evolve. The human ego struggles with this idea because it does not want to accept its own impermanence. I mention this here because, as a scientist, I have spent my life observing the evolutions of my understanding (consciousness). I can review my personal memory and can see where it becomes increasingly vague then ends, confirming it emerged (was created) and has thus far evolved. Therefore, it is not fundamental as many wish.

Force (Newtons=kg m/s^2)[1] is a distributive generalization normally treated as fundamental. Acceleration units m/s^2 are time resisting change in distance. The specifics as manifolds using meter units is fundamental. As momentum (kg m/s), force becomes a discrete generalization. There are many very specific behaviors and qualities tracing their values back to this one concept of force.

Traditional force does not describe a simple thing, but a combination of hidden variables. Generalizations are a compromise to adapt to otherwise unmanageable things like infinites or complex combinations of more fundamental things.

Flux (kinematic m^2/s or dynamic N s/m^2) is the latent generalization of force. Notice the inversion of variable roles such that space resists change in distance as a temporal function. Kinematic describes an internal resistance to flow (e.g. static). It can also describe an ambient state, like ambient temperature providing a static volume (ergodic) transferred by contact. Dynamic flow occurs when a force manifold is applied in a kinematic context. Fundamental latent variables derive from flux forms.

I list the units explicitly because flux has an alternate unit form of kg m. See a pattern? This group is independent of time. By itself, it is not subject to change that is resisted, it just is. Only in discrete form does it have change to resist, and only as a distribution does resistance itself become a duration enabling transformation. These quantum forces fundamentally value traditional force generalizations.

Polarizing Flux

Light is simply a propagation of value. Without some sort of reference frame, the value is nothing but a scalar. The propagation reference frame gives the scalar units consistent with flux. Just because you can derive a scalar by multiplying a combination doesn't mean that is how it works. A multiple of c^2, however, readily converts a flux into a frequency.

Frequency translates into a change operator cycle as the generalized perimeter (monopolar=π; dipolar=2π) in a metric of change resistance (time). The concept of monopole in magnetic context is like having a north pole without a south pole.[2] For flow to occur, flux must have a counter medium to flow into. Without infusion, diffusion (heat) will not flow. Heat that is not flowing is ambient temperature—static=contact transference. It defines a volume of space but it doesn't go anywhere. Perhaps the better term would be omnipole (any or every direction) or apolar (no direction).

A dipole moment is a measure of polarization, where the energy levels of the poles define enough space to close the distance needed to establish a flowing connection.[3] Magnetic fields are hypercomplex, having satisfied the conditions needed to flow. Of course particle accelerators aren't observing monopoles.[4]

They are looking for energy in motion instead of ambient pressure or volume. Ironically, the numbers are all there but being ignored because they aren't changing. The mathematical definition of a monopole, when you can find it, is seriously ambiguous: "a connection over a principal bundle G with a section of the associated adjoint bundle."[5]

Let's put monopole in plain language: a one-directional field effect connecting a whole with its parts (distribution). As a field effect, it is simply describing where in the distribution the high and low potentials are that value affects, but the value does not flow or otherwise convey. Instead things are conveyed by and within the distribution effect.

Surface gravity and mass are related examples of mathematical monopole.[6] Like color charges, mass and gravity are valued by how a space is defined (e.g. manipole below). It does not exclude the local effects but instead prioritizes the general effect. Without this, gravitational fields would encounter hollowing and canceling issues. Instead of hollowing or canceling, convection currents form smoothing the geometry from multiply connected into a simply connected field.

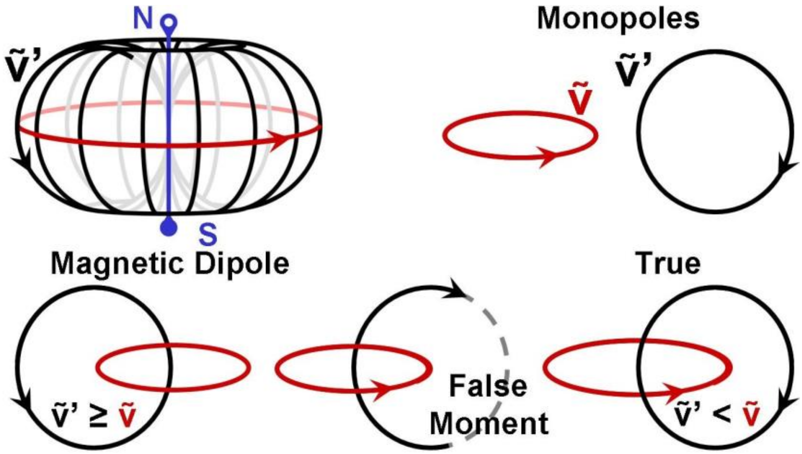
As a simply connected field, a monopole is not subjected to informational deviation that would cause the value to convey, transfer, or transform. An electrical monopole, as an example, is a low potential into which charge flows, therefore all charge lines point to it.[7] The dimension is not seen in motion or changing its distribution. Color charge, mass, volume, and pressure as static, intrinsic values are easily observed forms.

Ordinarily we don't think of mass as something that flows, but in mechanical systems like the atmosphere or ocean, mass does flow. Mass also requires a static mixing of spatial features that constitute interaction of high and low potentials. Similarly, light consists of a dynamic mix of interacting high and low potentials.

We can call these information mixtures **manipoles**, distinguishing them as static (gravity) and dynamic (light). Manipole describes most of our natural experience. Our normal experience consists of countless discrete things arranged into a variety of shapes, textures, and densities (e.g. distribution bundles). The arrangement itself is information, but most information is itself in a state of flux.

A byte of that information is the unit cycle defining the whole. In frequency terms the perturbation is mc^2/h. The bits dividing that byte can be discrete or any arbitrary division of the whole. A discrete division means the information arrangement depends on the discrete parts arranged. When it normalizes into a common field, no matter how you divide the field you get the same information—a holographic information effect.

The nature of information first challenges the ego by explicitly showing that information cannot be conserved and is in fact the most changing thing in the universe. Next, putting it into context like this lends to memory overload. The brain fries because it is trying to manage too many variables at once. We compensate for this by either generalizing or switching to something simpler, like magnetism.



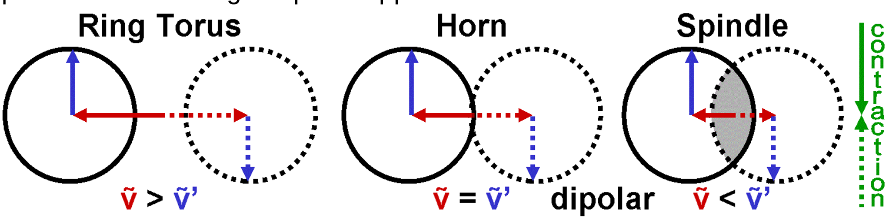
8.1: Magnetic Dipole

The flux variables for magnetism are kinematic angular volume ($\tilde{v}=\mu/\rho$) resisting dynamic angular pressure ($\tilde{v}'=N/\mu$). A true monopole would be one dimension or another. Each is a radius in 0-sphere mode, becoming a circle in 1-sphere, and overlapping to form a horn torus in 2-sphere mode. The 3-sphere is the spherical mode which would include the linear action of the environment acting on the torus. True monopoles simply apply these modes to each dimension individually.

A magnetic dipole requires a functional horn (neutral) or spindle torus (charge). Both kinematic and dynamic dimensions are present. The dynamic dimension connects N to S as non-inertial when it is equal to the (inertial) kinematic resistance. Equality is a tad tricky because one is inertial volume and the other is non-inertial pressure. But these can find a common variable by converting them to their spatial forms.

It is also important to note a possible misconception. Each of these flux dimensions defines an entire space. Not part of a space. Connecting the poles is not a matter of completing a circle. Connecting the poles is done by at least achieving a dynamic value greater than the resistance preventing the connection. The true dipole moment illustration shows a larger ring of resistance. This is easier to see differentiating torus types.

When considering torus shapes (below), the hierarchy demands linear volume and pressure provide the initial geometry. Hierarchy is also why the angular pressure applies second to the angular volume creating a torus instead of a sphere. Instead of the two circles having the same geometric origin position, the volume always comes first as the equator then the pressure connecting the poles applies around it.



8.2: Magnetic Dipole

The ring torus only occurs like this in a multiply connected system, as the Virial theorem forms a common mass, shape, and motion. The ring torus does not apply to a simply connected central identity. Instead the configuration on a sub-temporal level is a chiral color charge, and on a temporal level simply swaps axis roles or helicity (e.g. an anti-proton). An example of this on a large scale is Neptune rolling in its orbit. It is indistinguishable from any other spindle form of torus.

The horn torus is neutral. The angular pressure only reaches the surface to connect the poles. Because an intrinsic field will simply swap roles, it is not possible to find a magnetic monopole. Only magnetic neutrality is possible. And it will polarize to any high potential line. Neutrons are a prime example of this, Their neutrality makes it possible to form nuclides through strong interactions without violating the hierarchy.

The spindle torus has an additional singularity feature that causes a linear polar contraction. The kinematic resistance and contraction both distort fields causing layers of the dynamic circle to be elliptical. In the hierarchy, the effect on linear volume and pressure in a simply connected unit system is a smaller observed polar radius.

You can see from this why polarization is specifically linked to magnetism and from there to electromagnetism. You can also see how it is very easy to misunderstand the monopole concept and look for it in the wrong ways. Monopoles aren't active. They just are. The ring torus in a multiply connected system is a perfect example. The variables are fixed observations of moving parts. A simply connected unit is confined. You can only make a fixed observation until the energy becomes accessible and observably dipole.

Standard Model

There are four "fundamental forces" in the Standard Model. In descending order to weakest they are: Strong, Electromagnetic, Weak, and Gravity.[8] I put the word "forces" in quotes because the term is semi-misleading. These are all fundamental classes (groupings) of manifold effects, the manifolds being force analogs.

- Strong interaction describes the formation of spaces from valuing and intersecting axes (0 to 1-sphere). Gluon mediation.
- Electromagnetism is all 1-sphere flux and feedback transformations leading into or deriving from strong interactions. Photon mediation.
- Weak (Electroweak) interaction describes entropy gloming (mixing) of hypervolume and hypersurface axes. The angular momentum of volume rotates the hypersurface from 1-sphere to apply to the volume. The mix is a 3-sphere (glome) with an intrinsic angular pressure field. It also satisfies the geodesic field equation for mass/conventional gravity.
- Gravity is the last of these forces and weakest, describing a geodesic displacement in phase space consistent with mass.

Particle mediation is problematic, even with gluons and photons. Weak bosons are alleged carriers of the weak interaction. The reality is even simpler. These "mediators" are just the most basic quantizations of these groups. They mediate simply on account of the interaction is their defining feature. Such quantizations are **virtual**, meaning they don't have to be actual discrete particles for the interaction to occur. We use these and other quantizations to map the processes as with Feynman diagrams.

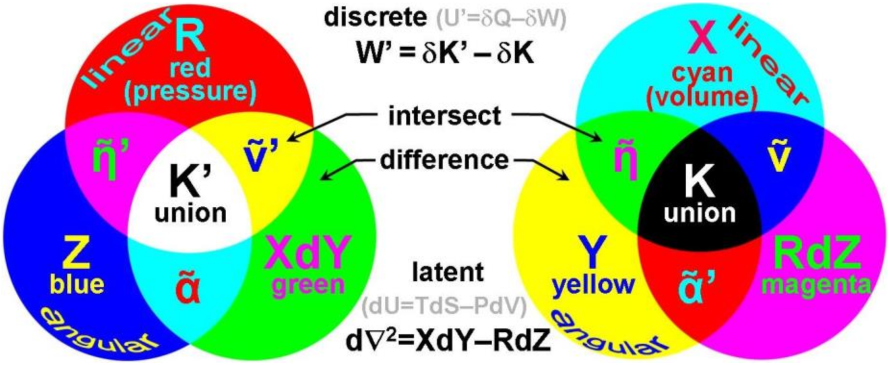
These fundamental groupings follow the hypersphere pattern. They also follow the same use of space concepts as Newton's laws and the related laws of Thermodynamics and propagation. Newton's laws form a basis for distribution of motion. Thermodynamics further generalizes that to energy providing the basic latent-discrete-void breakdown of perspectives in the first law.

	Latent	**Discrete**	**Hyper-Void**
Conservation	Circular **$c^2=X^2+Y^2$**	Hyperbolic **$c^2=R^2–Z^2$**	0 - Sphere **flat value**
Uniformity	Propagation **$\acute{j}X+\acute{\imath}Y$**	Strong color charges	1 Atemporal **static**
Information (**S**)	Scalar wave ψ	Electromagnetism **$\delta K'–\delta K$**	2 Temporal **geometry**
Conversion	Axis Rotation **XdY**	Electroweak **RdZ**	3 Angular gloming **dynamic $\nabla^2\|W^2$**
Dilation	Redshift **$z=\Delta E/E$**	Mass/Gravity **$R_{\mu\nu}–\frac{1}{2}Rg_{\mu\nu}$**	4 Geodesics **interactive$\Rightarrow G_{\mu\nu}$**

8.3 Fundamental Forces in Context

The first stage simply determines how the variables are being used. Nothing is changing until change applies in a category affecting the others. That unit change then carries down to the second law/stage where the bases of the categories are defined in the moment. At this level the value is either diverging (light, $\imath$-entropy), converging (color confinement, $\jmath$-entropy), dynamic (real S), or static (hypercomplex S).

The third stage is where information defines the geometry. For light this is a value generalization of a wave function. For matter, this is where 1-sphere axes (hypersurfaces) form feedback systems like microstates or magnetism. Forming these feedback systems requires combining the hypersurface axes into volumes and surfaces applied to volumes (2-sphere). The void perspective is then whichever distribution system applies: W' with geometry or $d\nabla^2$ independent of geometry.



8.4 Charge Color Palate

The color palates use the logic of sets[9] to distinguish between applications by separating analytical manifolds (R,X,Y,Z) from potentials (α̃,η̃,ṽ) and unions/disunions of distribution being charge axes (K',K) consistent with octonions. If the analytical perspective is latent, then intersects will form discrete color perturbations. If the analytical perspective is discrete, then the intersects describe surfaces for value exchanges and quantizations.

Conversion (4th stage & related laws) is the process of rotating axes into uniform generalizations. For a distribution this is called gloming because the information of each axis is combined in a complex interactive form. Surface applies to every point of volume, not just the general whole like a balloon filled with a volume of air.

For light such a complex is a system of conversion. For matter it is the weak interaction where angular momentum defines what we are calling a Wheeler space. This is the available space consistent with information that relates the linear and angular axes. The weak field defines all points of the identity, but also creates a local pressure system with very little range.

It is within the weak interaction space that a geodesic generalization defines surface gravity as a dilation (the scaling element of a metric). This dilation reflects displacement consistent with mass because changes in it affect the capacity for change in position (motion). Mass resists acceleration via Lorentz factor affecting the dilation of time. Conversely, redshift resists conversion through dilation of space—its surface increases.

By recognizing these patterns and putting everything into related contexts, we can see the “fundamental forces” are generalizations of entire classes of interactions. In the up-coming chapters we will endeavor to cover the full range of interactions for each category. We can also see they are discrete forms of applied flux.

Flux is latent (potential), applied either as static (fixed) or dynamic (flowing). Both can also be simultaneously true to specific contexts. This only happens when entropy is hypercomplex, as with degenerate densities (protons, neutrons, nuclides, pulsars, neutron stars) and other instances of static volume and pressure. Elementary matter has a limited entropy—the energy observably flows among the parts in quantized batches of energy.

With hypercomplex entropy, the energy is proportionally and simultaneously flowing in and out of the same parts. It looks like nothing is happening. A zero entropy state conditionally applies. The geometry is no longer fluid. It has a static temporal context that finishes off the process known as renormalization.

Renormalization makes quantum things relativistic. In this case it generalizes the quantum to classical in the geodesic level of distribution. It is so generalized that energy acts on it uniformly and Newton’s laws clearly apply. That does not exclude quantum conditions, like magnetism, from applying given context.

Electrodynamics

In graduate school, I put together and delivered my first presentation on cosmology. Whether the audience was genuinely impressed or just polite, I will never know. I will roll with polite because I considered it an abysmal failure even before delivery. It fell apart when I was defining my variables starting with energy and was struck with the realization that all my research had failed to answer what energy is to my satisfaction.

Over the decades, my research focused more and more into chromodynamics. I typically scoffed at encouragement to give more attention to electrodynamics. I scoffed because I was aiming for the fundamental to chromodynamics, which itself is fundamental to electrodynamics. I was looking the wrong direction out of force of assumptions and bad habits.

$$Ax^2+Bx+C=0 \qquad x=\frac{-B\pm\sqrt{B^2-4AC}}{2A}$$

$$x^2\pm 2yx+y^2-c=0 \qquad x=\begin{cases}\dfrac{\mp 2y\pm\sqrt{4y^2-4(y^2-c)}}{2}\\[2ex] \dfrac{\mp 2y\pm 2\sqrt{y^2-y^2+c}}{2}\\[2ex] \boxed{\mp y\pm\sqrt{c}}\end{cases}$$

8.5: Scalars in Quadratic Equation Example

Ironically, I used electrodynamics to explain the variables in metaphor. I assumed they would be specific scalars like we see in the quadratic equation. Except the electrodynamic model isn't a metaphor for the fundamental. It is where the fundamental emerges in meaningful and observable form. It never occurred to me to think that generalization can not only go both ways, but in different ways that created a confining (hiding) difference, essentially dividing the quantum from relative universe.

Electrodynamics is the "study of phenomena associated with charged bodies in motion and varying electric and magnetic fields."[10] This is the point in the Standard Model where we observe and break down the variables into their most familiar forms. Electromagnetic flux gives us the variables needed to identify color charges of strong interactions and understand energy transformations through weak renormalization.

Outside electrodynamics, flux values generalize in different ways. In this book we use the term latent to describe the quantum universe of variables generalizing through strong interactions to propagation. They generalize into electromagnetic radiation (EMR) and absorption (EMA). The information woven from this weft and waft comes into focused interference as strongly interacting perturbations in the field of light—virtual matter. The most primitive of these are simple (photon) and complex (gluon) color charge surfaces and flavour volumes (Weyl fermions).

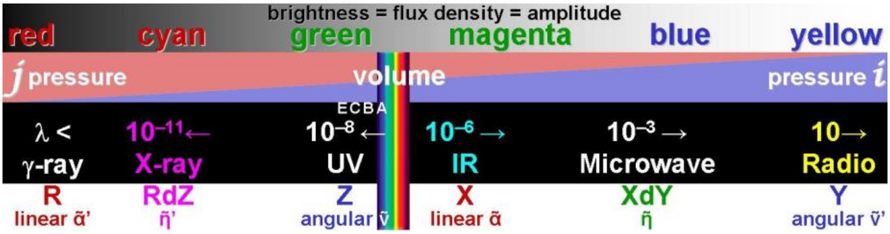
Virtual is really hard for us to grasp when our conventional perspective is the universe of relatively stable atoms. It is even hard for us physicists to look at something like an electron and accept that it is a perturbation in a field. It may be incredibly durable, but on a fundamental level, leptons are incredibly easy to form and break down. It is only reasonable, then, to characterize this photon-related family as EM "mediation" particles.

Photons and leptons differ only by applying their active field value to a hypersurface or hypervolume. They are two different ways to apply the same value. Gluons are yet a third, and weak bosons are a transitional fourth. It is only natural to look at these as mediators. Weyl fermions are also mediators, specifically of static volume under pressure (flavours).

Likewise, basic color hypersurfaces are static forms of the flux variables accounting for the complex space sequence of light. This sequence was and remains a significant distraction from the EMR-EMA generalization of light. The hypersurface of light is one of these forms, and as it propagates transforms sequentially. The differences we observe and classify into familiar terms like gamma ray, x-ray, ultraviolet, infrared, microwave, and long/radio waves. Visible light is an artificial group carved out of a range between UV and IR.

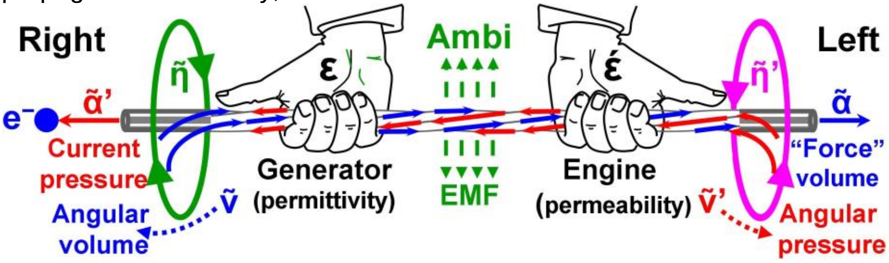
The electrodynamics breakdown (below) given a chromodynamics lens shows the shape and qualities of light waves as they transform along the manifold transformation process. It also shows that flux density is its own factor. Flux density is the brightness, the distribution in space independent of frequency. Frequency gives the energy density in time.

The tiniest differences have enormous biological effect, like germicidal UVC (1E-7m) versus tanning in barely visible UVA (up to 4e-7m), not to mention ionizing EUV at 1E-8m. The visible range is in the middle of a radical difference in phase perspective between angular and linear volume. If it were a gamma ray following this path, the visible spectrum would occur at z=1. Hydrogen creation's Lyman-α is low energy in the range of UVC at 1.21E-7m.



8.6: Manifold Transformation Along the Spectrum

The manifold boundaries blur along the latent spectrum. Vast areas can be one manifold or the other. The visible spectrum is a perfect example. RdZ being hyperbolic can be unfolding **or** enfolding (right-handed $\hbar$'), whereas X is definitively unfolding **and** Y enfolding in XdY (left-handed $\hbar$). It should be no surprise to learn that modern physics, by observing propagation and decay, has determined the universe is left handed.[11]



8.7: Fleming's Rules & Force Variables

With a significant caveat, handedness comes from Fleming's familiar rules (see pg. 59 et seq.). The caveat is the roles and sequence contextually change for XdY (η̃) and RdZ (η̃'). Chromodynamics is converging into identity (discrete), light is diverging from identity (latent), and the electrical system is simply redistributing the value. Each has its own way to look at the variables.

- The discrete field (QCD) needs a compatible active axis to join.
- The latent field needs an opposite available variable to facilitate propagation converting from linear pressure to angular volume, then changes phases to linear volume converting to angular pressure in the visible spectrum. This is why green is ideal for photosynthesis.
- The distribution field (QED) needs an applied local variable to cause the conversion from linear pressure ultimately to linear volume.

These quantum subtleties are quite frustrating but also not entirely difficult to keep track of. Fortunately for us, these variables generalize quickly and with painful simplicity, splitting the quantum from relative universes along this electrodynamic fulcrum. In essence, the hidden variables are in plain view. Naturally we want to start at the "bottom" and work our way up from truly fundamental.

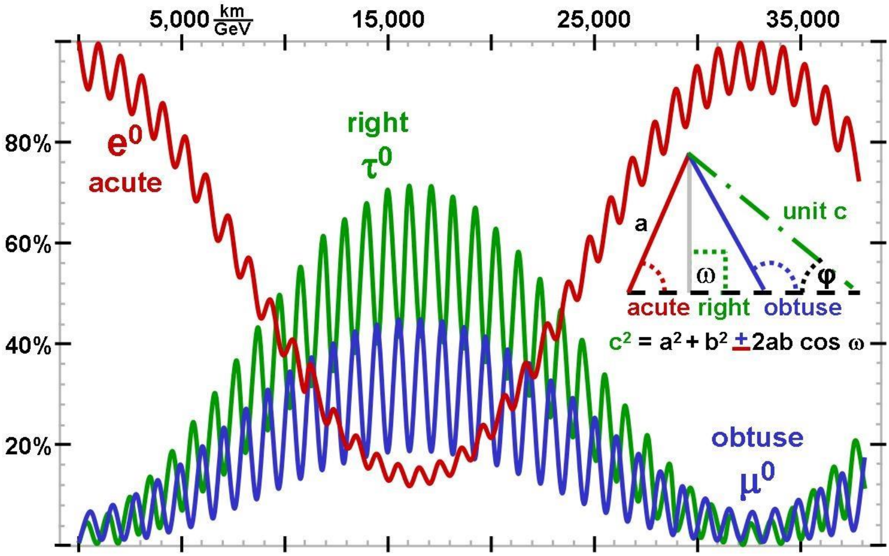
Quantizing

Renormalization is one of the hardest things to wrap your head around. Put simply, renormalization describes a qualitative point in the processes that divides the quantum and relative worlds. People have no idea the can of works they open asking, "What is the smallest particle?"

In what terms do you mean small? If you are talking holding a tape measure up and seeing how much objective special distribution is being used, then you have to cite the baryons (protons and neutrons) as smallest. Ironically, more primitive and more advanced forms of matter are bigger. Quantizing is another awkward generalization that can be applied to all kinds of things.

Quantization never applies to latent things unless the latent is being formalized into discrete things or contexts. Like many others, I have wasted a significant part of my life trying to determine quantizations. I finally realized the quantizations are contextual hypersurface and hypervolume (permittivity and permeability) and derivatives (degenerate pressure, degenerate density, and minimum frequency).

I won't pretend we have all the details and formulations nailed down. From a latent perspective, the quantization we need to address here are the EMR and EMA elements in minimum arbitrary units needed to define the mechanisms of perturbation (e.g. virtual identity).



8.8 Triangulating Probable Neutrino Oscillations

The Bose-Einstein microstates approach to this problem simply generalizes the elements with the components. We will further subdivide the concept into active and passive. Active microstates are configurations of energy units flowing among the parts. Passive microstates describe all compatible quantize-able states possible: contexts of possible interaction. As such, the Bose-Einstein statistics no longer apply.

Our focus is mainly with dynamic microstates, especially where latent is bordering on discrete. QED again provides a reference point. Oscillation is used to describe change in neutrino identity (volume flavour) due to phase change in the distributed wave function.[12] Oscillatory information consistent with identity renormalizes the arbitrary active microstates into passive fixed quanta. Typically when we think of primitive quanta, it is relative to the passive microstate perspective.

The oscillatory differences as a function of EMA-EMR information can be treated as triangle forms by oscillation angle (ω). These forms are consistent with the active "flavours" (color as volume=2-sphere) observed in neutrino oscillation statistics above.[13] Triangle types generalize the radiant-absorption axes into common information of color charge axes.

- **acute** (angles $\omega<90°$)—law of cosines gives $j \equiv \nu$. For red: EMR=a, EMA=b. Anti-red (cyan): EMR=b, EMA=a.
- **right** (one angle $\omega = 90°$)—generalizes $\hbar \equiv m$. Contains the Pythagorean elements. At a=b, $c^2=2ab$ and $\varphi = \pi/4$, color and chiral anti-color are set initially by context.
- **obtuse** (one angle $\omega > 90°$)—law of sines gives $i \equiv \mu$. For blue: EMR=a, EMA=b. Anti-blue (yellow): EMR=b, EMA=a.

Active linear is subject to Schwarzschild $2G/c^2$ (colors=1-spheres), the flavours are 2-spheres at $1/\varepsilon_L=G/c^2$. Active angular is subject to permeability $\acute{\varepsilon}_A=4\pi/\mu_0$ for flavour, $8\pi/\mu_0$ as color. Planck's reduced constant ($\hbar$) limits the information as the quantum of angular momentum (c=hypotenuse) for color (1-sphere=unit spin).

$$\varepsilon_V = \left[\frac{4\pi}{\mu_0}\right]\left[\frac{G}{c^2}\right]\left[\frac{1}{\hbar}\right] = 2 \sec \varphi \ _{/\mathrm{kg\ m^2\ s}} = \left[\frac{ab}{c}\right]$$

The mixing angle (φ) comes from rotating 1-sphere axes into 2-sphere as part of the weak interaction.[14] For a single axis, the hypersurface applies to volume by means of the azimuthal number $\pm\hbar\sqrt{3}/2$. An electron has a similar experience as its entanglement surface behaves similarly, giving shape to electron orbits.[15]

Rotating axes into 2-sphere simply applies temporal context. It then glomes into a common 3-sphere structure, renormalizing to $\pm\hbar/2$. Gloming means to wind or ball up together.[16] It is a relativistic process of renormalizing two or more quantum axes into a hypersphere. This gives a common half-integer state of angular momentum consistent with applying a surface to a sphere with half the radius.

Gloming also combines the information of the axes into a common distribution. We call this a Wheeler space (W) because the absorption pattern is what he called quantum foam. The whole process optimizes the use of space into a state of degeneracy pressure or density—limits to the use of space. Because fusion involves joining perturbations of varying sizes, there is always excess to omit. Radiant values will fill absorption spaces as they can, conflict with other radiant values, and emit where exclusions apply.

Geometrizing

I originally diverged from physics to study topology. I was drawn back to physics because I was unsatisfied with topology representing anything more than abstractions. Topology was missing qualities my life of physics had conditioned me to not just expect but insist upon having. Ironically, my journey away from geometry has inadvertently come back to a form of geometry I never conceived. Despite my limitation, the one thing I can offer is recognizing its place.

The critical difference between latent and discrete cases is geometry. Discrete spaces define their own shape whereas latent spaces have their spaces shaped for them. As Wheeler put it, “Spacetime tells matter how to move; matter tells spacetime how to curve.”[17] This topic has a great future for explorers to unravel some of the most intimate and involved features of the universe. We are only beginning to scratch the surface.

This difference evolves with the way change operators are applied. In the absence of change logic being applied, the latent value is indistinguishably a relatively static pressure-volume. In latent applications, the change logic dictates manifold transformations fitting propagation requirements.

Latent manifolds are opportunistically shaped. The closest they have to geometry is the sequence of manifold transformation: linear pressure converting to angular volume (RdZ) phase changing in the optical bandwidth to linear volume converting to angular pressure (XdY). Geometry begins with axis formation as latent values come into focus to perturb a color (pressure) or flavour (volume) charge.

Having an axis is no sign of actual ownership. Wey fermions, aka semi-metals, are an example of an ad hoc volume axis in a conventional alloy.[18] Surface tension is one of the very specific pressure axes regularly identified, fitting a primordial definition. In a way. these handle the “loose change” from everything around them. They don’t need ownership. They are owned collectively to form a static geometry.

Geometrizing is a very formal way to quantize. As you just saw, it helps reveal where the most basic of material identities are hiding in plain view. It is ironic how well we know them without recognizing their quantum significance. This brings me back to the underlying logics.

As soon as the latent involved itself with an axis, it began to geometrize and the logic evolves from basic operator to color (pressure) or flavour (volume) charge. These are distinctly pressure and volume unlike the indistinct latent pressure-volume version. As distinct they have specific qualities easily observed showing they can come into focus or from focus.

Flavours can emerge in two different ways: by joining pressure axes to create a volume through strong interaction or by direction perturbation. Either way, the flavour is itself a charge axis for a discrete volume, dramatically limiting the availability of space and nature of interactions. The most common interaction is entanglement, using an available pressure manifold to create a discrete system with at least some degree of independence from the perturbation field.

We expect geometries to be simple axes joined together followed by shaped topologies. At this level we are robbed of specific shapes, stuck with impositions of the environment followed by generic lines, arcs, circles, spheres, etc. We are only just getting a hint of discrete points/vertices. For an ionic field, these points are just probabilities actualizing for context. It takes layers of different types of interactions we will cover in the next chapters before we begin to formalize the use of space.

Renormalizing the geometry is precisely that: formalizing the use of space. I'd love to say that forming a degenerate density (volume) solves the whole problem, except it doesn't. It simply changes the nature of the problem. The problem now has active and available pressure conditions of different types. For a proton this means offering some value needed by neutrons to form nuclides and needing some value offered by electrons to form atoms.

Despite sounding like we have finally geometrized, we haven't. The problem is that electrons are perturbations. They are active fields where value is constantly flowing among quaternion-like pressure and volume change containers. They are quaternion-like because the color and flavour containers are different charge types, which occurs also in proton and nuclide constructs. These subtle differences require generalizing the operators to more generic quaternion forms.

The next generalization are octonions. Octonions (aka Cayley numbers) stem from John T. Graves seeking to extend imaginary numbers into eight dimensions called octaves.[19] Octonions are a way to integrate a hypercomplex macrostates matrix into an iterative algebra. Each iteration is non-commutative and non-associative—a fixed ordering of variables (operands) and operations. Fixing the order is an explicit geometrization.

Octonion-quaternion association[20] is a layer of group generalization that links with specific pressure and volume axes. While the more intimate logics of quaternions are "lost" in the transition, they can re-emerge in the details if managed properly. This simplifying makes accessible a static geometry known as an octet. Nobel gases already have this feature satisfied, while other atoms actively engage in trying to satisfy the octet geometrization by forming molecules.

This is our familiar perspective and the active components of energy in flux leave a contextual quantum door open. Unfortunately, this is so beyond the scope of this book as to likely lead into an entire field of materials science. It may, in fact, be the future direction of high energy physics, and appears to already be establishing those roots.

As with other instances of renormalization, this further points to a reversal. Reversals inevitably mean rhyming in chiral ways (imperfectly mirrored). It should bear other interesting fruits in the study of matter on celestial, galactic, and cosmic scales. We need a better understanding of what is going on fundamentally and build up before we step off those planks to drown in a sea of speculation. That brings us to the case of perturbations.

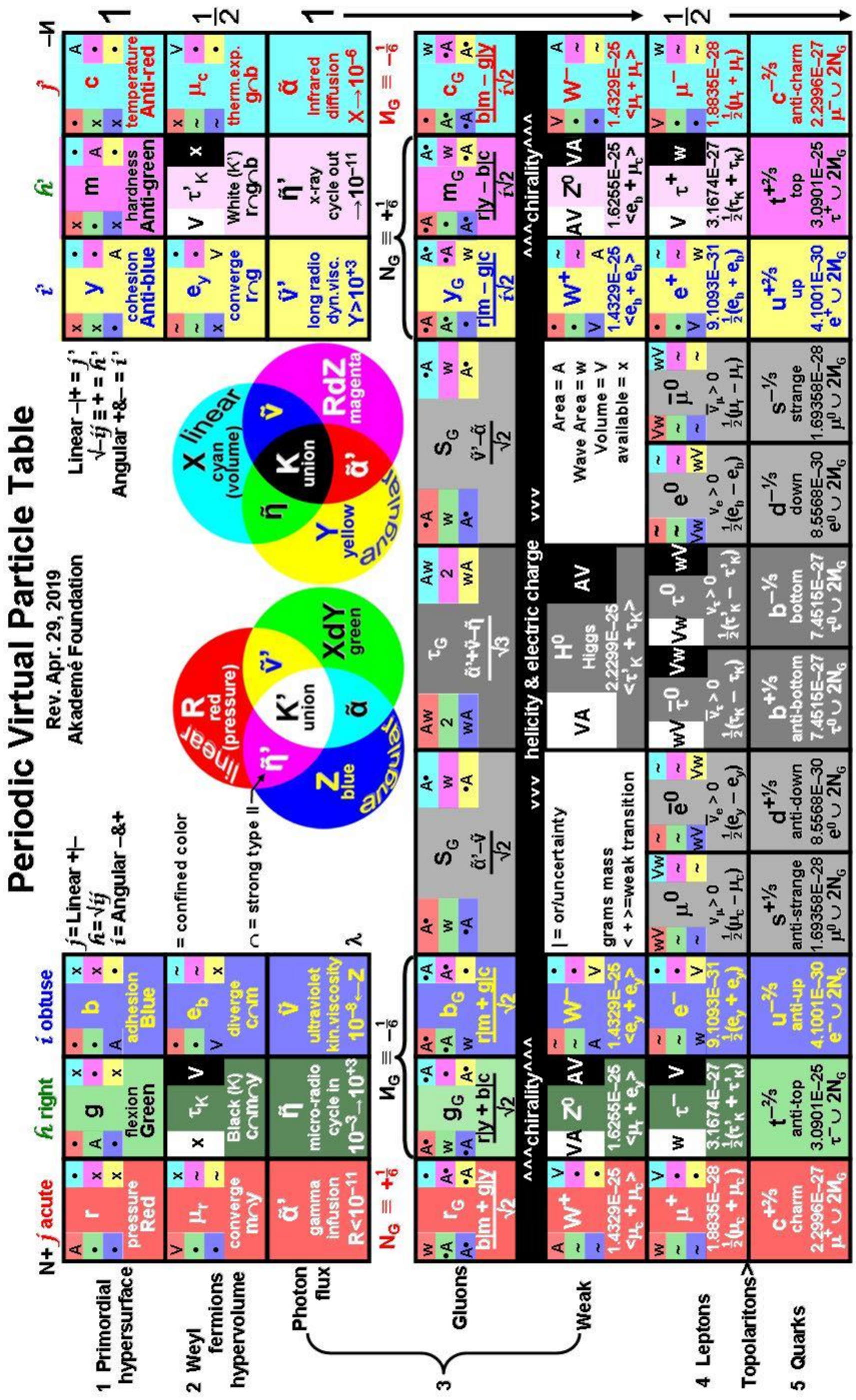
Endnotes

[1] (Oct. 1, 2014). SI Unit of Force. UK: National Physical Laboratory. npl.co.uk/reference/faqs/si-unit-of-force.
[2] Sutter, P. (June 13, 2018). The Mystery of Magnetic Monopoles. space.com/40868-where-are-all-the-magnetic-monopoles.html.
[3] Blaber, M. (Jan. 16, 2018). Dipole Moments. chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Physical_Properties_of_Matter/Atomic_and_Molecular_Properties/Dipole_Moments.
[4] Julius, T.D. (Aug. 9, 2016). The mysterious missing magnetic monopole. phys.org/news/2016-08-mysterious-magnetic-monopole.html.
[5] (ret. Apr. 4, 2019). Monopole. en.wikipedia.org/wiki/Monopole_(mathematics).
[6] Cho, Y.M. (1990). Theory of Gravitational Monopole. http://inspirehep.net/record/295935/files/c90-08-02-p715.pdf.
[7] (2016). The American Heritage Dictionary of the English Language. "Monopole." 5 ed. Houghton Mifflin Harcourt Publishing Company. https://www.yourdictionary.com/electric-monopole.
[8] Lucas, J. (Dec. 24, 2014). What Is the Weak Force? https://www.livescience.com/49254-weak-force.html.
[9] Yool, G.R. (2000). Practical Algorithms. Tempe, AZ: Premium Source.
[10] (2012). "Electrodynamics." The Columbia Electronic Encyclopedia. 6 ed. Columbia University Press. https://www.infoplease.com/encyclopedia/science/engineering/electrical/electrodynamics.
[11] Gallagher, L. (July 27, 2015). New study shows universe is left-handed. imperial.ac.uk/news/166827/new-study-shows-universe-left-handed/.
[12] (ret. Apr. 12, 2019). Neutrinos and Neutrino Oscillation. Japan: Hyper-Kamiokande. www.hyper-k.org/en/neutrino.html.
[13] Meszéna, B. (Mar. 7, 2011). Neutrino Oscillations. Wolfram Demonstrations. demonstrations.wolfram.com/NeutrinoOscillations/.
[14] Muheim, F. (2006). *Nuclear and Particle Physics*. Univ. of Edinburgh. https://www2.ph.ed.ac.uk/~muheim/teaching/np3/lect-ZandW.pdf.
[15] Helmenstein, A.M. (Mar. 7, 2017). Azimuthal Quantum Number Definition. thoughtco.com/definition-of-azimuthal-quantum-number-604809.
[16] Mahoney, K.D. (Ret. Apr. 14, 2019). LatDict: "glomus, glomeris." latin-dictionary.net/definition/21538/glomus-glomeris.
[17] Wheeler, J.A. & Ford, K. (1998). Geons, Black Holes, and Quantum Foam: A Life in Physics. NY: W.W. Norton & Company, Inc.
[18] Kuroda, K. et al. (Aug. 21, 2017). Evidence for magnetic Weyl fermions in a correlated metal. https://www.nature.com/articles/nmat4987.
[19] O'Connor, J.J. & Robertson, E.F. (Feb. 2016). John Thomas Graves. www-history.mcs.st-and.ac.uk/Biographies/Graves_John.html.
[20] Weisstein, E.W. (ret. Apr. 19, 2019). Octonion. MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/Octonion.html.
Graves, J.T. (1845), On a Connection between the General Theory of Normal Couples and the Theory of Complete Quadratic Functions of Two Variables. Phil. Mag., 26: 315–320.

The Perturbative Case

> Isolated material particles are abstractions, their properties being definable and observable only through their interaction with other systems.
>
> —Niels Bohr, 1934[1]

[1] Bohr, N. (1934). Atomic Physics and the Description of Nature. Cambridge University Press.



Periodic Virtual Particle Table

9. Quantum Morphology

At best, physics bundles related groups, and tucks new matter creation under confinement and quantum fluctuation uncertainty.[1] This is due to observational perspective limitations. Biology has already established correlate language and processes for creation and sequential evolution we can apply reconstructing matter from nature's perspective.

Morphology is a study of formation, structures, changes and use of a key component in a field (e.g. word in linguistics,[2] spatial structures in physics,[3] etc.). Morph~ means to change form. Matter comes into form as new (morphogen), evolves (anamorph), compounds (morphotrope), and synanomorphs (multi-forms of the same). Let us begin with sequence.

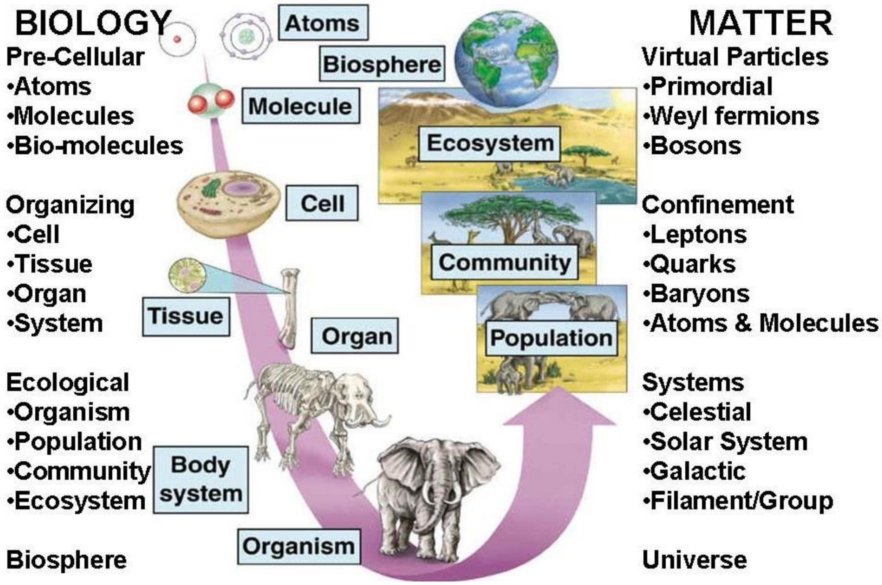
We have five out of seven types of strong interaction to cover in this chapter. All of these types are particle interactions in the hadronization and isotope processes.

I. Morphogenesis—instantiating new matter. Next chapter.
II. Primordial Bonds—joining 2 colors into type I Weyl fermions and 3 colors into type II Weyl fermions.
III. Primordial Entanglements—forming common identity of microstates by sharing available change spaces as bands (photons and most gluons).
IV. Ambiguous Transitions—4-6 primordials in complex entanglements (gluon-photon singlets) including constriction into temporary volume-surface identities (weak bosons).
V. Mixed Layer Bonding—gluon-photon sets form type II core and surface bonds as flavours form an intermediary mantle (quarks and into hadrons).
VI. Trionic Band Bonding—bonds between available color band edges and surfaces, presumably among trionic band structures to form nuclear isotopes.
VII. Degenerate Equilibrium—change information forming levels of equilibrium resulting in degenerate growth and evolution. As a function of normalizing and sequencing "quantum foam" information, we call this **Wheeler interaction**.

Generations of Matter

The hierarchy of life/biological organization has 12 levels[4] analogous to the hierarchy we call the generations of matter. We are dividing these levels into four groups: pre-cellular (atoms, molecules, macromolecule/bio-molecular complex), organizing (cell, tissue, organ, organ system), ecological (**organism**, population, community, eco-biome), biosphere (the whole).

The pre-cellular group is everything physics would call virtual: primordials (color charges), Weyl fermions (bound colors), and bosons (ambiguous loose interactions). These are so primitive they can only be real (e.g. biological) by being confined (in organic context[5]). Note: macro/bio-molecules are omitted from the image but not the listings. We also observe that, unlike biological systems that tend from simple to complex, matter can form directly, build up and break down.



9.1: Hierarchy of Life v. Generations of Matter

Confinement organizes by indistinguishably combining into a uniform geometry. It begins with the simplest that can exist independently (leptons) followed by states dependent (quarks & baryons) on the independently functional (organism is equivalent to atoms and molecules of physics). These coordinate into ecosystem levels. You are a complex like atoms and molecules; an ecosystem unto yourself.

A population of ecosystems interacts as a community forming a nested system called a biome. Nesting means putting one equivalent inside another. A macromolecule, for example, describes a molecule pattern with potential application. These patterns can be and often are extremely intricate with more member atoms than can be independently counted. They nest and compound.

This speed bump of nesting massive numbers of atom and molecule groups is the same in physics, just in a different point of the modeling. The entire biological model gets squeezed (nested) into only two generations of physics. Stages from macromolecules to biosphere nest into the celestial organism (e.g. planet).

Each population comprising a true whole, even if it only has two parts, at a minimum shares an available hypersurface establishing its identity. This is not as simple as a brane or Fermi surface is typically described because it is an available axis defining all the points in the geometry. In simplest terms, this shared condition is entanglement such that the set acts as a whole with a uniform reference frame.

Organisms form system populations in galactic communities, themselves members of a local system of galaxies. The totality of all these is the whole universe—or biologically the biosphere. Spacetime is the generically shared hypersurface of the universe. It is the one feature common to all the parts, defining all reference frames in common terms.

The image suggests the hierarchy is cyclic. In effect, the physical state of the biosphere is synonymous with that of the universe of physics generally. High level changes affect everything from the bottom up. All levels in some way interact with other levels.

Unlike biological systems evolving from simple to complex, all the lesser levels of matter can be created as-is, broken down from greater, or built up from lesser. The cycle is completed by redistribution of value (light), which would be the zeroth (0^{th}) generation. It is zero because it isn't actually matter. It is the latent connection between whole and its most finite and numerous parts.

As latent, this connection is opportunistic. Where the opportunities come into useful focus the "virtual" perturbs. The parts cannot be examined individually except relative to or together in a confined discrete system. Thinking back to our architectural model, this applies to the Abstraction Layer, making the universe a latent system with virtual perturbations.

The universe (biosphere) as the zeroth and twelfth levels is first AND last. As the highest order its effects are most subtly at the foundation of everything. From a biological perspective, a change in the weather is a biosphere issue affecting from atoms up the entire hierarchy of levels. The same is true in physics. Ability to affect everything from the bottom up increases with advance in levels (generations). A local group phenomenon like a gamma ray burst, manifests from the bottom of the process up.

Virtual Particles

All particles are technically virtual, meaning they can be brought into existence as a focused pattern of energy—a "transient fluctuation"[6] or disturbance. At this point our key focus is on the basics of hypersurfaces and hypervolumes, even allowing for weak interactions. These are not just esoteric mathematical constructs as they are normally treated. Like waves on the ocean, they are very much real. Virtual identities appear as commonly observed qualities on a macroscopic scale.

Chromodynamics is a Quantum Field Theory (QFT) using additive and subtractive colors as quantum numbers. The colors have non-commutative features making them non-abelian. They are used to describe strong interactions initially among quarks and baryons, "mediated" by gluons.[7]

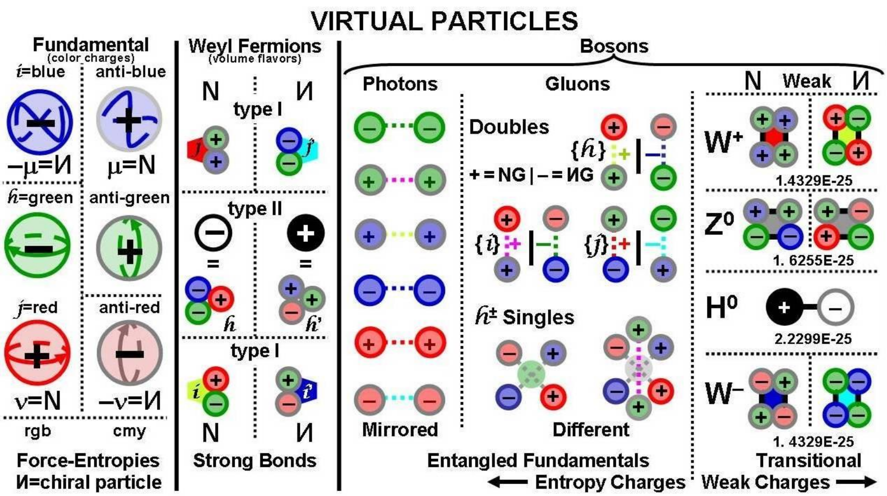
Mediation is an awkward term because it suggests something discrete is carrying a value between points. Quite often, as in the case of gluons and the strong interaction, it is simply a way to describe field qualities belonging to the objects interacting. The interaction involves building spaces using those qualities.

Virtual particles describes everything more fundamental than a proton. For this part of the discussion, they are specifically the first three families: primordials (color charges), Weyl fermions (volume flavours), and bosons (transitional particles). Bosons further divide into photons, gluons, and weak bosons.

These are always mathematical objects, meaning they appear as qualities in a context that don't exist apart from the context. Contexts include energy converging into specific focus (latent), emerging as a group dynamic (discrete), or distributive effects like motion (kinematic).

The diagram below is an attempt to make sense of content. It is not an indication of ordinary structure and certainly not of geometry or size. Size depends on the nature of the perturbation. Virtual particles are converging toward a geometry, and can be caused or causal of a group geometry. For example, surface tension of cohesion creates a rounded surface versus adhesion creating a concave surface. Virtual identities are often dependent on the environment for their shape (geometry).

The diagram is meant to illustrate content relative to manifold axes whose existence and interaction define an identity. Virtual chirality (sign and color) is an anti-particle analog. As an analog, they don't necessarily annihilate. Instead they more commonly work together and against each other (e.g. pressure and heat). They are chirals, but to annihilate they need to have a direct symmetry conflict that negates the change operators confining their energy. Quite often the chirals function together, like temperature (volume) and pressure (hypersurface).



9.2: Virtual Particle Quantum Constructs

Primordial (Color Charges)

Particle sizes get smaller as the approach hadronization. Primordials are static hypersurfaces generally applied to a group. Latent perturbations of primordials are dynamic and only distinguishable as polarized spherical wavefronts (e.g. BICEP-2, pg. 116). These can adopt a related color charge context that redefines them as a more sophisticated perturbation like a gluon or neutrino. Discrete perturbations are specific to their contexts but easily identified by the qualities identifying their hypersurfaces.

Charge		Manifold Nature			Open Identity	
ν	Red	Compress	Pressure	R	Kinematic Linear	δQ
ν'	Cyan	Expand	Temperature	X		
μ	Blue	Hetero	Adhesion	Z	Dynamic Angular	δW
μ'	Yellow	Homo	Cohesion	Y		
m'	Magenta	Closed	Hardness	XdY	Conserved XdY – RdZ	U'
m	Green	Open	Flexion	RdZ		

9.3 Discrete Primordial Perturbations

Physical chemistry and materials science provide the most accessible examples of primordial perturbations. These are discrete occurrences applying to group behaviors. Kinematic potentials (δQ) are linear latent values associated with motion, like Virial theorem. These provide the basic foundation of group behavior as an intrinsic quality.

Next is the working (δW) miscible nature—the ability to be mixed to a degree of sameness. This is basic group dynamics with angular effects like rounding and troughing surfaces. A similar mixed group has homogenous miscibility with group cohesion. In liquid state its surface rounds consistent with surface tension effects of cohesion holding the group together. An unmixable group is immiscible, like water in a glass forming a trough-shaped surface. This adhesion provides the capillary effect.[8] In a large enough context as with a pool, lake, sea, or ocean these occur together as wave anomalies.

The distributive nature of the group describes the degree the space's shape or nature is preserved (malleability). Gases, as an example, have a maximum compression density consistent with the gas state and the ability to fit into any shaped volume.[9] Solids are to some degree inflexible. They break. Flexible things can also be drawn, stretched, shaped, or spread. Generically speaking, hardness is a fixed quality (closed). Flexion like bending (flexural strength), malleability, and load capacity (modulus of rupture)[10] adjusts to other variables like heat, making it an open variable.[11]

Again, these are just examples of primordial perturbations appearing in ordinary circumstances. Perturbations occur everywhere you see the condition specifics met. Similar conditions will evoke hypervolume perturbations (Weyl fermions) or weak/geodesic perturbations of interactive volume regions with hypersurface effects such as barometric pressure in the atmosphere.

These three levels of virtual identity are vital concepts whose algorithms apply repeatedly on many levels. It is important to note that all virtual particles and even baryons can be formed by focused interference, by constructing lesser into more sophisticated forms, or breaking down sophisticated forms. There is more than one path to perturbation and no reasonable expectation that cause is even linear. They can all simply be perturbed together as a working unit.

Weyl Fermions (Flavour Volumes)

A latent volume can be static or dynamically propagating. Static instances of latent volume are perturbed relative to a group's intrinsic field. For example, cosmic background temperature is the static volume effect of group field interactions. On a more intimate level, we see a similar effect in alloys where gaps between atoms and compounds take on an energy identity of their own giving value to volume.[12] This affects other perturbation qualities like the primordials we just discussed.

A Wyle fermion consists of the intersection of two or three primordial axes resulting in a volume. This is not to say they have a pretty geometry, just the axes for one. The nature of these volumes is consistent with the three flavours of leptons and quarks. Such an intersection is a type II strong interaction consistent with part of the strong bonding actions of quarks. It happens when the in-phase volume spaces of the primordials contact. The intersection forms a volume identifiable.

Instead of an intrinsic surface, the interaction provides a color quantum number called flavour as potential for entanglement into a lepton. Conventionally, Weyl fermions are reported as consisting of a volume (flavour) with an attributed "Fermi surface"—a sort of virtual space. "The Fermi surface is the surface in reciprocal space which separates occupied from unoccupied electron states at zero temperature."[13]

Such a negative space on this level would isolate the volume into its own reference frame. Isolating from the group violates both perturbation requirements and Lorentz symmetry. Lorentz symmetry basically states the reference frame of one thing is unaffected by the reference frames of things around it.[14] A Weyl fermion reference frame (density) depends on group action, unable to individually satisfy the geodesic interactions to have mass. The space does apply to entangle a pair into a lepton.

It is also important to condensed matter physics where Luttinger's theorem shows particle density as a function of Fermi surface-enclosed volume.[15] To put it simply, the difference between the enclosed whole and its parts leaves a volume with its own energy identity and value—a Weyl fermion. Condensed matter describes degeneration—the process of matter fully occupying its space like nucleons.

Nucleons (protons and neutrons) have the same degenerate density separately as together as nuclides. Unlike molecular structures, there is no volume difference to fill with a Weyl fermion. No volume differences also means no conventional motion among parts—no dynamic spaces, only dynamic potentials in static microstates. There are angular low potential (absorption) hypersurfaces energy interacts with.

While these are not separating spaces, they do satisfy geodesic requirements for mass. This gives each nucleon its own individual reference frame. This would be a problem if nucleons did not enjoy the extra spaces of electrons to make up the differences. In group dynamics, Weyl fermions perturb hypersurface qualities that may not act individually on the Weyl fermions, but act collectively to retain shape and scale (reference frame) for the group.

There are two general designations of Weyl fermions, each a flavour providing colored band potentials for entanglement. There are six specific particles consistent with three flavours resulting leptons and quarks. Weyl fermions consisting of only two bound parts are **type I**: rg and cm are electro with $\acute{\imath}$ bands; bg and my are mu flavours with $\acute{\jmath}$ bands.

Weyl fermions consisting of three parts (rgb and cmy) are **type II** (tau flavours) noting their band potentials are quasi-temporal and not color fixed (Heisenberg uncertainty applies). This gives them polarization such that they show different potentials between aspect positions. It also leaves them vulnerable to environmental flavour changes. Most useful of all is a quantum tunneling ability. This allows them to bypass other color variables to act as nucleation and surface for nucleons.

Our type II definition agrees with and expands on: “The type 2 particle exhibits very different responses to electromagnetic fields, being a near perfect conductor in some directions of the field and an insulator in others.”[16] Fermions have three flavours.[17] Our Weyl fermion definition shows them as the root of flavour, their hypersurface potentials forming charged interactions.

Unbound Identities

Type I strong interaction is color confinement—the instance of identity (next chapter). Type II strong interaction is bonds by joining axes into Weyl fermion volumes. Type III & IV strong interactions are entanglements and the transitional weak bosons. Types III & IV are not firmly bound like the axis conjunction of type II. There is no expectation matter is constructed from most primitive to more sophisticated. This is simply the order we use from most primitive to most sophisticated.

Entanglements are available hypersurfaces joining parts into a whole. The most familiar forms of entanglement simply join complex matter into clumps, and aren’t even normally thought of as entangled. They all share the same reference frame. Among initial hypersurface and hypervolume axes, entanglement is a form of strong type III interaction forming identity two generations greater than the greater parts.

Entangled primordials are bosons, where values transfer among initial axes. These transfers include incidental axis rotation and volume interaction with weak bosons satisfying the GFE and giving them mass. The angular momentum of these weak interactions leads to differentiation into photons or leptons. Weak bosons are basically a transitional stage commonly seen in local lepton perturbations (e.g. nuclear decay). These are designated type IV because their microstates simultaneously provide surface and volume resolutions. Type III just adds a hypersurface.

Photons

Light is propagating flux. Photons are perturbations of light relative to material observation, or how we describe a specific propagation. Photons are generally assumed to be from a specific direction relative to a specific source. An unspecified photon is indicated by the lower case symbol gamma (γ). The generalization applies even to specified flux variables simply because those identities aren't clearly quantized—they are probability densities.

If we know the exact identity, it has already been applied or we have mastered its creation. In such cases we can reasonably associate specific flux photon symbols with primordial color charges entangled with their own reflections. Since they are entangled with their reflections, the hypersurface "bands" (identical axis pair) are technically twisted (synchronous, see pg. 197) as with a neutrino. Adding value is very hard and does not create new particles. Instead it oscillates particle identity.

The identity of the photon, like the identity of a gluon or lepton, is determined by the entanglement. The entanglement is the available hypersurface. Each primordial has two axes (radiant and available absorption) triangulating into a distribution. A red color charge (radiant value) entangled with its reflection makes a cyan photon ($\tilde{\alpha}$=infrared diffusion).

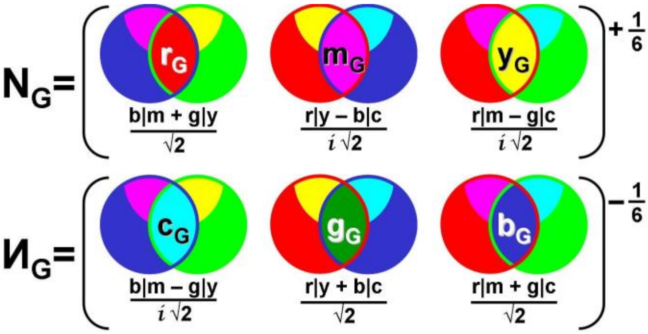
The entanglement regulates the microstates where energy exchanges among the parts into or out of focus and determines intrinsic motion. In the cyan ($\tilde{\alpha}$=IR) case it diffuses out of focus as heat and propagates at c. The value asserted in this system of microstates is its cycle resisted by time giving the familiar dimension frequency (υ=Hz= cycles per second).

The cycle is enabled by the available space. Without it, the value is static. As the means of conveyance among the parts, it is the dominant feature, generalizing identity into the distribution. This confines (hides) the color charge identity of the parts.[18] It is independent of time but resisted by time. The resistance provides metric scale with opportunistic shaping.

The spectrum gives magnitude differences among opposing functions. Gamma infusion ($>10^{-11}$) contracts linear pressure and infrared diffusion (10^{-6}) expands linear volume. Ultraviolet (10^{-8}) is angular volume resisting (kinematic) angular pressure flow as long-wave radio (10^{3}). X-rays (10^{-11}) cycle into focus and microwaves (10) cycle out; seen as fluctuation in orbital variables.

Gluons

Color-anti-color are simplified here to additive-subtractive for accessibility purposes on many levels from keyboard characters to actual coloring. This doesn't change their definitions,[19] although we are inclined to use symbolic logic for the uncertainty factor (| = logical OR). The active (entangled) parts have an orientation affecting the bands. This appears as + or –, which is particularly significant for leptons and photons where a negative indicates a synchronous (neutralizing) band.



9.4: Confined Color to Weak Charge Equivalence

Gluons and photons by themselves do not have a weak charge. Put into the right context and they have a charge effect of 1/6. This and generalizing the uncertainties is very important to understanding the construct of quarks. Gluons in like pairs have photon microstates, making them more than a little ambiguous. The singlets are in fact easier to describe by their photon composition. The gluon-photon pairs generalize as $2N_G$ or $2И_G$ with a lepton to form a quark. The pair has a combined ±⅓ charge effect on the unit lepton to form a quark with ±⅔ or ±⅓ charge.

There are eight gluons, but we separate the gluon singlets as ambiguous like the weak bosons. The six basic gluons are simply entangled color and anti-color of different types that swap color/anti-color roles but retain the same confining entanglement surface identity.

All gluons are strictly active hypersurfaces entangled by available hypersurfaces. They have no mass because there is no volume for a surface to interact with. Adding energy into them expands and rotates their bands, typically oscillating identity.

The energy can also quantize, splitting the particle into two new gluons. Each gluon has half the parent's parts—analogous to quarks.[20] An r_g gluon has gy or bm parts. Assuming either gy or bm at division provides the same offspring: y_g and m_g. This is a form of instantiation (morphogenesis) we term mitosis—the offspring have the same scale and number of parts as the parent. We will detail matter creation in the next chapter.

Ambiguous Cases

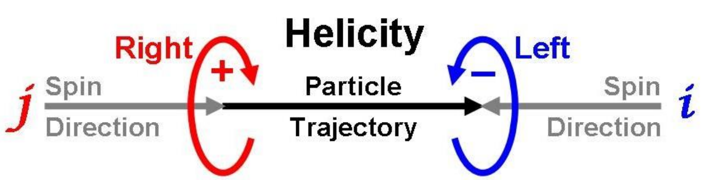
There are two types of ambiguous cases, both of which involve complexes of four or more entangled primordials. Only the weak bosons provide volume interaction. Gluon singlets are equally describable as entangled red-green or red-green-blue photons. All gluon and photon interactions apply, but the bands do not apply in the same role simultaneously.

The singlets are out of phase strong type III entanglement interactions. Being out of phase means they are not simultaneously interacting in a way that forms volume. How these couple gluons rotate into phase determines the volume flavouring of weak interaction to emerge. Conversely, weak bosons devolve into distinct gluons[21] depending on the context specifics differentiating the interactions.

Type III (entanglement) rotates the conjoining axes into a type II strong bond, generalizing chirality into helicity plus geodesic benefits we won't see until much later. The rotation is type IV (weak). In a simple strong bond, the axes conjoin to form a volume (flavour) with common information exchanged among the axes making up the volume. There is no mixing of that volume with a surface until two volumes are entangled.

Helicity v. Chirality

Helicity divides matter into right handed particles that move the same direction as they spin, and left handed that move the opposite direction of their spin.[22] These hands correspond with Fleming's rules.[23] This is the product of how the microstates in a transformative change function define their spaces. The twisting feature of the weak interaction is transformative. A balance of these transformations allow for conservation of identity consistent with stability.



9.5: Helicity

Chirality is the quality of not being identical to its "mirror" image. Red and anti-red (cyan) color charges are chiral because they have the same right-handed change function (*j*), but their field dispositions are inverted. Such chirality describes virtual particle and anti-particle.

Photons (and presumably neutrinos) consist of entangled pairs of particle and anti-particle, reverting their chirality to two helicity states (±

circular polarization, or = becomes linear).[22] Helicity of Weyl fermions prevents annihilation as chirals but cancels weak interaction and mass.[24]

A particle anti-particle pair is created by adding energy to the confined spaces of an entanglement band or "flux tube" pair until they quantize.[25] A photon from electron quantum leap is the most familiar example.[26] These always occur in positive and negative pairs, and not necessarily entangled as with photons. Gluons split into new pairs.

The energy going into this is light. Light has both attributed (EMA) and emitted (EMR) values in it.[27] Both EMA and EMR will contribute to momentum and new particle creation. When EMR quantizes, the perfect child splits into chiral particle and anti-particle. Like our singularities, EMA and EMR are applied in separate fields. Singularities have ideal EMA-EMR information sequence.

The division follows an EMA information pattern specific to the host's intrinsic values and microstates. We observe this in light,[28] which is subject to the same extratemporal change conditions as it bleeds from a source including a photon. Naturally this robs the system of all the associated momentum and related qualities.

The universe uses things that aren't there, conserves them because they quantize, AND consequently makes quantum wholes far greater than the sum of their actual parts. Antithetical to Aristotle's "A system is more than the sum of its parts."

With the weak rotation, each charge axis retains its duplicitous nature. Each charge has two axes and a distribution. Adding a twist (rotation) prevents generalizing as just volume, allowing the axis pairs of each color charge to participate. The twist forces role transformations (handedness) and a degree of mutual phase for all axes in 2-sphere mode, while gloming (3-sphere) the geodesics to interact as required for mass (4-sphere).

The mechanism for every mass is this axis rotation into interactive geodesics. It is like an assembly instruction that simply states: combine parts, add twist so they have to work together. More familiarly, social relationships among people add a cohesive twist to their activities. The twist makes them a unit charge, generalizing the color charge identities of the parts into helicity.

Endnotes

[1] Gilman, L. (2018). Virtual Particles. Net Industries. science.jrank.org/pages/7195/Virtual-Particles.html.
Jones, G.T. (2002). The uncertainty principle, virtual particles and real forces. Physics Education. hst-archive.web.cern.ch/archiv/HST2005/bubble_chambers/BCwebsite/articles/06.pdf.
[2]Aronoff, M. & Fudeman, K. (2011). What is Morphology? 2 ed. Wiley-Blackwell. abudira.files.wordpress.com/2014/03/mark-aronoff-kirsten-fudeman-what-is-morphology-fundamentals-of-linguistics-second-edition-2011.pdf.
[3] Mecke, K.R. & Stroyan, D. eds. (2002). Morphology of Condensed Matter: Physics and Geometry of Spatially Complex Systems. Springer.
[4] Solomon, E.P.; Berg, L.R.; & Martin, D.W. (2002). Biology. 6 ed. Belmont, CA: Brooks/Cole.
[5] Image (modified): Pen, J. (2013). Introduction to Life Science & Biology. Heartife. https://www.slideshare.net/JuliePen/intro-to-life-science-biology.
[6] Thomson, M. (2017). Modern Particle Physics. Just the Facts 101 ©.
[7] Manoukian, E.B. (2016). Quantum Field Theory I: Foundations and Abelian and Non-Abelian Gauge Theories (Graduate Texts in Physics). Springer.
[8] Laurén, S. (ret. Apr. 21, 2019). What is the difference between surface and interfacial tension? https://blog.biolinscientific.com/what-is-the-difference-between-surface-and-interfacial-tension.
OpenStaxCollege. Cohesion and Adhesion in Liquids: Surface Tension and Capillary Action. opentextbc.ca/physicstestbook2/chapter/cohesion-and-adhesion-in-liquids-surface-tension-and-capillary-action/.
Nave, R. (2017). Surface Tension. http://hyperphysics.phy-astr.gsu.edu/hbase/surten.html.
[9] Nakleh, M. et al. (2004). The Properties of Gases. chemed.chem.purdue.edu/genchem/topicreview/bp/ch4/properties2.html.
[10] Elsevier, B.V. (2019). Modulus of Rupture. sciencedirect.com/topics/engineering/modulus-of-rupture.
[11] (ret. Apr. 21, 2019). Mechanical Properties of Polymers. Smithers Rapra. https://www.smithersrapra.com/SmithersRapra/media/Sample-Chapters/Physical-Testing-of-Plastics.pdf.
[12] Kuroda, K. et al. (Aug. 21, 2017). Evidence for magnetic Weyl fermions in a correlated metal. https://www.nature.com/articles/nmat4987.
[13] Dugdale, S.B. (Apr. 18, 2016). Life on the edge: a beginner's guide to the Fermi surface. The Royal Swedish Academy of Sciences. iopscience.iop .org/article/10.1088/0031-8949/91/5/053009.
[14] Zyga, L. (Dec. 23, 2016). Still no violation of Lorentz symmetry, despite strongest test yet. https://phys.org/news/2016-12-violation-lorentz-symmetry-strongest.html.
[15] Halboth, C.J. & Metzner, W. (1997). Fermi surface of the 2D Hubbard

model at weak coupling. Springer. https://link.springer.com/article/10.1007/s002570050318.

[16] (Nov. 25, 2015). 'Material universe' yields surprising new particle. Princeton University. https://phys.org/news/2015-11-material-universe-yields-particle.html.

[17] (May 23, 2017). Weyl fermions exhibit paradoxical behavior. Leiden Institute of Physics. https://phys.org/news/2017-05-weyl-fermions-paradoxical-behavior.html.

[18] Hansen, L. (Feb. 27, 1997). The Color Force. webhome.phy.duke.edu/~kolena/modern/hansen.html.

[19] Griffiths, D. (1987). Introduction to Elementary Particles. John Wiley & Sons. pg. 280. ia800909.us.archive.org/5/items/GriffithsD.IntroductiontoelementaryparticlesWiley1987/GriffithsD.Introductiontoelementaryparticles%28Wiley%2C1987%29.pdf

[20] Butterworth, J. (July 18, 2010). Quarks, Gluons and Jets. lifeandphysics.com/2010/07/18/quarks-gluons-and-jets/.

[21] Djouadi, A. (Dec. 1997). Decays of the Higgs Bosons. Université Montpellier. cds.cern.ch/record/340786/files/9712334.pdf.

[22] Dreiling, J. & Gay, T. (2014). Chiral Photons and Electrons. University of Nebraska. http://physics.unl.edu/~tgay/content/CPE.html.

[23] Klauber, R.D. (2017). Chirality vs. Helicity Chart. quantumfieldtheory.info/ Chiralityvshelicitychart.htm.

[24] Romão, J.C. & Silva, J.P. (May 29, 2016). Helicity and Chirality. Instituto Superior Técnico. porthos.tecnico.ulisboa.pt/CTQFT/files/HelicityAndChirality.pdf.

[25] Smilga, A. (2001). Lectures on Quantum Chromodynamics. World Scientific.

Muta, T. (2009). Foundations of Quantum Chromodynamics: an Introduction to Perturbative Methods in Gauge Theories. 3 ed. World Scientific.

[26] Schombert, J. (2015). Quantum Physics. University of Oregon Department of Physics. abyss.uoregon.edu/~js/cosmo/lectures/lec08.html.

[27] Mattson, B. (Mar. 2013). The Electromagnetic Spectrum. imagine.gsfc.nasa.gov/ science/toolbox/emspectrum1.html.

[28] Wood, D. (2018). Atomic Spectrum: Definition, Absorption & Emission. study.com/academy/lesson/atomic-spectrum-definition-absorption-emission.html.

10. Instantiation

Instantiation is a synonym for perturbation. I am adding this synonym to compel a point on the impermanence of a shaped focus occurring within a dynamic set of field conditions. Up to degenerate density with a static microstate (e.g. macrostatic protons and neutrons), the field conditions come first and the incidents of perturbation will pop in and out of existence based entirely on local context. The duration of that instant of discrete existence depends on sustaining that context or continuing focus into degenerate density.

A regular source for geometrizing requires macrostatic contexts. Without that, it is treated as a field dynamic of light. The ionosphere of Earth, for example, is a field within which ions (free electrons) perturb. You can't think of the ionosphere consisting of discrete ions the same way you as the atmosphere consists of atoms and molecules. Basic perturbations can occur spontaneously wherever the conditions incidentally occur, and cease when that focus is not sustained or confined into more stable form.

Every story has a beginning, middle, and end. The quantum universe is a setting, not a story. Settings are timeless unless you happen to be the weary traveler stuck taking the long way through the pages of a story.

In physics, matter is the story, transformation the plotline. For virtual matter and even baryons, it can forged whole, built up or broken down. For matter, the story is a unique combination of substance in motion changing to its local conditions. The story is evolution. Evolution can play any role in the existence of matter from creation to termination—arguably every role.

Using story elements invites ethical dialogs like: What is the purpose of ____? Science and the physical universe simply apply definitions in context. Being a definition in context plays a role in transformations and evolution on many levels. These roles can be active, passive, giving, or receiving, like being redefined by local turbulence.[1]

Strong Type I

The four reproductive phase-stages of mitsosis and meiosis[2] outline the first type of strong interaction: creation of new matter at any scale. This is a presumably passive process of quantum fluctuation associated with Heisenberg uncertainty and confinement.[3] The particle or otherwise available spacetime is acted upon, accumulates, reacts, and diverges into multiple forms (cladogenesis[4]).

The first two stages provide explicit details of interphase—routine existence. Each consists of a sequence of sub-processes. The references provide a better outline of the cellular analogs that do not always convert directly into the new matter process. Life, mind and civilization are imperfect mirrors attempting to emulate the perfection of physics.

Prophase establishes the reproductive potentials (leptotene, zygotene, pachytene, diplotene, diakinesis[5])
Condense—focusing in available spacetime, like color charged attributed value spaces (bands) or incidental focus;
Conjugate—paired groupings or topological ordering;
Connect—pair mirroring or symmetry;
Crossover—energy connecting exchange like microstates and oscillation;
Confine—Fermi surface encapsulation.

Metaphase—spindling[6]/value fills a confining change shape:
Adjacency—capture/focus of value;
Configuration—information mirroring, distribution, and smoothing;
Carry/Accumulation—energy compounds with new adjacency up to…

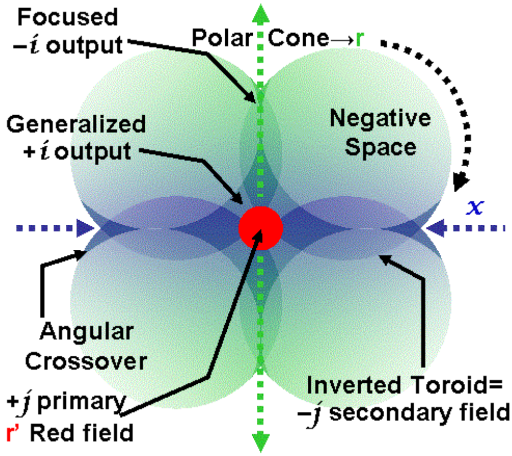
Anaphase—conception/establishment of new (sister parts separate[7]):
Quantization—establish unit identity proportional to contextual availability;
Snap—attributed space separates from acquired value;
Rip/Unzip—radiant value divides by absorption into chiral units;
Alignment—initial interactions of new parts.

Telophase—differentiation/separation into distinct identities[8]:
Cycle initiation—microstate cycle of new parts and interactions;
Re-alignment—interactions and chirality of parts established;
Conflict resolution—quantum number swapping/leaping to tunnel or jet through exclusion conflicts;
Confinement—into prophase/interphase.

It is easy enough to envision perturbations of virtual particles forming and evolving through this process in the band spaces of particles. Imagining this in the complex field spaces of a galaxy developing complex matter like atoms, celestials, and systems is a bit harder. It seems further complicated by having not one but two types of right-handed field generators (cyan and red singularities). Shape is the only significant difference, and asymmetric baryogenesis to be expected.

The image below illustrates the smooth generic field condition of the universe acting on a red singularity. There are color-predisposition spaces in the field where x-ray ($+\hat{\imath}$) and gamma ray ($-\hat{\imath}$) emissions regularly occur. There are vast spaces where seemingly nothing occurs (negative/unused space). Around these is a toroidal electromagnetic feedback system.

The universe of things imperfectly acts on the singularity. The toroidal effects are kinetic energy acting on and by the singularity. The universe of things is not just local but also the myriad of overlapping systems like singularity-horizon bubbles creating large scale anomalies. While a member of the electromagnetic family, this toroid is no ordinary magnetic field. Ordinary magnetic fields also occur, but they are not as effective at steering the direction of matter let alone light.



10.1: Complex Toroidal-Phase-Interactive Singularity Fields

You cannot see a beam of light from the side unless it is reflected off something and comes straight into your eye. As such, you cannot see light following this path unless you are in the way or it incidentally deflects. The light caught in this field also cannot be observed without it reflecting off something, like the light reflecting off the rings of sombrero galaxies and gas clouds on galactic rims. This isn't just stellar light reflection.

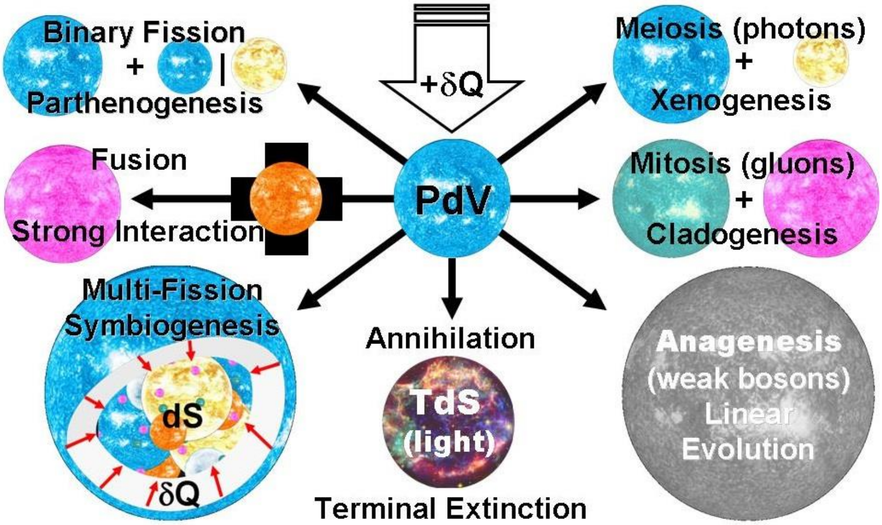
Despite the illustration not accounting for system information or spacetime anomalies, there are clear focal points and dilations. At these points, energy and/or matter focus resulting in new and evolving matter from virtual photons to solar systems and everything between. Galaxies literally create everything from seemingly nothing.

Initially the information is negligible allowing the creation of hydrogen (Lyman-α=1216Å wavelength) evolving from simple emission to stellar break.[9] When we add in system information, the perturbations become complex dynamics. Information evolves in these dynamic systems as the complexity of matter evolves.

Cladomorphology

A clade is a group classified by common ancestry.[10] This term is problematic in physics where more than one path to the same outcome is expected. The plot paths of change are more easily classified. It is in these contextual paths that matter's stories emerge, unfold, evolve, and end.

Darwin's concept of evolution of the fittest suggested a gradual system of adapting to the environment. This led anthropologists to seek a clean progression in human evolution from primates. The concept has a limited degree of truth. Selective breeding shows dramatic changes happen from one generation to the next with a significant and consistent behavior change, like domestication.[11]



10.2: Cladomorphology Types and Thermodynamics

In thermodynamics, enthalpy (H) describes the total energy of a system in a change of state (e.g. solid-liquid-gas). It is a function of heat (E) and linear pressure (P) applied to a volume (V): H=E+PV.[12] The same concept is true for biological evolution in that change in behavior (E) is combined with the motivation (P) of a population (V).

As a change boundary condition, enthalpy can be thought of as a quantization value. This can be triggered via enthalpy equivalent relativistic momentum. For particles, the behavior change appears in oscillation—periodic motion consistent with identity.[13]

Oscillation is a product of intrinsic information and is subject to normalization conflicts with transient information. The longer transient energy remains, the more their separate information normalizes. This consistency and other environmental pressures increase the probability of change at and beyond enthalpy as shown in neutrino studies.[14]

Enthalpy is the trigger for change when thermodynamic energy (**δQ**) applies to a contextual (PdV) path. We assume the path is material, but it can be a field or incidental focus (perturbation), creating a loophole in the material requirement for creating new matter. There is always more than one way to twist the plot.

Here, energy is vaguely defined as a capacity for work (**δW**).[15] Mass contains capacity and resists work. Time contains and resists changes where work applies. The work here is evolution or creation of matter. We will call the creation of a new matter object **instantiation** to include more than just virtual perturbations.

Instantiation—The contextual process of bootstrapping a material identity into existence; the creation of an actual object instance in a context (object) oriented system.[16]

Instantiation establishes an active change function generally in the space of an inactive change function (e.g. entanglement band). Another is signal interference, which is a temporary perturbation—a virtual instantiation. Instantiation is opposite to annihilation where a change function is lost with value evaporating as light.[17]

The assumption of instantiation is spontaneous creation of a cycle moment. An identity is called into or out of existence like a virtual entity. Such spontaneity is generally classified under quantum fluctuation and Heisenberg uncertainty.[18] Virtual particles (primordials, Weyl fermions, and bosons) are always instantiated—commonly by mitosis and meiosis (later).

Singularities are virtual identities, as is the case of extreme degeneracy (extreme pressure-density[19]). Both are generally a kinetic byproduct (stellar remnant[20]) of parthenogenesis (binary fission) splitting an existing identity[21].

Confined particles and even degenerate matter also only require perturbation of energy in the right spacetime density conditions. While hard for us to imitate, the complex fields of galaxy-singularity interactions can mass produce protons and neutrons (e.g. Lyman-α). New matter is generally produced in confined complex systems making direct observation or imitation extremely difficult.

Neutrino synthesis is a common example in the very familiar stellar fusion process.[22] Such complex systems break down (fission) and interactively create not one but many types of matter. The interactions form cooperative fission-fusion cycles into hadronization and nucleosynthesis.[23] Such cooperative evolution is symbiogenesis.[24]

Anagenesis is adaptation in isolation.[25] A familiar example among particles is the part of nuclear fission where a neutron becomes a proton. Another is stellar evolution. Systems evolve in the composition of their parts, like stars evolving toward heavy elements. Some of these changes are simply adaptation to energy conditions. Others are from information equilibrium interactions among the parts of a complex. Anagensis also occurs in cyclic evolutionary processes, like the fusion process in stars.

Oscillation is the common physics synonym for anagenesis due to intrinsic behavior change. Usually it is one identity transforming into another of the same class, like leptons and quarks changing flavours, photon filtering and gluon color changes. We can call these horizontal anagenic changes. A lepton transforming into a photon[26] would be vertical.

Baryogenic Asymmetry

The baryogenic asymmetry problem basically asks why atoms and the emphasis on matter over antimatter? Why do we see matter and antimatter created together but in the end see so little antimatter? In 1967, Sakharov suggested thermal equilibrium, Baryon number, and charge-parity (CP) symmetry violation.[27] A significant part of baryogenesis is covered by galactic cycle (see pg. 58). What about the rest?

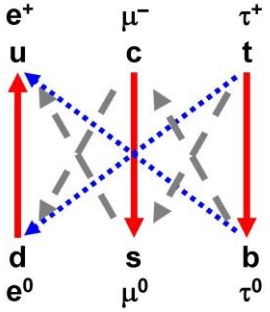
The study of new matter generally focuses on quarks undergoing mitosis splitting into quark and anti-quark pairs. It is low-energy and easy to observe. This is ONLY ONE way quarks can be created, but each way involves mater going out of focus. This makes quarks poor candidates for regular baryon creation.

Baryogenic asymmetry is normal because the universe wasn't constructed by the same rules as our limited ability to observe it. Let us recall that chirality is a feature of virtual particles which are all far more fundamental than quarks. Chiral parts work together and renormalize as helicity.

The concept of helicity evolves from and replaces chirality (see pg. 156 et seq.). Virtual particles are familiarly created with their antiparticles, but the definition of antimatter changes with confinement. Being born together doesn't mean they die or evolve together. The familiar path is not the only path to perturbation, and not all paths require pair creation.

Helicity is relativistic tying-in with high-level phase conditions. The universe is left-handed. Left handed means rotation and trajectory go opposite directions—naturally tearing the identity apart. The universe draws out disorder following the second law of Thermodynamics. Value available for disorder is systematically lost. The parts are only relevant to finding the most efficiently ordered definition (stability).

More pressing than the baryon asymmetry is electro-flavour symmetry (electrons, down and up quarks, neutrons and protons). These are all based in electro (y|b) type I Weyl fermions consisting of red-green (rg|cm) ordered combinations. The y|b designation translates into Fermi surfaces. This is an ideal combination of having right-handed volume providing a null left-handed interface with the left handed universe.



10.3: Quark Decay Path with Flavours Indicated

The alternatives to electro-flavour are mu and tau. Charged muons and tauons have average life expectancies: $\mu^{-}=2.197\times10^{-6}$ and $\tau^{-}=2.906\times10^{-1}$ seconds.[28] These reflect their disposition to disorder versus the lowest complementary denominators like electro-flavours and neutrinos.

Primary decay paths are in red, secondary in dashed grey, and least in dotted blue. This series follows the Cabibbo–Kobayashi–Maskawa (CKM) matrix.[29] Quarks decay from charged μ (charm) and τ (top) to stable neutrino (strange and bottom).

Stable electros, however, decay from neutrino (down) to +charged (up). +Up has right-hand oriented volume and surface. Baryogenic asymmetry is expected when virtual chirality pairing is not confused with helicity decays toward right-handedness.

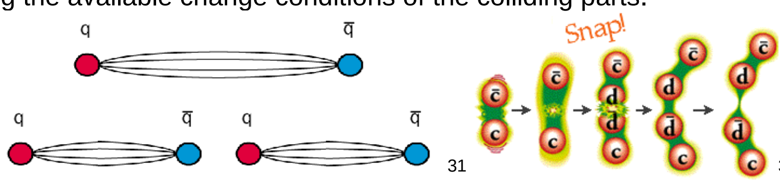
Mitosis v. Meiosis

The words “new matter” imply the spontaneous creation of something from nothing—or at least completely unlike things. All matter is essentially energy value applied to change in a space ($m=E/c^2$). Unlike “nothings” that are actually somethings include: value, change, and space.

The creation of something from nothing then familiarly follows one of two general paths: mitosis producing twins with the same number of genes, and meiosis quadruplets reducing the genes.[30] We will start with the particle version and double back later for grander scale productions. Among particles:

Mitosis—The creation of two new material identities with the same entropy but of opposite states. When formed, the new material identities entangle or bond separately with the parent particles (e.g. gluons and quarks).

While this is known to occur among gluons, confinement makes quarks observationally accessible. As energy is added to bands, the bands rotate and expand until they snap at new identity formation. Alternatively, the pressure of collision can convert into workable energy to create new matter fitting the available change conditions of the colliding parts.



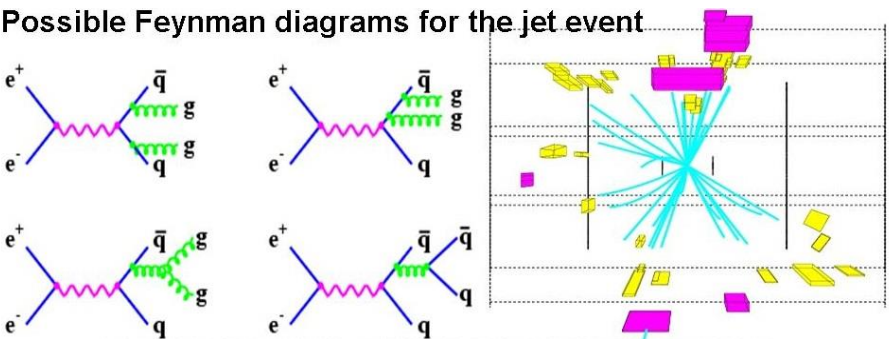
[31] [32]

10.4: Band Growth to Mitotic Snap

These snapping illustrations are better suited for gluon mitosis, with energy simply accumulating in the bands. Instead of quark-antiquark it should be color-other anti-color like red magenta (r+m). This has b-y bands such that at band snapping you get r+y and b+m gluons.

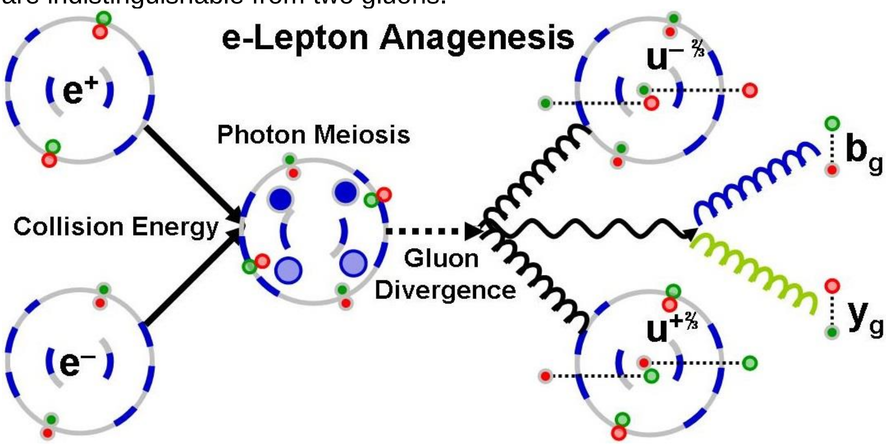
Meiosis—The creation of two or more new material identities generally of fewer change features. This would include photon emission from electron quantum leaping, and jet emissions.

Thomson's image below is described as a four jet system.[33] The jets occur due to exclusion forbidding a space to be defined simultaneously the same way. We classify it as anagenic meiosis because it is linear evolution involving the creation of b:y photons that diverge/differentiate into –b(c:g) & +y(r:m) gluons.



10.5: Exclusion Jets

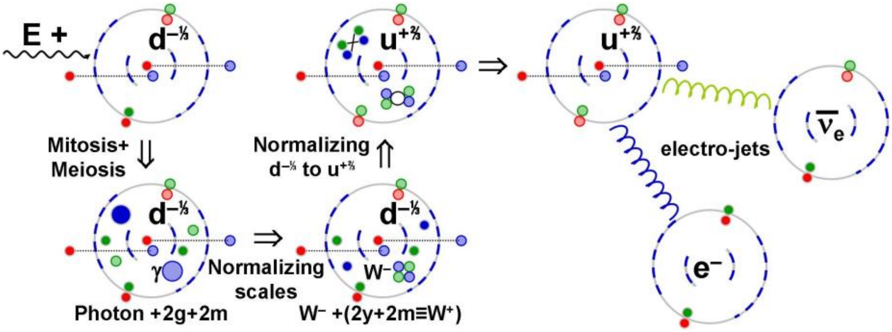
The vertical anagenesis diagram below is more detailed than the usual Feynman diagram. In a charged e-lepton collision (pressure-volume), the energy appears as a photon (virtual being a squiggly line). The result is a quark-antiquark pair plus two more gluon jets. Those gluons are created by means of photon meiosis and uncertainty. Two distinct photons confined are indistinguishable from two gluons.



10.6: e to q + g Anangenetic Diagrams

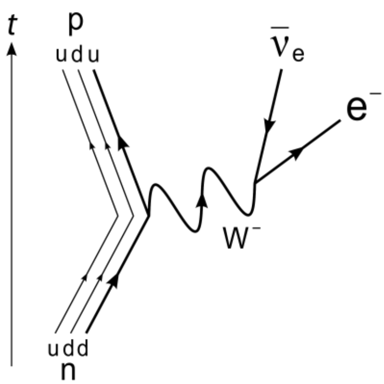
In confined spaces like a neutron, the jets can point into available host spaces. This creates a weak boson with its uncertainty as shown in down decay below. This is the same decay that switches a neutron to a proton, and why we can't just ignore transition particles or their uncertainties because they lack independent existence.

Chirals complete a space. This gives topological reasons why they emit conditionally as positron or antineutrino. When they emit as a positron, they go through a +W phase instead of a –W phase.[34] Procedural pressures of a space (volume) confine energy to generate form. Adapting form then conveys into working optimization and result.



10.7: d to u + e + v Anagenetic Process

Color roles get swapped from mu (μ)=gb to electro (e)=rg. Violating exclusion requires the particle to quantum tunnel (applied Heisenberg uncertainty) to escape as a jet. The proton to neutron process emits muons[35] due to down quark's b^0 flavour. Feynman diagrams are handy for showing observations. These show why observations happen, giving the diagram predictive ability.

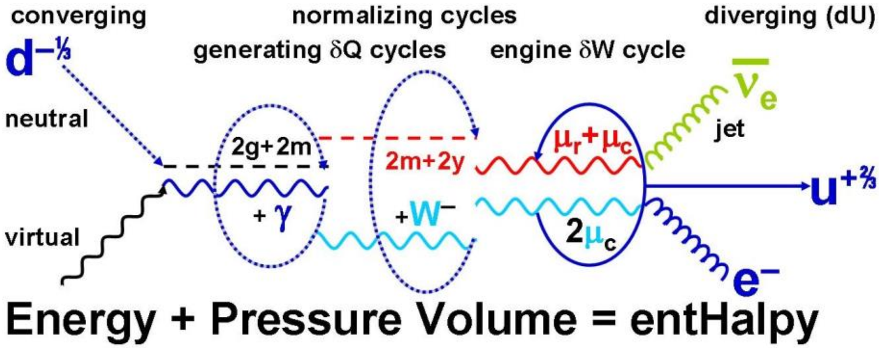


36

10.8: Feynmann Diagram of d to u + e + v

A Feynman version of this shows the quark confined in a hadron, and a common issue of which way to point the arrows. We can adapt a Feynman diagram-like form to show the enthalpy process (H=E+PV) in better detail.

Chiral uncertainties appear to duplicate value in our more detailed diagrams, like the down decay sequence below. In practice, however, we know there is only one **field** value being divided down two paths. The details in two dimensions do not easily show one chiral is asymmetric, interacting as synchronous like 2m+2y=(m+y):(y+m). For W-bosons, the asymmetric chiral resolves as a neutrino with synchronous (crossed) bands). For neutral Z and H bosons, both emissions are charged leptons.



10.9: Enthalpy Process Diagram of d to u + e + v

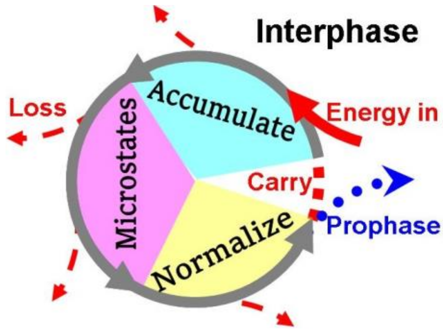
Again, the jets occur because of quantum number violations (e.g. Pauli exclusion) and sticky color conditions. To escape they have to take the available b:y space they are strongly interacting with. Instead of quantum leaping to break this, they simply swap identities.

Muon probability is shown here in the process. Emission favors the electro probability. This change corresponds with quantization forcing spontaneous emission (jetting). The new electro-identities stick. If we reverse the W-boson role, the y^0 antineutrino (having –½ chiral isospin) becomes b^0 and the electron becomes a positron (y-bands).

This engine cycle loses a lot of energy forging the Weyl fermions. That energy is contemporarily looked at as “fission.” The diagram shows the fusion process is responsible for fission. From an atomic perspective it is fission because a nuclear isotope breaks down in the process.[37]

We tend to look at things in terms of our ways to dissect them. We see particles when we are smashing them into each other with intense added energy and pressure. Such violence is indeed commonplace, but so too is the passive version of these processes as with the down decay diagrams.

Interphase



10.10: Interphase Process

In biology,[38] interphase is "the time between mitoses… During G1 (Gap 1), the cellular organelles and cytoplasm, including important proteins and other biomolecules, are duplicated. S (Synthesis) Phase is the point at which DNA is replicated. G2 (Gap 2) is spent double checking that no errors have been made during DNA replication."[39]

In physics, this sub-phase breakdown fits a phase (moment) energy cycle. Energy enters the system and accumulates with other excess energies. These energies pass through the extra-temporal microstates to metabolize. Metabolizing normalizes the information of intrinsic and transient energies. What hasn't escaped in the process compounds with future accumulation or triggers prophase.

Normalization is the observational perspective of smoothing into information equilibrium. This is computed using Schrödinger's equations,[40] which we later simplify into the Wheeler interaction (pg. 273 et seq.). Schrödinger's wave normalization function was designed to evaluate a wave function (ψ) to compute the probability of finding a particle along a trajectory axis (x) in time (t).

normalization of t in the wave over cycle (k)

$$\int_{-\infty}^{+\infty}\left|\psi\left(x,\int^{c}\left|\psi\left(t,\int_{0}^{2\pi}|\psi(k,f_k+\Delta f_x)|^2\,dk=|k_t^2|=+1\right)\right|^2 dt=1\right)\right|^2 dx=1$$

cycle normalization = oscillation

10.11: Schrödinger Normalization of x in Wave (ψ) over time (t)

We are approaching from the opposite direction as if we are nature with all the answers. We aren't predicting. We are specifying by creating the wave cycle from the EMA-EMR information in the force energies. These smooth into the predictive normality.

Schrödinger's probability density $|\psi\ (x,t)|^2$ is the observational frame in which force information differences sequentially oscillate and smooth relative to the duration (c) of time (t). Spacetime reference frame can be refined specifically because it is dependent on the central force oscillation.

Time resists microstate cycles and change of identity. Increments of time (δt) are defined by the period of cycle frequency (υ).[41] Cycle frequency increases directly to energy in the system per Planck's E=hυ, so δt change resistance decreases.

Energy adds into a system via relativistic momentum ($E^2=E_k^2 + E_x^2$). The value origin is quantum force in kg m units. Applied to spacetime, energy becomes the time derivative E= d cF/dt. More practically F is observed as light frequency where information is the EMR-EMA detail. It is in this relationship where the particle wave confusion emerges. The correct interpretation of the relationship between frequency and relativistic momentum is temporal dilation.[42]

In each increment of time, energy can be added or removed from the system. In each increment of time, intrinsic and transient information goes through the microstate sequence and to a degree smoothes into one complementary sequence of information.

Generally speaking, the transient energy (f_x) is significantly less than the intrinsic energy (f_k). They proportionally mirror each other. Proportional mirroring gives the transient energy the identity of the interaction—the bands defined by attributed value like absorption bands from a reflection.[43] Even if the energy passes straight through, it passes during a microstate cycle, influences and is influenced.

Excessive application of force, as with acceleration, causes an excess in oscillation attempting to normalize the information. This and pressure preventing escape, lead to identity loss or transformation (k_t→anagenesis). If we could have all the information, we could also identify exactly which identity oscillation applies at specific points in the timeline.

Eigenstates

Lower case psi (ψ) represents the complete wave function of an identity—the Schrödinger equation. The function is the cycle of all energy distribution sets (macrostates). Each set consists of all the color change functions acting as containers defining the whole identity. Each change container is a distinct wave function commonly called an eigenstate (Ψ).[44]

Each eigenstate in each set has a scalar energy value ($\hat{E}$). This scalar acts like a Laplacian in that it contains the EMA-EMR information: $\hat{E}=\hat{A}+\hat{R}$. The sequential sum of these for the set is the Hamiltonian operator ($\hat{H}$).

Ordinarily we think of the scalar just giving the wave function magnitude. What we actually have is a feedback system. The wave function has a smoothed operational perspective. The energy information is anomaly applied to the wave function. If the anomaly is too extreme, it changes the wave function of identity.

$$\hat{H} = V(r,t) - \frac{\hbar^2 \nabla^2}{2m}$$

Traditionally, $\hat{H}$ is broken down as the sum of kinetic and potential energies. Potential appears as a vector radial position in time=V(r,t). This potential is the effect of extrinsic forces acting on position and motion.

Kinetic (motion) energy appears as the absorption/intrinsic space defined by the Laplacian operator in a mass. The negative here resolves as generic $i^2=-1$. the change function diverges value (m) into the Laplacian. This is like giving a bag value and shape by putting things in it.

Technically, all virtual particles have complex (imaginary/latent) mass functions which are attributed by context. Weak bosons normalize by equivalence into ordinary mass. Through the conduct of eigenstate evaluations, the complex forms must be explored. This is especially true for computing confined mass from the quantum details.

That imaginary element affects the divergence pattern of i^2. The divergence can be into a surface in or out of phase, volume, or a combination of these. Specific surface-volume combinations satisfy the GFE in the degree to which that eigenstate applies to the total wave function. Just as we overlay these maps in degrees to illustrate the fields, those same degrees affect the emerging mass value.

Endnotes

[1] Richings, R.J. & Faucher-Giguère, C.A. (Nov. 23, 2017). The origin of fast molecular outflows in quasars: molecule formation in AGN-driven galactic winds. Oxford Academic. academic.oup.com/mnras/article-abstract/474/3/3673/4655190.
[2] Hartwell, L.H.; et al. (2008). Genetics From Genes to Genomes. New York: McGraw-Hill.
[3] Gilman, L. (2018). Virtual Particles. Net Industries. science.jrank.org/pages/ 7195/Virtual-Particles.html.
Jones, G.T. (2002). The uncertainty principle, virtual particles and real forces. Physics Education. hst-archive.web.cern.ch/archiv/HST2005/bubble_chambers/ BCwebsite/articles/06.pdf.
[4] McClean P. (1997). Population and Evolutionary Genetics: Speciation. ndsu.edu/ pubweb/~mcclean/plsc431/popgen/popgen6.htm.
[5] Staveley, B. (2017). Principles of Cell Biology. Memorial University of Newfoundland. mun.ca/biology/desmid/brian/BIOL2060/BIOL2060-20/CB20.html.
[6] Kimball, J. (Apr. 5, 2014). The Centrosome. biology-pages.info/C/Centrioles.html.
[7] Kimball, J. (Apr. 5, 2014). The Cell Cycle. biology-pages.info/C/CellCycle.html.
[8] Miko, I. ed. et al. (2014). Telophase. nature.com/scitable/definition/telophase-128.
[9] (2012). Lyman-Alpha and Lyman-Break Galaxies Hubble/ESA and NASA. hubblesite.org/hubble_discoveries/science_year_in_review/pdf/2012/exploring_lyman_alpha_and_lyman_break_galaxies.pdf.
[10] Polly, P.D. (2013). Phylogenetic definitions of taxonomic groups. indiana .edu/~g404/Phylogenetic%20definitions%20of%20taxonomic%20groups.pdf.
[11] Trut, L.N. (Mar.-Apr. 1999). Early Canid Domestication: The Farm-Fox Experiment. American Scientist, Vol. 87.
[12] Hall, N. (May 5, 2015). Enthalpy. grc.nasa.gov/www/k-12/airplane/enthalpy.html.
[13] Evans, L. (2010). Oscillations. webhome.phy.duke.edu/~lee/P53/osc.pdf.
[14] Kayser, B. (2011) Neutrino Oscillation Physics. Batavia, IL: Fermilab. hep.wisc .edu/~sheaff/PASI2012/lectures/BorisK-Oscillation.pdf.
[15] Nave, C.R. (2017). Work Energy Power. Georgia State University. hyperphysics .phy-astr.gsu.edu/hbase/work.html.
[16] Rouse, M. & Macleod, J. (Sep. 2005). WhatIs.com: Instantiation. whatis .techtarget.com/definition/instantiation.
[17] Strassler, M. (Mar. 25, 2012). Particle / Anti-particle Annihilation. profmattstrassler.com/articles-and-posts/particle-physics-basics/particleanti-particle -annihilation/.
[18] Župančič, A.O. (Jul. 17, 1965). Creation Rate of Matter and the

Heisenberg Uncertainty Principle. Nature: 207, page 279.

[19] Carroll, B.W. & Ostlie, D.A. (2006). An Introduction to Modern Astrophysics. 2 ed. London, UK: Pearson.

[20] Sulehria, F. (2005). Stellar Remnants. novacelestia.com/space_art_stars/ stellar_remnants.html.

[21] (2018). Binary Fission. Cornell University. micro.cornell.edu/research/epulopiscium/binary-fission-and-other-forms-reproduction-bacteria.

[22] Larson, K. (2006). Neutrinos! University of Wisconsin, Madison. astro.wisc.edu/~larson/Webpage/neutrinos.html.

[23] Terzian, Y. & Herter, T. (Oct. 17, 2012). Stellar Energy and Nucleosynthesis. Cornell University. astro.cornell.edu/academics/courses/astro1101/lectures/13StellarEnergyNucleosynth.pdf.

[24] Margulis, L. (1981). Symbiosis in Cell Evolution. San Francisco: W.H. Freeman.

[25] McClean P. (1997). Population and Evolutionary Genetics: Speciation. ndsu.edu/ pubweb/~mcclean/plsc431/popgen/popgen6.htm.

[26] Minkel, J.R. (Jul. 22, 2002). Two Photons Diverged. Phys. Rev. Focus 10, 3, https://physics.aps.org/story/v10/st3.

[27] Sakharov, A.D. (1967). Violation of CP invariance, C asymmetry, and baryon asymmetry of the universe. Journal of Experimental and Theoretical Physics Letters. 5: 24–27.

[28] Amsler, C. (2008). Particle Data Group. pdg.lbl.gov/2008/listings/s035.pdf.

[29] Ceccucci, A., Ligeti, Z., & Sakai, Y. (Feb. 2014). 12. The CKM Quark-mixing Matrix. http://pdg.lbl.gov/2014/reviews/rpp2014-rev-ckm-matrix.pdf.

[30] Scott, S. et al. (May 17, 2017). Mitoses versus meiosis. yourgenome.org/facts/mitosis-versus-meiosis.

[31] Breinig, M. & Hitchcock, J. (2012). The Standard Model. electron6.phys.utk.edu/phys250/modules/module%206/standard_model.htm

[32] Barnett, M. et al. (2014). Quark Confinement. particleadventure.org/quark_confinement.html.

[33] Thomson, M.A. (2004). Particle Physics. Cambridge University. hep.phy.cam.ac .uk/~thomson/particles/questions/Q16_answers.html.

[34] Irvine, J. (ret. Feb. 12, 2018). Particle Physics Tutorial 11 - Particle Interactions. antonine-education.co.uk/Pages/Physics_1/Particles/PP11/particles_ page_11.htm.

[35] Gorringe, T. & Fearing, H. (Jun. 18, 2002). Induced pseudoscalar coupling of the proton weak interaction. https://arxiv.org/pdf/nucl-th/0206039.pdf.

[36] Silverman, D. (Feb. 11, 2013). Weak Isospin and the Weakly Interacting Bosons (Force Particles). sites.uci.edu/energyobserver/2013/02/11/weak-isospin-and-the-weakly-interacting-bosons-force-particles/.

[37] (ret. Feb. 12, 2018). Nuclear Fission. nuclear-power.net/nuclear-power/fission/.

[38] Riggio, G. (Jun. 2, 2017). 5 Stages of Mitosis. sciencing.com/5-stages-mitosis-13121.html.

Grimes, B., & Hallick, R. (Oct. 2004). The Cell Cycle & Mitosis Tutorial.

http://www.biology.arizona.edu/cell_bio/tutorials/cell_cycle/cells3.html. (2018). Mitsosis and Meiosis. Khan Academy. khanacademy.org/test-prep/mcat/cells/cellular-division/a/mitosis-and-meiosis.

[39] Baker, R. (May 18, 2017). Stages of the Cell Cycle - Mitosis (Interphase and Prophase). https://owlcation.com/stem/Stages-of-the-Cell-Cycle-Mitosis-Part-1-of-2.

[40] Santra, S.B. (2013). Quantum Mechanics-Schrödinger Equation. iitg.ernet .in/santra/course_files/ph101/QM-02.pdf.

Fitzpatrick, R. (2010). Normalization of the Wavefunction. farside.ph.utexas .edu/teaching/qmech/Quantum/node34.html.

Nave, C.R. (2017). Particle in a Box. Georgia State University. hyperphysics .phy-astr.gsu.edu/hbase/quantum/pbox.html.

[41] OpenStax College (2018). College Physics. Rice University. courses .lumenlearning.com/physics/chapter/16-2-period-and-frequency-in-oscillations/.

[42] Acosta, D. (2006). Relativity 4: Relativistic Momentum. University of Florida. http://www.phys.ufl.edu/~acosta/phy2061/lectures/Relativity4.pdf.

[43] Blair, W.P. (ret. Feb. 15, 2018). The Basics of Light. Johns Hopkins University. http://blair.pha.jhu.edu/spectroscopy/basics.html.

[44] Simons, B. (2009). Operator methods in quantum mechanics. U. of Cambridge. tcm.phy.cam.ac.uk/~bds10/aqp/lec3_compressed.pdf.

Simons, B. (2009). Handout Chapter 3. U. of Cambridge. tcm.phy.cam.ac .uk/~bds10/aqp/handout_operator.pdf.

11. Virtual Anatomy & Cytology

We are mapping the construction of inert discrete spacetimes from active latent spacetimes. This multi-faceted complex poses challenges as the mind prefers simple linear paths. This challenge has four major components: classifying our subjects (**morphology**), how they evolve and are created (**instantiation**), what they are made of (**anatomy & cytology**), and how those parts work together (**physiology and histology**).

> **Anatomy** is the study of the structure and relationship between body parts.
> **Physiology** is the study of the function of body parts and the body as a whole. …
> **Histology** is the study of tissues at the microscopic level.
> **Cytology** is the study of cells at the microscopic level.[1]

A cell is the basic unit of life with only minor ambiguities as with viruses or caulerpa algae. For virtual matter, the basic unit is an axis. Like a cell membrane, the axis is what encloses the parts (value) into a whole. The ambiguity for matter is how it combines axes into distributions that are then axes to another level. These evolutions of material form are often concurrent at least in degrees, like growth of complex biological systems.

Virtual anatomy evolves from "single celled" cytology of individual axes to complex histology assembling hyperspaces. Along this path we have another topical division into function (physiology). At the active latent end of this, function is the interaction of the axes as they convey value between them. These are Bose-Einstein microstates among uncertain identities. As axes form contained systems with certain identities, they become inert and act as possible functions.

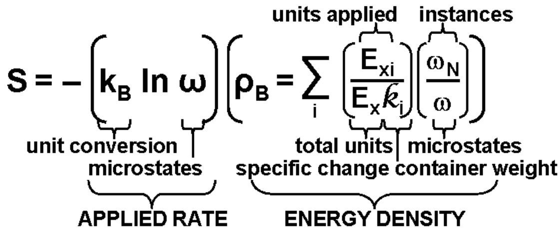
Bose-Einstein

We have a tendency to try and treat things in certain terms. We want a circle to always be a circle. We don't think of it as a line on one level, a surface on another, or a sphere on yet another, etc. Entropy and microstates are also evolving concepts. Traditionally, a microstate is an energy distribution among macrostates.[2] Unfortunately this is too simple. There are multiple ways that are all valid to their contexts.

Einstein could not envision an entirely indeterminate universe. He could envision the universe acting on incredibly fine details we could not reasonably know. These details occur in a particular sequence whose detail gets squeezed into a unitless concept called a cycle. The scale of this cycle relative to temporal resistance is its frequency, proportional by Planck's function to an energy definition $E=h\upsilon$.

Light, as latent energy, is what gives value to spaces that make up matter. Light propagates, so the expectation of its effect on the spaces of matter is to continue propagating. This is basically what the Bose-Einstein system of microstates does. It allows the value defining matter to flow from one available space to another. It also allows for the differences in that energy to regulate the degree to which values flow among the spaces.

Since all these spaces are equivalent, the energy is simply divided into proportional units, such that all available spaces can in one microstate have equal quantities of energy. And for that matter, all the energy can land simultaneously in only one available space.



11.1: S-entropy as Energy Density

Entropy (S) is an uncertainty relative to distribution (e.g mixing angle W=cos φ) linking it to the effective rate of Newton's constant. Boltzmann and Gibbs used an accessible density probability on the macrostates variable (ρ ln ρ) to conceptualize relative to energy context S=k ln W. Shannon[3] used a binary information approach: $\sum p_n \log_2 p_n$. Bose and Einstein took a simpler unit approach. They divided integer units of energy (E_x) among N equal but distinguishable spaces.

$$\boldsymbol{\omega(E_x,N)=(E_x+N-1)!/E_x!(N-1)!}$$

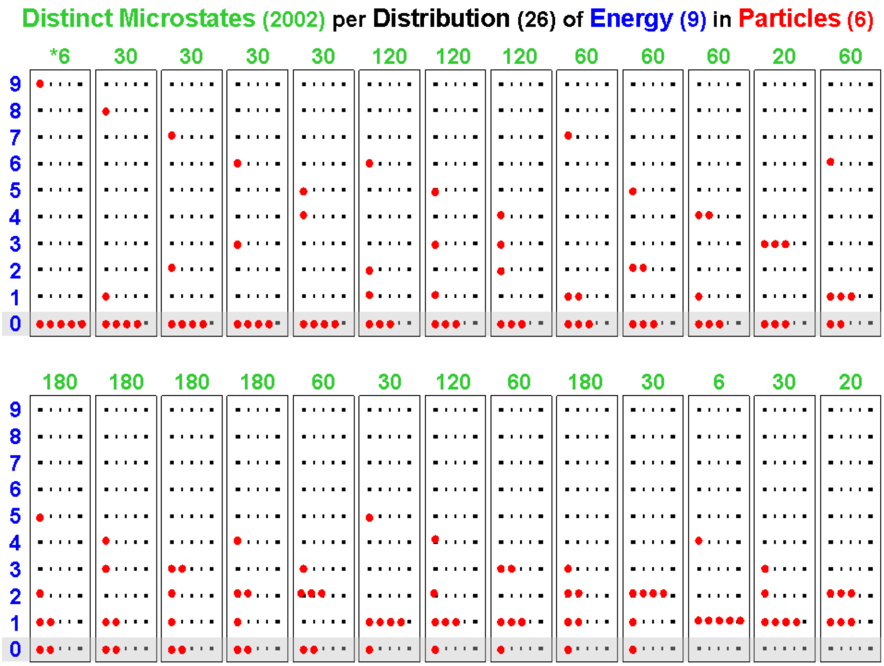
$$\boldsymbol{\omega=(9+6-1)!/9!(6-1)!=14!/9!5!}$$
$$\boldsymbol{= 14\times13\times\underline{12}\times\underline{10}/\underline{5}\times\underline{4}\times\underline{3}\times\underline{2}\times1 = 14\times13 = 2002}$$

In the diagram below, each dot represents one of six material identities. These are "loose" identities—their interaction is not relevant. Where the dot is placed vertically describes the amount of energy units applied to that indistinguishable part. Each box represents a macrostate—a traditionally arbitrary region. Within a macrostate of the table below, the total energy is always E_x=9.[4]

At the bottom of the box are all the identities without value. These are highlighted to draw attention to them. If we label each of these dots to make them distinct, we may label them parts A,B,C,D,E,F respectively. At the top of each box is a number indicating the number of possible ways to label the energy values provided.

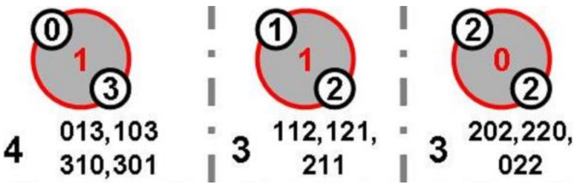
$$\boldsymbol{\omega/\Omega=N!/N_O!N_A!}$$

Those with no value aren't counted. Only those with value are ordered. If all the energy is in one container, it could be any one of the six possible microstates per macrostate (Ω) . There are 30 ways to arrange them when only two have energy, and so on. Where N=number of containers, N_O = containers without value (noting 0!=1), N_A = containers with value:



11.2: Bose-Einstein Microstate Example

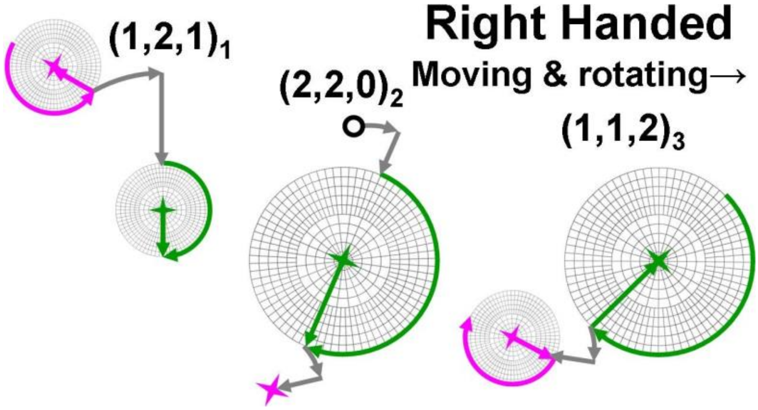
This is great as a concept, except it does not account for identity issues—enough spaces must have value to maintain the identity. It works for a boson macrostate because they are a single active axis. If we have two active axes, then two must always have value to retain identity. These conditions in algorithms are called business rules. They makes establishing the total integer value easy.



11.3: Microstates of Binary Virtual Particle

Entanglements are a prime example of an extra space that must have a zero value state. There is always an available space to act on. Filling it creates a whole new challenge to include new matter and emission. During the filling process, the change in energy simply gets divided across the total integer value.

In the first edition, I wrongly argued and provided for spaces of different values. Doing the whole workup on light changed a lot of things. Photon amplitudes associated with color charge axes (rcgmby, see pg 184) would seem to support such an argument, except for one detail: uncertainty. Uncertainty means the value axis can change its identity by means of dilation. That change in axis is simply a matter of applying a different scale, like brightness. Brightness is the amplitude of the wave, the flux density in space independent of frequency.



11.4: Affect of Microstates on Intrinsic Motion

Real number microstates are a great visualization tool, and are particularly relevant in mechanical and basic relativistic situations. From a quantum perspective, they show spaces valuing in sequence causal of intrinsic motion. At least until you realize two things…

Not all value propagates. A lot of it fails to meet the requirements to propagate. That value remains inert like background temperature and pressure. Propagation is a complex form of entropy. As matter becomes more inert, it passes through different types of complex forms. The real numbers aren't practical until you are working with groups or from a mechanical (e.g. Newtonian) perspective.

Weak Bosons

Weak bosons are low-density transition particles; a preview of baryons while a relic of chiral forms. Chiral interactions jump back and forth across the table, their identity a function of uncertainty and opportunity. Unlike baryons, they have no static microstates, making their isospin and hypercharge unique, while initiating helicity and electric charge.

All the possible transitions come from how the weak boson diverges into pairs of new identities. A charged boson forms a charged and neutral lepton or derivative quark pair. A neutral boson form oppositely charged lepton:anti-lepton (10%), derived quark pair (70%), or neutrinos (20%).[5] In the right conditions, weak bosons start the trend of direct descendance. Now let's see **why**.

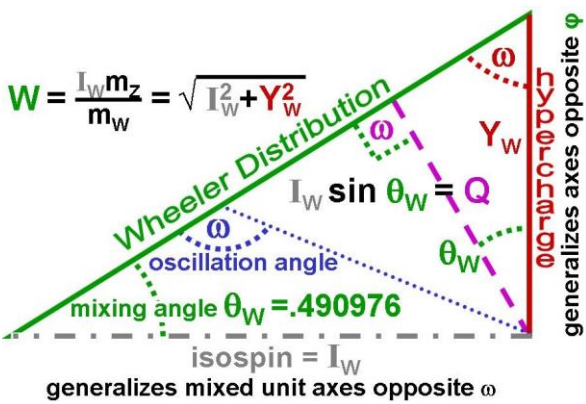
A weak boson has two complex axes that appear as both hypersurface and hypervolume simultaneously. Each complex axis (k) consists of absorption and radiant values defining hypervolume and hypersurface spaces that alternate roles as the values move around. These spaces are mixed together (φ_k opposite to Y_k) into a unit of distribution generalizing the identity (I_k). The oscillation angle (ω_k) identifies the complex axis type.

Oscillation angle is a one-dimensional mixing of radiant and absorption axes into a conserved unit identity. That singular dimension is the first stage of generalization (strong type I). It is either a color hypersurface or a flavour hypervolume. Flavour hypervolumes can also be analyzed as strong type II (bond) in two or three hypersurface dimensions. For weak bosons, our only concern with them is as one-dimensional generalizations.

The values in the complex axes triangulate into weak hypercharge ($Y_W^2=Y_k^2+Y_k'^2$) and weak isospin ($I_W^2=I_k^2+I_k'^2$). The term weak is added for clarity of role differences. In weak bosons the microstates are all active and subject to uncertainty.

These two axes merge into a common distribution we refer to as a Wheeler space. The Wheeler space is so-named for Wheeler's concept of quantum foam. It is a mixed distribution that includes an available axis, and its definition applies to every point in the identity.

The Cabibbo mixing angle[6] becomes $I_W \tan \theta_W = Y_W$. For weak bosons this is called a Weinberg angle. Weinberg's angle is defined by CODATA[7] as $\sin^2\theta_W$ =.2223, by mass ratio to target particle ($\cos \theta_W = m_W/m_Z$),[8] or succinctly as θ_W =.490946 (radians).



11.5 Symmetric Weak Boson Variables

Weinberg's angle is relative to the plane, not on the plane as with the prior φ_k mixing angle. The diagram works but is misleading. If we can put it into three dimensions we would see the red and blue oscillations are at symmetric (mirrored) angles of about $\pi/8$ to either side of the plane, and together $\varphi=\Delta\theta_W$ $=\sin^{-1}\sqrt{(2\times.2223=.4446)}$ = .7299. This complex mixing is called gloming (3-sphere).

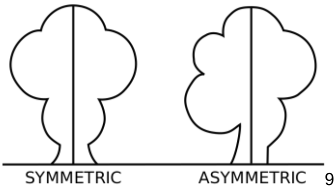
Gloming

Gloming combines axes, starting with two complex axes. Each of complex axis is pushed together relative to a plane from opposite components. We push them together from another angle as we would with kneading bread. The kneading process mixes by pushing in from all axial directions. We have essentially mixed four axes in three directions to create more than just a volume with a surface.

The volume and surface are mixed in a way that applies to every point in that space (e.g. field or smooth manifold). Because of this, those spaces now interact geodesically (4-sphere) which satisfies the field equation for surface gravity consistent with mass. As we will see, surface gravity and mass are more complex than typically presented. The surface gravity occurs within a local region that has pressure parallel to the surface, and the effects displacement is its mass effect. That local region of pressure is also the range of the weak interaction between separate objects.

Gloming ($\Delta\theta_W = \varphi$) modifies Newton's constant (pg. 71). It is a little less than $\pi/4 = .785398$, the natural angle of rotation between distinct axes. That natural angle gives the axes independence making them asymmetric. Symmetry applies within $\Delta\theta_W < \pi/4$ as a function of directional (–) relationships. At less than $\pi/4$, the two axes are trying to define the same space.

Space cannot be defined more than once at the same time. Violating this leads to exclusion—which ultimately evolves into Pauli exclusion. To get around exclusion, primitive axes can swap roles (e.g. volume or surface), which creates the uncertainty factor. With uncertainty, they retain their low-density 1-sphere unit spin feature and form a pseudo-axis: the electric charge axis ($Q = I_W \sin \theta_W = 0.491\ I_W$).



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Symmetric axes are invariant: mirroring each other exactly relative to the common pseudo-axis of a plane.

Asymmetric axes are rotated apart from the plane leaving them independent and without a common axis.

11.6 Symmetry v. Asymmetry

Electric charge is intrinsic directional potential (±) that "experience(s) a force when placed in an electromagnetic field."[10] Symmetric weak bosons have electric charge and respond to electromagnetic fields. Asymmetric weak bosons are neutral. They can form these axes in group dynamics as with synchronous neutrino bands (see pg. 199), which enables them to locally interact.[11] Separately, asymmetric bosons like Z have no charge axis to interact with.[12]

Divergence

Weak boson anatomy is confined. You cannot observe the color-flavour charges involved. If you could, then you can follow the processes and symmetry on an uncommon level of detail. All weak bosons can be described as simplifying chiral functions into helicity (e.g. handedness) and electric charge. The detail of chiral elements shows where they have symmetry and the nature of uncertainties.

$$\left(\frac{dz}{dt}\right)=\left(\frac{dz}{du}\right)\left(\frac{du}{dt}\right)=\left(\frac{\partial z}{\partial x}\right)\left(\frac{dx}{dt}\right)+\left(\frac{\partial z}{\partial y}\right)\left(\frac{dy}{dt}\right)$$

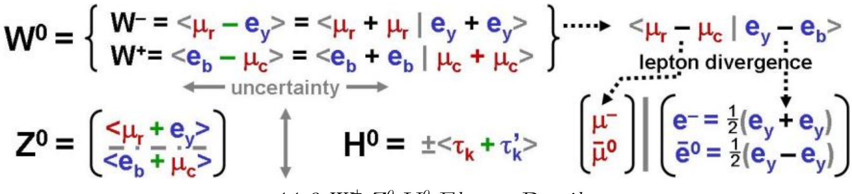
11.7 Basic Chain Rule

The chain rule diverges fairly simply by deriving two functions.[13] We start with the uncertainty pair <a+b'> that must now be expressed in complete detail <a–a' or b–b'>. Negatives are chiral equivalents: a≡–a'. Because a' and b' are chirals, we now have to actually split the variables and value among those variables.

$$Z^0 = \langle \mu_r + e_y \rangle = \langle \mu_r - \mu_c \text{ or } e_b - e_y \rangle$$
$$\rightarrow \tfrac{1}{2}[\langle \mu_r + \mu_r \rangle - \langle \mu_c + \mu_c \rangle] \text{ or } \tfrac{1}{2}[\langle e_y + e_y \rangle - \langle e_b + e_b \rangle]$$

This time for the sake of clarity, I spelled out or (|) and highlighted it with the negative leading into divergence between $\rightarrow \mu^- - \mu^+$ or $e^- - e^+$. Thanks to uncertainty there are two possibilities, both having to play out and therefore dividing value ($\tfrac{1}{2}$) across two leptons.

This half bumps the axis to 2-sphere from the 1-sphere gloming of the weak boson. Each lepton is a flavour volume entangled with itself, just as a photon is a color charge entangled with itself. This is important because with continued divergence, the volume differentiates into entangled pairs of gluon-photon hypersurfaces.

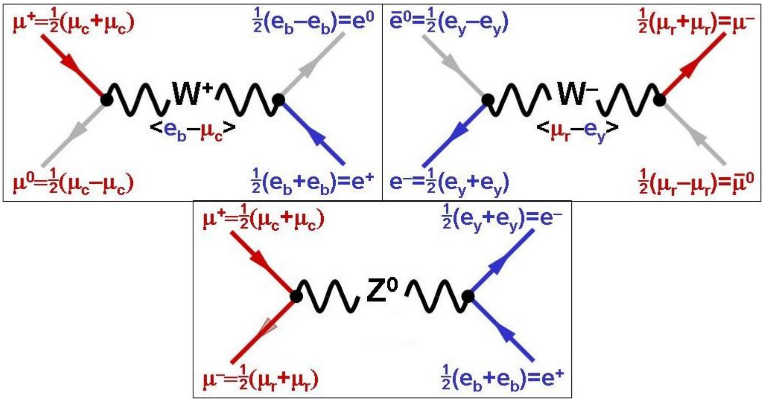


11.8 $W^{\pm}$,Z^0,H^0 Flavour Detail

Generically we make no assumptions, but given context, probability becomes certainty. The flavour detail shows horizontal homogenous uncertainties of the W bosons are its symmetry, just as the vertical heterogeneous uncertainties of Z and H bosons are their asymmetry. Symmetry reflects in the lepton divergence paths.

A divergence will always differentiate into one flavour class. W and Z bosons offer only mu or electro options despite a significantly wider array of possibilities. A W-boson initially diverges into a charged lepton and a neutrino (typically shown as nu: ν_e=e^0 and ν_μ =μ^0). The positive W gives right handed neutrinos and the negative gives left-handed anti-neutrinos.

Feynman diagrams (below) show probable divergence directions. The probability of continued divergence into related quarks depends on context—particularly enough energy to continue forcing the process. It can continue to diverge into opposite charges and neutrino into gluon-photon pairs ($2N_g+2И_g$) to satisfy up ($u^{+⅔}=e^-+2N_g$) and anti-up ($\bar{u}^{-⅔}=e^++2И_g$) quark definitions.

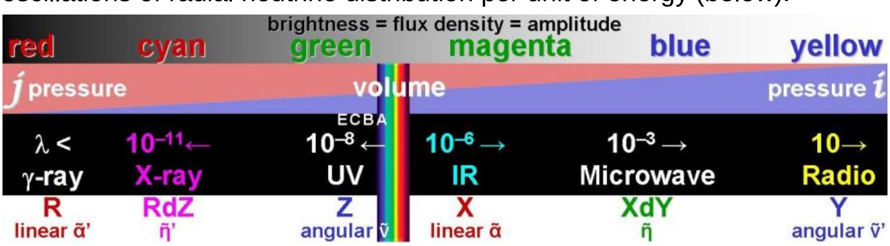


11.9 W & Z Divergence Paths

Oscillation

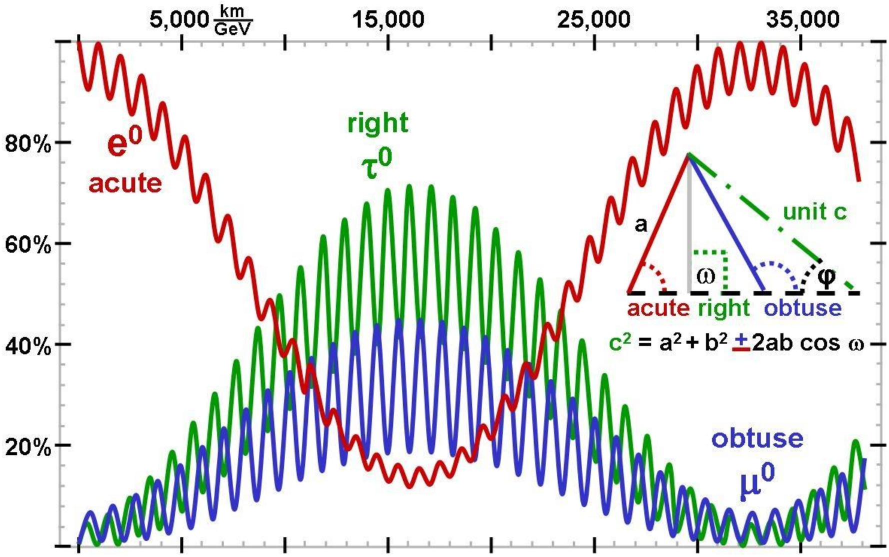
Oscillation is the change in identity caused by changing energy focus. In light terms, the energy focus is the flux density commonly known as brightness, or mathematically as amplitude. This variable is a scalar multiplier independent of frequency and wavelength. You are used to seeing E=hυ. Amplitude simply multiplies across the whole thing AE=Ahυ.

Differences in frequency between one color axis and another are so dramatic that related colors are separated by two other colors. With brightness, they are next to each other. Then you look at the probable oscillations of radial neutrino distribution per unit of energy (below).



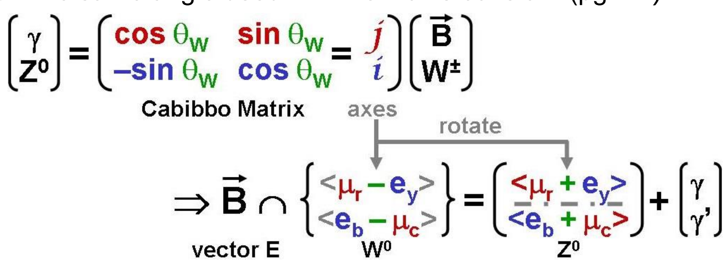
11.10: Oscillation Factors

It doesn't take much to tweak the functions and change the scales on the oscillation probability graph. What it does not account for is metric shape. A metric definition such as the color axes has both. Dilation or distribution affects flux density, the scale part of the metric. The scale part of the metric put in the triangular distribution terms describes the density of distribution. That density affects the mixing angle (φ) defining the triangulation as acute (red), right (green), or obtuse (blue). Add a shaping factor and you are no longer in the realm of probabilities.



11.11: Oscillation Graph

Because bosons consist of diverging color/flavour axes, they are also subject to oscillation factors. W and Z-bosons can be oscillated into each other. Such oscillation follows neutrino probabilities, and the result remains uncertain. Weinberg's mixing angle (θ_W) is explicitly used with symmetry breaking weak interaction. It is the specific φ angle relating W and Z bosons—the same angle used with Newton's constant (pg. 71).



$$\begin{pmatrix}\gamma \\ Z^0\end{pmatrix} = \begin{pmatrix}\cos\theta_W & \sin\theta_W \\ -\sin\theta_W & \cos\theta_W\end{pmatrix} = \begin{pmatrix} j \\ i \end{pmatrix}\begin{pmatrix}\vec{B} \\ W^{\pm}\end{pmatrix}$$

$$\Rightarrow \vec{B} \cap \begin{Bmatrix}\langle \mu_r - e_y \rangle \\ \langle e_b - \mu_c \rangle\end{Bmatrix} = \begin{pmatrix}\langle \mu_r + e_y \rangle \\ \langle e_b + \mu_c \rangle\end{pmatrix} + \begin{pmatrix}\gamma \\ \gamma'\end{pmatrix}$$

11.12 Cabibbo-Weinberg Electroweak Interaction

The effect of applying a general vector field to oscillate any W boson is a classic equal and opposite reaction. The value generalization perturbs as a specific photon or its chiral. If we pay close attention to this little detail it can be relevant to a future event. The vector direction adds the rotational effect to oscillate symmetric W axes to asymmetric Z. Everything going into the operation comes out in opposite form.

Symmetry breaking strips away identity leaving just asymmetric energy. This provides a nice transition state for one material identity to oscillate (transform) into another. The Weinberg approach is to apply a vector boson (typically B^0) to a generic W-boson (W^0). The vector boson is a general field with directional value and unit spin. It causes the identity elements of W^0 to probabilistically oscillate into a Z-boson formulating an explicit photon.[14]

In a system of stable microstates you don't need to worry about uncertainty or oscillating between identities. Active microstates add uncertainty variables even in inert environments. In divergence, the Weinberg angle becomes the entanglement band synchronicity angle σ (pg. 199). It is an oscillation factor acting on the relationship between change operators ($\jmath$ and $\imath$) consisting of directional (+/–) axes.

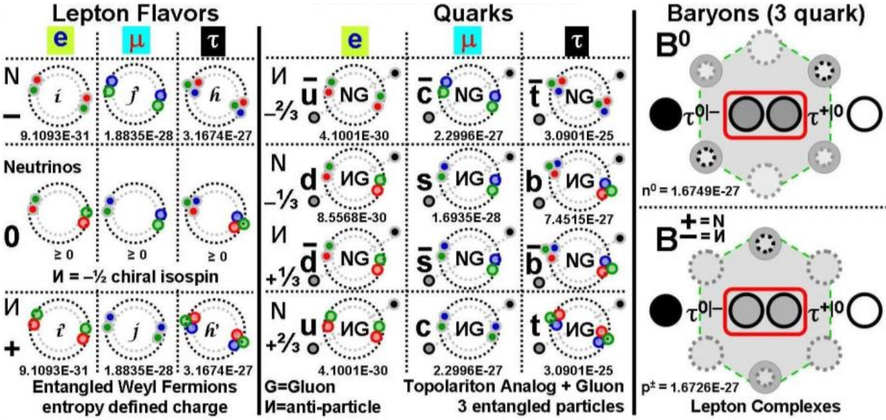
Adding value in whatever form dilates and rotates the system of axes. The Cabibbo matrix orients these directional axes—the shaping component of the oscillation metric. Rotating these axes affects the degree and way the electric charge axis applies. Synchronous angles cross the bands, neutralizing charge features. Conversely, the axes of asymmetric bosons do not share the same plane, so they cannot form a charge axis by themselves. Put into context with neutrinos, their axes form local electric charge interactions. as between Z-bosons and neutrinos. [15]

Into Normality

Normality in a quantum universe is your familiar perspective, whoever you are. Outside the familiar perspective, differences in nature subtly change to seemingly unrecognizable. It is all the same basic rules adjusted to fit the contexts. Our perspective also tends to narrow our view of how things are or can be constructed, which in turn affects speculations about how things can happen.

For example, we expect particles to build up into more sophisticated identities. This is what we see with chemistry, geology and engineering. Instead, particles are generally just a macrostates grouping within more complex systems of several groupings. This is one of many reasons to call them virtual. As virtual we need to never lose sight of the word perturbation. Perturbation seems to be the first word everyone forgets about with quantum phenomena from photons to leptons to black holes.

With perturbation, particles form as-is from focused wave interference. And by particles I mean everything up to and including baryons and even beyond. Neutron stars and black holes are perturbed as is under extreme energy focus conditions. Energy focus of such magnitudes tends to defy the mind's ability to comprehend, so we forget that to the universe these aren't big numbers.



11.13: Confined Macrostate Composition

Particle "compositions" like the diagram are just charts of macrostate grouping probabilities. Note: we prefer the particle table (pg. 149) so no one gets confused that the particle breakdowns can be viewed as literal geometries. At the same time, literal geometries do occur and qualify as relevant contextual macrostates.

Some elements of the image are there to show the relationships to lesser generations, like the clusters of bound primordials. The clusters and interactions among the clusters are the macrostates. This is of particular importance for understanding how leptons and quarks function, and why we never see quarks individually.

Leptons

A lepton has three parts: two related flavour components (Weyl fermions) and the flux tubes (band pairs) entangling them. As with gluons and photons, the observed feature is the one available for interaction: the entanglement. The entanglement reflects what is missing in the parts. In the charts here you see these bands explicitly identified by color charges. From an observational perspective, they define the electric charge axis.

Gluon and photon bands are the same magnitude as their bands with one band pair. The band pair satisfies both states of the same change function. All further bands and flux tubes, no matter how many, are of that "primitive" magnitude. Primitive here does not mean small, but rather simple. Greater simplicity has greater energy and spatial requirements. In essence, entanglement is a group dynamic.

Leptons have pairs of flux tubes, and flux tubes themselves consist of band pairs. This means each flux tube has inner and outer sides given the opportunity to nucleate as with electrons to protons. The orientation of these is the spin quantum number (±½). To form a photon, a spin quantum number must be available. The hypercharge generalizes from the outer (presumptive) state of the color charge. An electron, for example, has negative outer *í*-bands, a positron has positive *í'*-bands, and the e-neutrino twists them.

We usually like to think of leptons relative to weak bosons as described earlier. Weak bosons are typically confined where lepton discharge is highly unlikely, but an easy to follow path. As a weak boson diverges into a lepton pair, available hypersurfaces form entanglement band pairs called flux tubes. Asymmetry is dynamic with band synchronicity (crossing).

Energy rotates bands in/out of charge potential. The synchronicity angle (σ) is the degree of asymmetry. Complimentary asymmetries form group symmetry with local charge interactions. The initial state of rotation crosses when the entangled volumes are chiral (imperfect mirrors). This asymmetry prevents neutrinos from having a ground state. The neutrino exists by adding energy giving it non-zero mass by uncrossing the bands.

Neutrinos are everywhere for the simple fact that they are among the simplest particles in the universe to perturb. If that perturbation occurred as part of a group identity, it would be a Weyl fermion. As part of a discharge it would be a photon consisting of nothing but hypersurfaces. But because it occurs in a free space as transient energy, the volume created is the available space holding its hypersurfaces together.

Volume and surface must interact to satisfy the geodesic field equation. Satisfying the GFE is what defines surface gravity and discrete displacement consistent with ordinary mass. Weyl fermions have no surface features of their own. Photons have no volume features. Primordials and gluons fail to satisfy the mixing requirements. Weak bosons, leptons, and quarks fulfill the requirements with active microstates of hypersurfaces and hypervolumes—incomplete spatial definitions.

We usually think of entanglements as hypersurfaces subject to n-sphere conditions. The word “band” seems to best fit the 1-sphere mode. Energy adds into a 1-sphere (singularity=hypersurface pressure) as volume. For charged leptons this means contracting into a density, reducing the use of space. While crossing bands negates a generalizing axis, it forms a hypervolume—a 2-sphere. Volume takes on value by increasing its surface, expanding its use of space.

Quarks

Quarks, unfortunately, are never seen individually. They are only seen as a macrostate component of baryons. Like weak bosons, quarks are transitional. Quantum number convenience is the name of the quark game. Each quark is flavoured by a lepton (e, μ, τ) providing base charge. This is populated by a gluon-photon pair alternately interacting as two gluons OR two photons modifying the base charge.

As mentioned before, when you cross active axes you create a volume with a common electric charge axis. Gluons and photons individually do not have weak or electric charges. Put into the context of mutual interaction in a weak field and they have a charge effect of ±⅓ as a pair collectively. More accurately, it is half the scale of the Weyl fermion parts of the interaction, which statistically reduces to ⅓.

Down (e), Strange (μ), and bottom (τ) quarks are flavoured by a neutrino. The gluon-photon pair gives them 0±⅓ charge. Charm, up, and top quarks are flavoured by a charged lepton. The gluon-photon charge effect is ±(1–⅓)=± ⅔. It is important to remember the conditions of this charge effect, shown on the periodic particle table as 1/6. It is never actually 1/6 because a charge axis rquires interaction of two active axes.

A photon-lepton (one of each) combination is known as a topological polariton (topolariton).[16] It has a unit of electric charge and ½ spin. On an atom it would quantum leap apart discharging light. In free space, it acts like a spherical wavefront within the field, holding its focus and information. These particles so far have only been seen as man made. They are the closest thing to a quark without actually being a quark.

Hadronization

In Dr. Who, whenever someone first steps into the TARDIS, they have to comment about how much bigger it is on the inside. Latent energy gives us our concept of space as vast. Brought into focus to form matter, the vast latent space gets compacted. Nothing is more compact than degenerate density. Degeneracy is our last section.

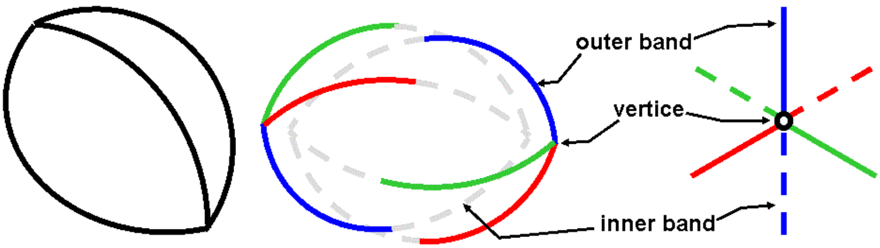
Quark bonding is more like the nested meshing of a novelty puzzle ball as below. It is really better described as a lepton combination than a quark combination. We are terming it strong type V (five) because it has unique elements. Like the puzzle ball, parts from the surface also make up the core, while others simply mesh like a layer of filler. To describe this formation as simply strong bonding is to not give the full set of responsible interactions credit.

[17]

11.14: IQ Puzzle Ball/Quark Bonding Example

Trion

A truly baffling band arrangement are the trion-shaped bands of rgb and cmy (Type II Weyl fermions). Michael R. Evans named this shape "trion re" for its shape and the crystalline prism effects it has on light. Of course the quantum universe couldn't just leave a shape so simple. True to form, given two potentials, the quantum universe is happy to utilize both at its convenience. It is a quantum quagmire.



11.15: Michael Evan's Trion and Trionic Bands

The trion with rgb bands consists of entangled cmy at the vertices (ends) where rgb intersect. They don't intersect at the equator because they are rotated to appear as cmy intersecting rgb relative to each other. They also don't occur concurrently, and edges of one side are connecting to faces of the other. The band associations swap places since they are not fixed commodities and each interacting primordial has two potentials.

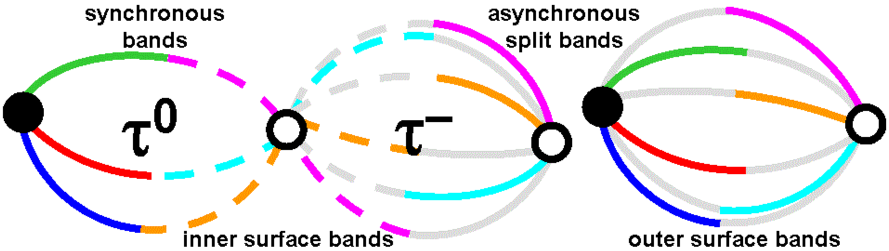
This sounds like purely academic detail. It is extremely relevant on many levels. Without the quagmire, tau leptons could not be used as both core and surface of baryons. It is also extremely relevant with type VI (6) of the strong interactions bonding baryons and making isotopes possible.

Their bizarre quasi-temporal nature makes exposed tau bands vulnerable to oscillation,[18] identity change, and ideal for their unique role in hadrons. That role can easily be described as a quantum tunneling-style system of entanglement. The bands in use are whatever (color) quantum number is available at that cycle point. Similar opportunism is common in neutrinos, gluon singlets, and weak bosons.

The quark's identity is almost completely lost—just enough evidence to be a macrostate group. The gluon-photon sets alternately form type II bonds—more Weyl fermion components. These come in tightly wound layers and cross-layers of flux tube band pairs. At the core of a hadron, for example, is a degenerated Higgs boson. It is degenerate because it is only its volume.

Gluon-photon bands in quarks already conditionally passed through a lepton layer, separating their halves between outer and inner. For hadrons they now form tau bands holding an outer-core of Weyl fermions and their mantle of lepton-like interactions between outer membrane and core volume (both unavailable).

Membrane includes volume and flux tube bands available as Fermi surface. Membranes can weakly interact and have strong type VI bonding potential. This numbering is convenient for remembering that type V occurs between quarks of generation 5 and type VI for baryons of generation 6.



11.16: Trionic Band Synchronicity

The separated surface is very important. It deprives the Higgs core from a direct GFE interaction leaving it a quantum variable in this respect. The leptons that were quark flavours now make up the outer core and mantle layers of the baryon. This layer is another membrane: a surface with depth. Baryons thus have two membranes and a volume filled in part or completely (as with nucleons).

Dilation has a profound impact on degenerate field behavior and how the spaces are being defined. They no longer behave anything like particles of lesser generations. These are fully constructed spaces with multiple mostly static macrostate groups. These trionic band macrostates help explain nucleon formations and the structure of hadrons the invites an electric charge axis bonding protons with electrons. This is yet another step in the direction of finally achieving static micro and macrostates.

Endnotes

1 (2016). Cliffs Notes: What Is Anatomy and Physiology? cliffsnotes.com/study-guides/anatomy-and-physiology/anatomy-and-chemistry-basics/what-is-anatomy-and-physiology.
2 McGovern, J. (2004). Microstates and Macrostates. Univ. of Manchester. theory.physics.manchester.ac.uk/~judith/stat_therm/node55.html.
3 Bain, J. (2014). Boltzmann Entropy, Gibbs, Entropy, Shannon Information. faculty.poly.edu/~jbain/physinfocomp/lectures/03.BoltzGibbsShannon.pdf.
4 Nave, C.R. (2017). The distribution of 9 units of energy among 6 identical particles (et seq). hyperphysics.phy-astr.gsu.edu/hbase/quantum/disbol.html#c1.
Hock, K.M. (2014). Basic Statistical Mechanics. University of Liverpool. http://hep.ph.liv.ac.uk/~hock/Teaching/2013-2014/1-basics.pdf.
5 (ret. Apr. 28, 2019). W Particle. atlas.physicsmasterclasses.org/en/wpath_lhcphysics2.htm.
… More about the Z boson. atlas.physicsmasterclasses.org/en/zpath_lhcphysics2.htm.
6 Cabibbo, N. (Apr. 29, 1963). Unitary Symmetry and Leptonic Decays. https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.10.531.
7 (ret. Apr. 27, 2019). Weak mixing angle. https://physics.nist.gov/cgi-bin/cuu/Value?sin2th.
8 Okun L.B. (1982). Leptons and Quarks. North-Holland Physics Publishing.
9 Image credit: Foresman, P.S. (Nov. 5. 2015). Asymmetric. wikipedia.org/wiki/Asymmetry#/media/File:Asymmetric_(PSF).svg.
10 (ret. Apr. 28, 2019). Electric Charge. wikipedia.org/wiki/Electric_charge.
11 (ret. Apr. 28, 2019). The Z boson. atlas.physicsmasterclasses.org/en/zpath_zboson.htm.
12 (ret. Apr. 28, 2019). The Z boson. home.cern/science/physics/z-boson.
13 Weisstein, E.W. (ret. May 1, 2019). Chain Rule. mathworld.wolfram.com/ChainRule.html.
14 Cheng, T.P. & Li, L.F. (2006). Gauge Theory of Elementary Particle Physics. Oxford University Press.
15 (ret. Apr. 28, 2019). The Z boson. atlas.physicsmasterclasses.org/en/zpath_zboson.htm.
16 Refael, G. et al. (Jul. 1, 2015). Topological Polaritons. CalTech. https://journals.aps.org/prx/abstract/10.1103/PhysRevX.5.031001.
17 (2018). 3 IQ Puzzle Ball. Littleton, CO: Dollar Item Direct. dollaritemdirect.com/iq-puzzle-ball.aspx.
18 Affects mass $\Delta m^2 L/E$. Boyd, S. (Mar. 24, 2015). Neutrino Oscillations. warwick.ac.uk/fac/sci/physics/staff/academic/boyd/stuff/lec_oscillations.pdf.

12. Brane Surgery

Proteins connect cells to form tissues, and function connects tissues as organs. One simple sentence connects histology to physiology. Any pattern of connectivity like this is easy when you find the right variables. Finding those variables does not exclude any other variables, it simply shows how the disparate things connect.

Spacetime connects everything in physics. The discrete case specifically constructs the spaces of matter from simple axes to complex systems of macrostates. In biology this is like mapping the path from chemical elements to an organ in an individual organism. The discrete case is all perturbations—all the virtual matter macrostates. These are all passively dependent on their material or field contexts.

A primordial particle is similar to a string (a one-dimensional extended entity). We start with applying value to a dimensional context, the context then extending to the other dimensional qualities of the entity. The value as a point naturally extends to a hypersphere axis defining a manifold space. These axes interact to confine into a point of spacetime in degrees. In their most primitive applied forms, axes are essentially branes.

> (In String Theory, branes are) physical objects that generalize … point particles to higher dimensional objects.
> The term derives from the word membrane that was originally used to describe 2-dimensional “particles”. When the need was felt to speak also about 3-, 4- and higher dimensional such “particles” the usage “3-brane”, “4-brane” etc. was introduced. Ordinary particles would be 0-branes in this counting, the strings in string theory would be 1-branes and membranes themselves 2-branes.[1]

QR confines into an “ordinary” point particle (e.g. a baryon). QR manifolds are complex elements of a hypersphere—commonly referred to as “higher dimensional.” These elements confine into the more familiar simplified geometry, which for QR would constitute “higher dimensional” because it is constructed from more fundamental. Our primordial brane is a hypersurface with no depth that can apply in or on a volume or as a plane. A membrane likewise describes a surface with depth.

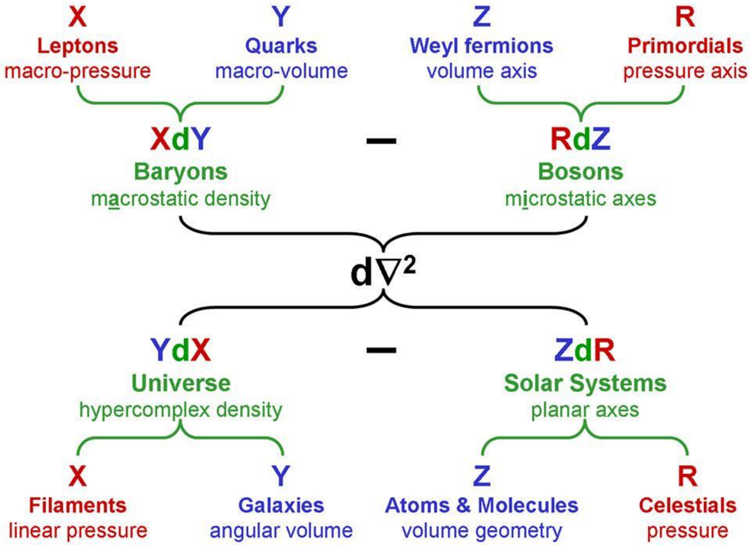
Physiology

To conceptualize, you need to show a reproducible pattern: a process of interactive systems (e.g. organ physiology) and their details (e.g. cellular and tissue histology). Physiology and histology provide an excellent analogy for constructing functional discrete spaces. Physiology is the big picture. Spacetime is a dynamic range of things evolving and transforming into each other. We showed this with light as a single latent space transforming across six stages by passing interaction with other spaces.

The discrete case constructs identity focus through six stages. The pattern explains how spaces form and are related to each other. In any one of these stages we have a histology that applies all of the manifolds. As such we must be cautious to distinguish between the manifold as applied in a specific context like the spaces of a color charge. Each color charge has its own manifold, but generalizes as a hypersurface (R).

Bosons are the only place where microstates and their related Bose-Einstein statistics technically apply. The reason for this is the simplicity of boson constructs as active perturbations. Throughout this text you see the term microstates being used to describe active conditions, including in complex and static conditions better described as macrostates.

Weak bosons are generally interpreted by microstates of equal parts where the energy swaps places. They also have macrostates, meaning more than one context by which their anatomy can be organized into containers. Because these are still equal, they do not affect the statistical analysis.



12.1 Manifold Generalization Pattern

With everything else, however, things are a tad more complicated. Primordials and Weyl fermions do not own their microstates. They are essentially passive effects of perturbations. The energy exchanges are among the perturbing sources. Lepton flux tubes provide two levels of scale for energy exchanges (macrostates), as do their flavours. Quarks have disparate levels of scale plus oscillation and macrostates, and baryons have multiple macrostate potentials.

When we consider how matter is constructed in sequence, related, and the macrostate contexts, we realize that each generation can be generalized by one manifold. This enables us to put the latent and discrete processes next to each other and see they are clearly related.

We have divided spacetimes into latent, discrete, and distribution. Now we further subdivide these into mirrored processes. Latent spaces are actively propagating (R→RdZ→Z→X→XdY→Y) into passively being. The passive spaces are the ambient temperature and pressure that apply in time-like space (e.g. distribution across time). Passive spaces become active in discrete or latent terms by reversing the process.

A similar pattern occurs with matter. Despite active microstates, particles are essentially the passive form of matter—the universe acts on them. Constructed in sequence we would see R→Z→RdZ→X→Y→XdY. In reality, however, they usually come out of higher generation processes as-is without passing through these phases. The energy accumulates in the available space until it quantizes as that identity and emits.

The generalizations for the higher orders of matter are indicative of their expected emissions. Celestial objects are expected to emit light (R) and do. They can be powerful enough, especially with the group dynamics of solar systems, to slowly construct particles in sequence up to and including protons and neutrons as needed to forge atomic nuclei. This is a reasonably accessible level of energy fitting our perspective.

Galactic processes mass-produce density volumes (Y=quarks) so quick that baryons emit but nuclei cannot form. Instead, the neutrons decay to protons, capture an electron and complete the Lyman-α process (hydrogen creation). Despite quark theory, this is hard but not impossible to replicate. It is simply harder for us to conceive that protons and neutrons can be created as-is because quarks never occur alone.

Weyl fermions are known to occur in alloys, linking them to the group dynamics of atoms. These patterns suggest that filaments could contribute to leptons somehow, and not just share the electric-arc pattern. This could be considered a reasonable assumption if on thinks of filaments as the universe's idea of a current. The galaxies in that current would be contributing their emissions and shared energy conditions consistent with density turbulence consistent with perturbation (e.g. creating waves on the surface of the current).

Unfortunately, most of the active universe is outside our realm of direct observation. We can certainly reproduce perturbations of all the particles, and see why we can't observe their distant counterparts. It is imperative, however, that we do not project speculations to distant observations that are not supported by the physics we can reproduce.

From the perspective of the universe, the processes most accessible to us are also the least representative. They are least representative because galaxies mass-produce hydrogen that is then rolled together into celestial objects and solar systems. This stacks the deck in one contextual favor. All perturbations and subsequent oscillations naturally follow the lead of that asymmetric setting.

Our concern is with purposing value into material identity that constructs discrete spacetimes. We want to know how these spaces are constructed leading into the nature of displacement and the resulting fields.

Relativistic spacetime emerges when the GFE apply in a complex multi-stage developmental process.

1. Extra-temporal color charge surfaces are valued.
2. Temporal phase impositions apply to define fields with strong potential.
3. This is confined in a quasi-temporal interaction such as
   - bond creating a subspace volume (flavour)
   - entanglement creating a subspace hypersurface or hypervolume
   - transient (weak) interaction creating both surface and volume from the same interaction satisfying GFE.
4. Transition glomes (mixes) volumes and surfaces together into a common manifold satisfying the GFE.

Basic Axes

The first mistake we make is to assume space works the artificial Euclidean positioning we learned in algebra and geometry. This is only a mapping convenience, not how reality works. If you want to understand how reality works, start with energy constants and Thermodynamics that show linear and angular applications to lengths, surfaces, and volumes. These axes come in three basic types: radiant active value (inertial), absorption value (potential), and propagating (microstatic).

These applications of energy to define space are your true axes. Yes, with 0-sphere mode you can artificially put them together like Euclidean axes, but that doesn’t make them Euclidean. Axes don’t have the courtesy to always intersect at zero points. Right angles are only certain where they are connected as a complex change axis where negative is a direction. Then there are always and only two axes for one change function.

We expect axes to simply connect at their origins and go on indefinitely. Basic axes don’t necessarily connect at all and are the extent of their values. We also expect a surface to apply either as a plane or on top of a volume. Hypersurfaces can occur within a volume as functional but inert variables like heat, flexion and hardness, or dynamic potentials like quantum foam or entanglement bands.

The universe does not conform to our conveniences. When you can finally accept that, then you can also see how spacetime is constructed in degrees by how these axes are put together. Those constructs are specific perturbations of virtual matter. These axes and their constructs provide macrostate contexts that can be static and include dynamic microstates obeying Bose-Einstein statistics.

A basic primordial axis can be static (fixed) or dynamic (changing), and applies with hypersphere logic. A 0-sphere reduces to a simple dimension. In 1-sphere mode, the value translates into a hypersurface (plane). As a hypersurface it can regulate flux (value flow). In 2-sphere mode, the surface applies to a volume. A 3-sphere is a volume.

A dynamic axis has propagating features (information) causing active microstates conveying value among a set of confined spaces potentially gloming (mixing) in 4-sphere mode. In this way, a basic axis macrostate can be used to describe all 46 identities of the first four generations of matter (including leptons). Weyl fermions, weak bosons, and leptons have an additional macrostate where volumes are decomposed into composites of primordial axes.

A hypersurface (brane) has only one axis with three possible modes (0 – 2). A latent hypersurface (light) begins to propagate with a total energy value (0-sphere) compressed into flux density (brightness). This brightness is the totality of its 1-sphere, the wave function squeezed within a cycle. The wavelength is initially short, but as the light propagates, it stretches and flattens out. In simple terms, light converts from 0-sphere (raw value) ultimately to 2-sphere (hypersurface).

Discrete hypersurfaces are perturbed by focusing kinetic energy—motion to include transient propagations, velocity, and group behavior. This value is not transferred, it is shared. To convey the value it needs to be glomed with absorption to enable propagation, and not be confined. In the absence of such a mixture, the hypersurface remains intrinsic to its perturbing group.

Instead of unfolding modes to propagate, they apply contextually and simultaneously. The causal perturbation of a typical hypersurface is group function defining its own 2-sphere container. This includes displacement creating a negative space that cannot be emitted like a gravity well. Put another way, the volume of content is causal of the surface. The more active the volume, the more intense the surface feature.

This common function of causal perturbation classifies it as a Cauchy hypersurface.[2] The 2-sphere is thus the domain, and local variations (0-sphere) would be anomaly of density applied to the 1-sphere range giving the surface depth. Sun spots are a prime example of such a surface losing value to emission. The anomaly of gravity measured by GRACE satellites riding along the surface is another example that cannot be emitted.

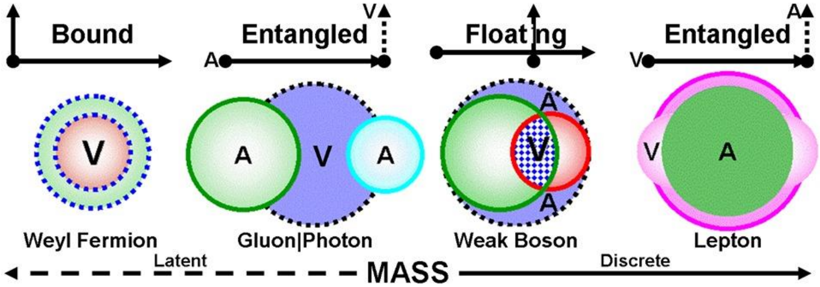
Conversely, a singularity's domain is the irregular aspect of the Virial perturbation. The range is the event horizon (relative plane), and the volume potential is its displacement density. The perturbation becomes internal relative to the degree to which the volume potential fills. In the absence of a gloming effect to confine and regulate, exclusion will eventually emit the value. Gloming can provide a way to recycle exclusion.

Basic Interactions

Primordials are hypersurfaces like surface tension and pressure. They are simply an axis giving value to a shared quality that could be shared or potentially transferred. Like Weyl fermions they are usually a function of group dynamics. You can't just put them together to form other identities because they don't have a functional change axis. A change axis requires absorption information to apply a second axis.

Modeled with a change context, primordials bond (Weyl fermions), entangle (photons and gluons), and transiently "float" (weak bosons). The main differences are whether the axes intersect at some point in phase, at the edge of phase, or at an intermediary point.

Magnitudes, perturbation causes, and micro/macro-states are the only other differences among the virtual particles. Primordials and Weyl fermions are uniform such that they are relatively static and only have a singular macrostate.



12.2: Interactions Compared

A macrostate is a way to divide an object into containers energy would apply to. A Weyl fermion, for example, has two macrostates: a primordial axis in volume context OR primordial intersects creating volume context. While these components are equal, they are simultaneous. Value cannot flow between them so there are no microstates.

Microstates describe specific energy distributions in a macrostate of equal parts subject to Bose-Einstein statistics. In plural form, macrostates can describe several systems that contextually apply. Each typically has elements of different magnitudes.

Where primordials and Weyl fermions have one static macrostate, bosons have dynamic microstates. Photons are primordials with a microstate condition just as gluons are Weyl fermions with a microstate condition. What differentiates them from leptons is which axes are active. The more complex axes creates a weak macrostate that includes elements of two magnitudes.

Weak bosons enjoy the best of both of these worlds and have equivalent macrostates. Weak bosons are very similar to quarks. Weak bosons alternate their active volumes and surfaces, whereas quarks have established volumes and surfaces despite floating axes. Thanks to macrostates, weak bosons, leptons, and quarks are able to satisfy the GFE and have discrete mass.

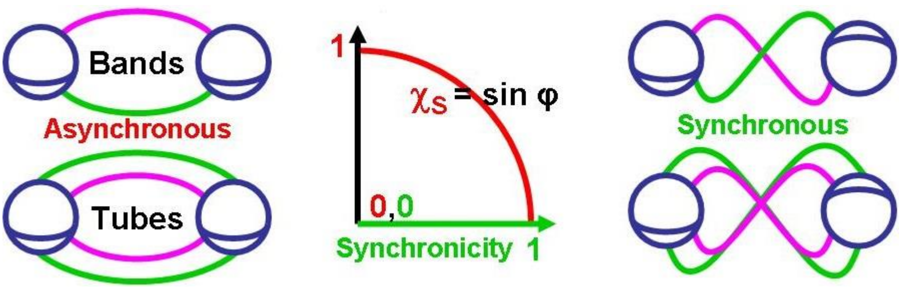
Entanglement

In an active (microstatic) macrostate, entanglement is the available change axis called a band. Microstates apply specifically to primordial change axes. As such, every band is of primordial scale relative to a primordial part of the identity. Two entangled parts will necessarily share a pair of bands going opposite directions. Parts that are bound and then entangled have complex band pairs called flux tubes.

In all cases of entanglement, the entanglement is the defining feature of common identity. The bands are the common change axis allowing propagation of radiant value among the parts. The bands define the reference frame scale and limit the range of entanglement. The absorption value alone is the minimum value and quantization is the maximum.

As an available axis, all transient values act on bands causing them to expand then contract back to their natural sizes upon emission. When the transient value quantizes and emits en masse, the bands snap to their ground state lengths like a rubber band. This snapping effect is how they got their name. The distribution of a propagation within any space affects its shape. In an entanglement band this can trigger oscillating into another identity.

Leptons are entanglements with volumes. When axes combine, their crossing mixes them (φ) to form a volume (synchronize) or run parallel forcing a surface (asynchronous). Bound axes necessarily cross. Failure to cross is a weak boson. When bands cross (neutrinos), the result is an attributed volume. An attributed space can act or be filled, but cannot be acted on to satisfy the GFE and have discrete (ordinary) mass.



12.3: Band/Flux Tube Synchronicity

To be in temporal phase and act as a surface, the bands must be asynchronous—not cross over each other. This occurs with gluons and charged leptons. Crossing over only cancels the ability to function temporally (a synchronous chi=χ_S function). It does not cancel the entanglement, only electric charge interaction.

Photons are colors entangled with their mirror image, where neutrinos are entangled chiral pairs. Either way, the parts are in opposite aspect positions causing the bands to synchronize. Adding energy or filtering to change relative rotation causes them to unwind and acquire relativistic qualities like dilation, slowing them from their ideal c-speed.[3]

Accelerating a neutrino adds mass to resist and triggers oscillation that can change flavour (Weyl fermion identity).[4] This was falsely attributed to ground state mass as quoted in the Nobel press release:

> The discovery led to the far-reaching conclusion that neutrinos, which for a long time were considered massless, must have some mass, however small.

A neutrino as a perturbation with non-zero mass has no rest/ground state. Mass as a function of particle definition consists of parallel concepts of momentum and satisfying the GFE. To have mass at ground state, the GFE surface-volume interaction must be satisfied. Synchronous bands neutralize the surfaces making ground state mass impossible for neutrinos. The Nobel Prize was given to

> Takaaki Kajita in Japan and Arthur B. McDonald in Canada, for their key contributions to the experiments which demonstrated that neutrinos change identities. This metamorphosis requires that neutrinos have mass.

Neutrinos don't have a ground state to set minimum mass as anything but >0. At rest, the bands are synchronous, canceling the effect by forming an attributed volume that cannot be acted on. To be interactive, kinetic energy must be added to rotate the bands into surfaces. That kinetic energy is added by means of momentum. As such, neutrinos do not have a rest mass or ground state. The terms do not apply.

Lie Algebra

Like $E=mc^2$, $XdY - RdZ = d\nabla^2$ does not distinguish latent from discrete. This is essentially the Yang-Mills "mass gap" problem. "The successful use of Yang-Mills theory to describe the strong interactions of elementary particles depends on a subtle quantum mechanical property called the "mass gap": the quantum particles have positive masses, even though the classical waves travel at the speed of light."[5]

This problem is a misunderstanding of the variables. If you take a big enough picture of any latent field, you will eventually reach a discrete result. The Yang-Mills challenge is suppose to be answered using Lie algebra. These are great for interactions, and mass does require interaction. What is missing is defining the variables in a way that distinguishes discrete from latent. Let's start with the basics of Lies.

A Lie group is a differentiable manifold with smooth group operations, providing a continuous symmetry (e.g. as a simply connected motion).[6] In a Lie bracket group [u,v], u is the function of change, the metric applied to v. Complex definitions like B±C form a chain, and a cross symmetry emerges as illustrated.

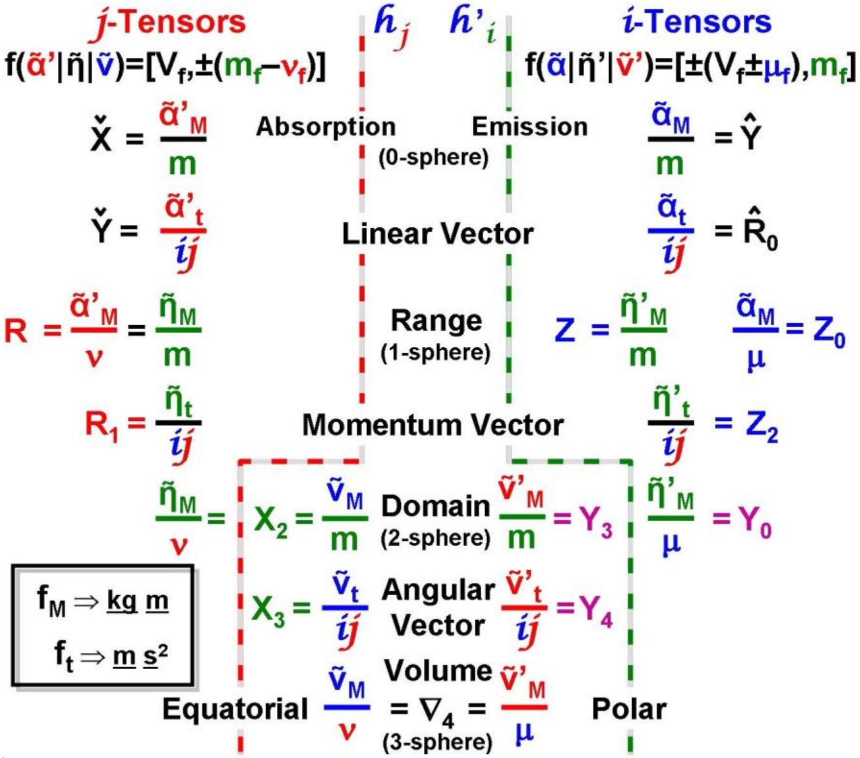
$$[A,B+C] = \mathcal{L}_A B + \mathcal{L}_A C = [A,B] + [A,C]$$

$$[A,B-C] = \mathcal{L}_A B + (\mathcal{L}_A C)^{-1} \qquad C = F/(\nu|\mu)$$

$$= [A,B] - [A,C] = [A,B] + [C,A]$$

12.4: Lie Algebra Basics

To define our variables we need the right dimensional analysis. We will come back to the dimensional analysis much later. For now we adapt flux value units (α̃,η̃,ṽ) to apply them within latent mass (ν and μ) and discrete change contexts (mass m, and acceleration vector *ij*=s²). Latent mass by definition as <u>resistance to distribution</u> is the density (brightness) of its energy (frequency). Discrete mass, by definition as <u>resistance to acceleration</u> is affected by motion and Lorentz factor.



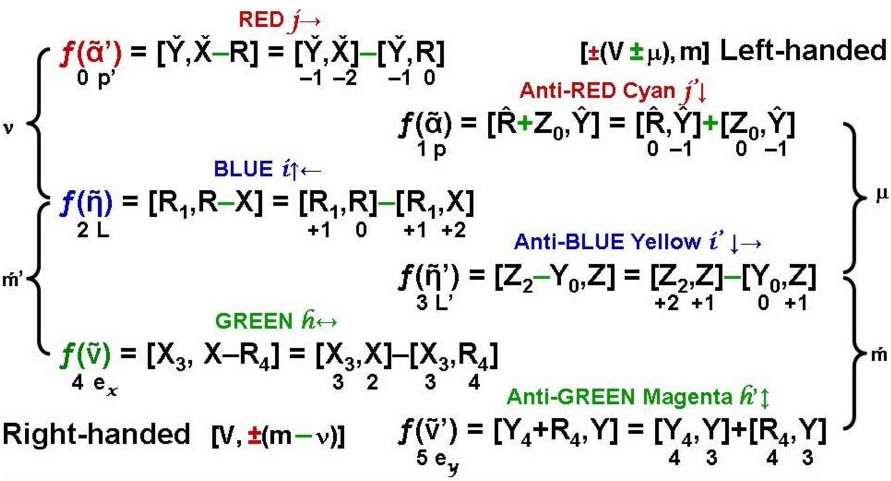
12.5: Lie Elements of Sub-manifolds

The problem with using Lie functions to solve for mass gap is understanding the interactive directions of the variables. At the top of this list of variables we see embellishments to indicate coming into focus (absorption=∨) or going out of focus (emission=∧). There is a clear sequence of events going down the *j*-tensors forming mass and geometry from latent, then up the *i*-tensors into latent.

The gap resolves at R where latent mass of singularity ($\nu=\tilde{\alpha}'_M/R$) is indistinguishable from discrete kinetic mass ($m=\tilde{\eta}_M/R$). The kinematic mass of Virial theorem provides the value needed to perturb the singularity. Of course only a tiny fraction of that kinematic energy translates into the singularity. It is all popularly referred to as "dark matter," confusing things unnecessarily.

It is still not technically a discrete mass until ν and μ are glomed in the 3-sphere geometry at the bottom of the variables list. Even here, all you see is Laplacian spatial distribution, not the gloming. At best your variables are being defined relative to discrete mass. You aren't defining discrete mass without the change context to establish a discrete spacetime.

At the top of the diagram are generic Lie statements relating left and right handed flux functions to manifolds. As time derivatives, these are "momentum" (p, L, e) lie groupings of flux variable functions (below). They are only momentum in discrete application, where each complex axis has two grouped vertically. Combining is what establishes the complex axis. Without it, the flux variables generalize and the group is horizontal as the transformation through redshift unfolds vertically.



12.6: Right-Left Lie Fields

Remember that m is not always a discrete mass. It could be latent. This alone does not solve the mass gap. The numbers beneath sequentially layer the axes. The key difference between left and right is whether the change applies directly to the vector manifold (u=V±μ) or dilates the available change manifolds (v=m – ν). Solving this reveals yet another element of the mass gap issue: time. For the Lie derivative definition: f(F)=[u,v]→[u,v](F)=

$$\mathcal{L}_u \, v(F) = \partial_u \, v(F) - \partial_v \, u(F)$$

where:

$$\partial_u \, v(F) = \lim_{t \to \infty} \frac{v(F+tu(F)) - v(F)}{t}$$

12.7: Lie Derivative Definition

Discrete mass is contained by a time-dependent function like the definition above. Latent mass is contained by space and distributes across time. The Lie functions here are only addressing the numerator. They are not handling the mixing dt=$\partial j+\partial i$ to create the temporal variable in the denominator.

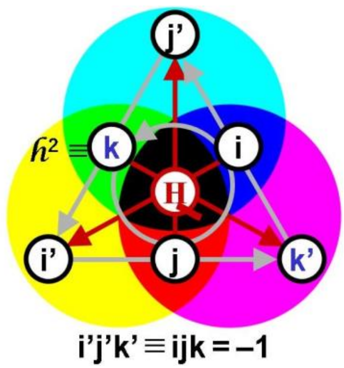
Octal Confinement

As I glome together these axes, I ask myself why weak bosons are transitional. Why don't they just keep focusing and stabilize into a degenerate density like a proton or neutron? What is the magic number of parts needed for static microstates?

So I look at their parts. Weak bosons have 2 complex axes where nucleons have 10. The 2 axes of a weak boson are good for establishing an electric charge axis or not. If I take that off the top of the nucleon, that leaves me with 8 axes defining the subject consistent with degenerate density, and 2 axes defining the object of available hypersurface in the form of a mutual electric charge axis.

The complex variables we've been working with are individualistic. They lead into group behaviors, but once confined things get trickier. I needed a group logic to handle this group dynamic, Octonions appear to fit this need. Also known as octaves or Cayley numbers, octonions are a form of quaternion with useful potentials. The definitions are based on context in group dynamics. Of course the logics leading from individual logic to group experience a significant change in perspective, but they rhyme. So let's start with the octonion logic using ordinary font.

	j	k	i	H	j'	k'	i'
j	−1	i	−k	j'	−H	−i'	k'
k	−i	−1	j	k'	i'	−H	−j'
i	k	−j	−1	i'	−k'	j	−H
H	−j'	−k'	−i'	−1	j	k	i
j'	+H	−i'	k'	−i	−1	i	k
k'	i	+H	−j'	−k	i	−1	−j
i'	−k'	j'	+H	−j	−k	j	−1



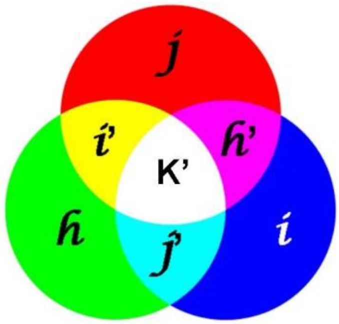
12.8 Octonion Logic v. Color Palate

This logic is simple enough to be diagrammed in a mechanical way with a triangular matrix. I superimposed it on a color palate because the two logics come very close. Symmetry is expressed by the order of operations best described graphically by the arrows in each set. This significantly enhances the color palate.

Consider the series i'→j→k'. On the table, j goes naturally toward k', so the interaction in that group balances oppositely jk'=–i'. Because i' gets to k' via j, i'k'=+j; etc. for the next two sides of the triangle. The inner cycle goes j→i→k, such that jk=i and ik=–j. Diagonals are easier:ii’=–H and i’i=+H. Finally there are the basic rules of all squares are –1 and ijk=–1.

The fourth “octave” or “octal” dimension comes in diagonally as helicity (H) emerging with the electric charge axis (Q). That helicity is the driving feature behind the signage consistent with symmetry. It is also the pivoting axis for renormalizing from complex variable color logic into octonion logic. So let us adapt the color palate (using Lucida Calligraphy font) to show where the common axis (Q) appears before we merge with octonions into one evolving sequence of logic.

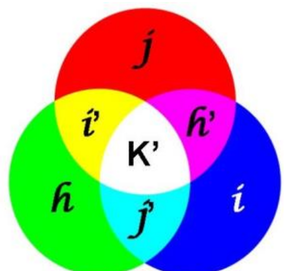
Q	j	h	i	j’	h’	i’
j	–1	i’	–K	–0	i	K’
h	i’	–1	j’	i’	–0	j’
i	K	j’	–1	–K’	j	–0
j’	+0	i’	K’	+1	i	K
h’	i	+0	j	i	+1	j
i’	–K’	j’	+0	–K	j	+1

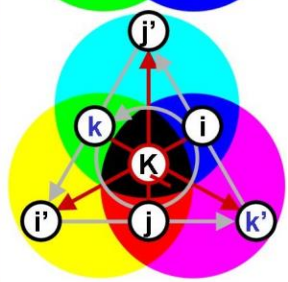


12.9 Color Logic into Electric Charge

The k axis (=ij=–1/k=h^2) is a generalization fixed relative to i and j, but all three are independent of Q. K’=kh is another generalization, fixed to k. When they affix, Q gets locked into a mixing angle (φ). The mixing angle is vital for determining the effective rate of geodesic interaction that defines gravity and mass.

Q	j	h	i	j’	h’	i’	K’	K
j	–1	i’	–k	–∅	i	k’	–j	j
h=√ij	i’	–1	j’	i’	–∅	j’	–k’	k
i	k	j’	–1	–k	j	–∅	–i’	i
j’	+∅	i’	–k	+1	i	k	–j’	j
h’=√k’	i	+∅	j	i	+1	j	–k	k
i’	–k’	j’	+∅	k’	j	+1	–i	i
k=ij	–i	K’	j	i’	–K’	–j’	–h’	h
k’=i’j’	i	–K	–j’	i	K	–j	h’	–h
K’=kh	–j	–k’	–i’	–j’	–k	–i	–1	+∅
K=k’h’	j	k	i	j	k’	i	–∅	+1





12.10 Evolving into Octonions

The table shows colors interacting in three ways: complex, confining, and electric charge. The complex interactions (resulting in *i* or *j*) can be volume forming unions or entangling intersects (hypersurfaces). The next interaction forces confinement. Confining (k) adds symmetry which allows the next level of interaction to define a charge axis. This enables the next level of confinement needed to ultimately attain degenerate density.

I replaced zeros with empty sets (∅) so you know not to cancel anything but the electric charge value. Once confined, the font type changes so you can see where renormalization applies. Once you have renormalized from individual to group logic, individual idenities are lost. Trying to go backwards from octonions into color charge is like trying to unbake bread.

As this shows, there are layers involved, and it is fairly easy in one interaction to accomplish multiple layers of confinement. Weak bosons are an excellent example, as they are not ordinarily associated with flavour except by output probabilities. Add to this the uncertainty factor of active microstates and no context to preserve a specific identity and you don't even know what kind of break you are trying to unbake. At least this way, you know all the paths to each result.

The hypercomplex ($\hbar$) is an unusual variable. It is lost in the initial interactions, then re-emerges at the end as electromagnetism. This is the active field next step beyond electric charge just giving direction or not interacting. This active field is what programmers would call a forced variable. There is too much value to be stored in the space given, so it is assigned a space relative to the space given so the value is projected away without violating boundary conditions. As active, it is a continuous microstate simply feeding its value back into itself.

Lie Distributions

In the Yang-Mills challenge, lie algebra tends to lead the mind to focus into distributions in space, like brightness. While providing the amplitude of density as function of field interactions, lies do not provide the mechanism for the substance of value. For that we look back to how light works.

With light, brightness describes the energy density in space. Conversely, the information of light is what defines its energy. That is contained within the scalar wave function of its cycle whose density in time is frequency (υ). Planck's $E=h\upsilon$ puts that scalar distribution in time relative to conventional discrete mass, not space.

Mass is a byproduct of displacement from the geodesic field equation. The GFE easily translates into a discrete distribution function. Every distribution function contains an axis available to be filled. That axis is the measure of available change. When you fill that axis with value, you add space and displace change. The more you fill that space, the less is available to act on requiring an increase in energy to act on that space and resisting the related velocity=mass.

Yes, mass is a use of space problem. It is a use of available space problem, which is a function of distribution. The specific information in the distribution is not relevant. We can generalize it as we have repeatedly in both latent and discrete cases using triangles. The triangles provide the mixing angles (φ) relevant to the change functions as mixed axes. That angle limits the period of the scalar function—the Fourier series defining the details of a cycle.

The process of octal confinement puts the change axes together making them real. Only real combinations are temporal. Unlike fields that interact in degrees, the change functions are truth logic that applies in total. When they are in the same space, they interact entirely. This makes color and flavour association easy to construct but impossible to deconstruct without using probabilities. The change function gives metric shape and scale to a space. When the change function is time, the shape is flat and the scale becomes a function of dilation derived from the availability of space for energy to act on.

Again, time is there or not. It is there if the change interaction provides a real number (e.g. 0,+1,–1,k). Empty set (∅),imaginary numbers ($\hbar, \imath, \jmath$), and their chirals are atemporal. Atemporal means they do not describe a distribution in time. They are strictly spatial definitions given magnitude, contextual shapes, and direction. These perturbations have latent mass.

Hypercomplex symmetries (i,j,K) have conditional discrete mass. They and the initial weak bosons are the mass gap problem. The condition is a proximal context making hypercomplex symmetries real, like an electron with a proton ($\hbar$). An ion is a latent perturbation ($\imath$) that becomes discrete (real, $\imath\hbar$=+1) put in the charge context. Our perspective creates a habit of treating ion perturbations as real electrons; and that habit carries over to other leptons leading to erroneous speculations.

The mass gap problem has two features: time and mixing angle. The mixing angle is there for all matter with at least one complex axis, which provides an available timeline to mix with. The timeline is a unit axis that is the nature of the available axis or not. The mixing angle links the available axis to the density of radiant value. If the available axis is time, the density is its wave function (ψ=tυ), a dilation of spacetime (ψ =γ) applied to the Lie function **γ $\mathcal{L}_u$ v(F)**.

The Fourier analysis defining the psi function as a scalar distribution makes it clear this is not as simple as it looks. The Yang-Mills challenge, like most modern challenges, is more a problem of understanding than a real problem of mathematics or science. We already have the solutions. As the Clay Institute mentioned, the issue here was simply identifying the mathematical foundation, which they surmised required new ideas. Sometimes the new ideas are simply a matter of taking a fresh look from a slightly different perspective.

Endnotes

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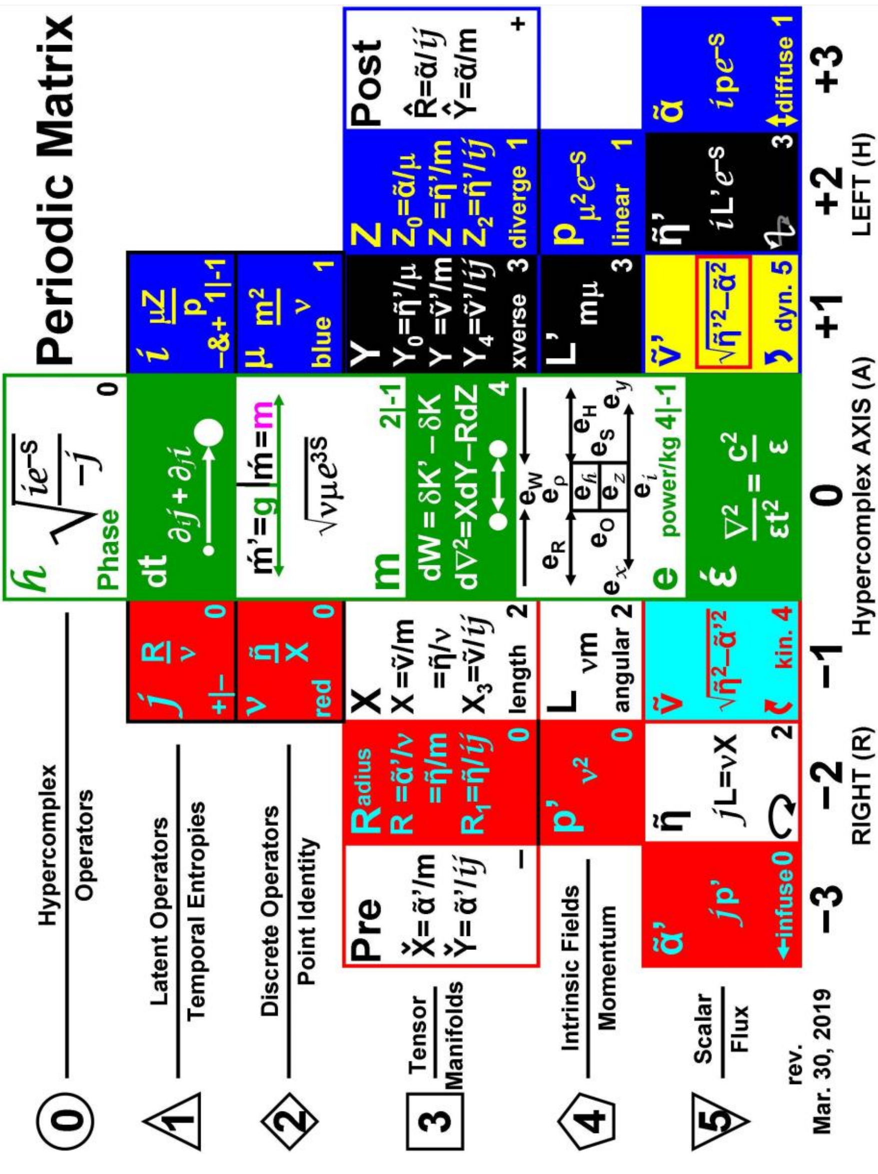
[1] nLab. (Jan. 1, 2019). Brane. https://ncatlab.org/nlab/show/brane.
[2] Budic, R. et al. (1978). On the Determination of Cauchy Surfaces from Intrinsic Properties. ccom.ucsd.edu/~lindblom/Publications/10_CommMathPhys.61.87.pdf.
[3] Giovannini, D. et al. (Feb. 20, 2015). Spatially structured photons that travel in free space slower than the speed of light. Science. Vol. 347, Issue 6224, pp. 857-860. http://science.sciencemag.org/content/347/6224/857.
[4] The Royal Swedish Academy of Sciences. (Oct. 6, 2015). Press Release. nobelprize.org/nobel_prizes/physics/laureates/2015/press.html.
[5] (May 21, 2019). Yang–Mills and Mass Gap. https://www.claymath.org/millennium-problems/yang–mills-and-mass-gap.
[6] Warner, F.W. (1984). Foundations of Differentiable Manifolds and Lie Groups. Glenview, IL. wisdom.weizmann.ac.il/~dnovikov/Manifolds5775/arner_Foundations_of_Differentiable_Manifolds.pdf.
Abbaspour, H. & Moskowitz, M.A. (2007). Basic Lie Theory. World Scientific.
Miller, W. (1968). Lie Theory and Special Functions. New York: Academic Press. https://www.ima.umn.edu/~miller/lietheoryspecialfunctions.html.
Ebrahim, E. (May 19, 2010). A Self-Contained Introduction to Lie Derivatives. web.math.ucsb.edu/~ebrahim/liederivs_tame.pdf.

The Distributive Case

> We are all agreed that your theory is crazy. The question that divides us is whether it is crazy enough to have a chance of being correct.
>
> —Niels Bohr, 1958
> to Wolfgang Pauli re: Heisenberg Uncertainty[1]

[1] Dyson, F.J. (Sept. 1958) “Innovation in Physics.” *Scientific American*. 199, No. 3, pp. 74-82. scientificamerican.com/magazine/sa/1958/09-01/.



Periodic Matrix of Fundamental Variables

13. Relative Field Theory

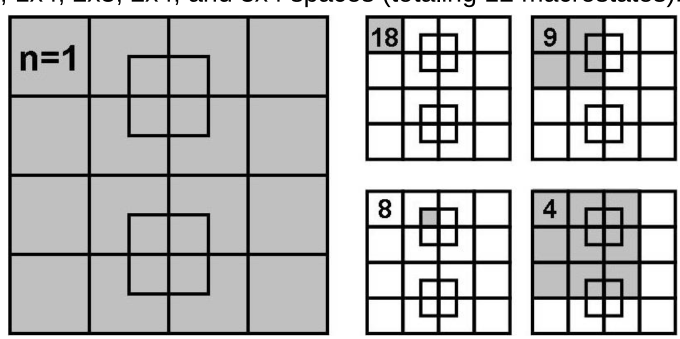
Wheeler explained Einstein's gravity succinctly: "Spacetime tells matter how to move; matter tells spacetime how to curve."[1] From the familiar perspective, the Einstein field equations (EFE) are abstractions leading to observable results. From a quantum perspective, it is all tangible and potentially observable.

Reconstructing the mechanisms shows levels of detail missed by the observational analysis perspective. Understanding the variables makes the EFE far more useful, showing several forms of gravity and insights into other fields. First we need to renormalize. Renormalization is a sequence of changes leading to relativistic identity.

Relativistic identities have macrostates that include groups of perturbation cases, each causal of other perturbations. The relativistic universe is our perspective, and accounts for less than 5% of the universe as a whole. That 5% exception does not mean exclusion from quantum effects. It is simply our domain of familiarity. By understanding the quantum aspect we can see the constructs and mechanisms of familiar phenomena.

Macrostates

A macrostate is a spatial configuration starting with the whole and deconstructing to all applicable lesser configurations. You can think of it like the puzzle below where n is the number of containers used if you can simplify to Bose-Einstein microstate statistics. If instead of how many squares the question asks for rectangles, you would need to add 0.5x1, 1x2, 1x3, 1x4, 2x3, 2x4, and 3x4 spaces (totaling 12 macrostates).



13.1 Macrostates Puzzle

Gluons and photons have two macrostates (whole and interacting primordial); weak bosons have three (adding interactive Weyl fermion). The unit macrostate is the static whole. Bosons have active macrostates where energy is redistributed in microstates among equal parts to define the whole. Energy changes in any particle resulting in active microstates are always evaluated as bosons. A proton has at least nine: its unit, structural geometry, trionic band, quantum foam, and groups of primordials (n=24), Weyl fermions (10), weak bosons (5), leptons (5), and quarks (3).

Redistributive exchanges only occur when the energy can propagate among multiple spaces. One such redistribution series of microstates in a macrostate is a cycle. That cycle resisted by time is a frequency, a unit of temporal displacement by space. It is not a geometry. A true geometry connects points into a whole distributed separately across time.

Geometrizing macrostates, like Weyl fermions as point-volumes, are exclusive of each other. This limits ability to quantum tunnel and related speculations of passing objects through each other by modulating frequency. Objects with geometrized macrostates are already pushing the boundary conditions for the use of space in time.

Macrostates can consist of quantities and irregularities (e.g. the half-sized squares) that can divert and complicate the energy flow into multiple frequencies. The details are not lost by generalizing, They emerge in contexts that activate those variables. While these separately are important, together they form a definition mixture.

Macrostates mix as a density (scalar magnitude) of unit frequency into a static temporal axis. Temporal context is a unit truth function that occurs when change functions (to include octonion evolution) interact to form a real number (0,1,-1, or k=-1). This provides the flat shape element of the metric. The scaling element of the metric is dilation of the dynamic axis. Value added to the dynamic axis increases the mixing angle triangulating the density relative to the static axis.

The dynamic axis defines the available bandwidth energy can act on. Adding energy narrows the bandwidth increasing the energy required to accelerate. It also increases the static axis and rotates the mixing angle. As active value, the transient energy manifests as a boson and limits the ability of related macrostates to function in their contexts.

Magnetic fields are a great example of contextual macrostate enabling. Added energy activates the geometric macrostate of a degenerate (nuclide) density enabling the field shaping. Neutrons direct the pathways for energy to cycle in a toroid-shaped space around the geometry. This is nature’s way to force a variable by directing the excess around. Too much energy simply quantizes and emits.

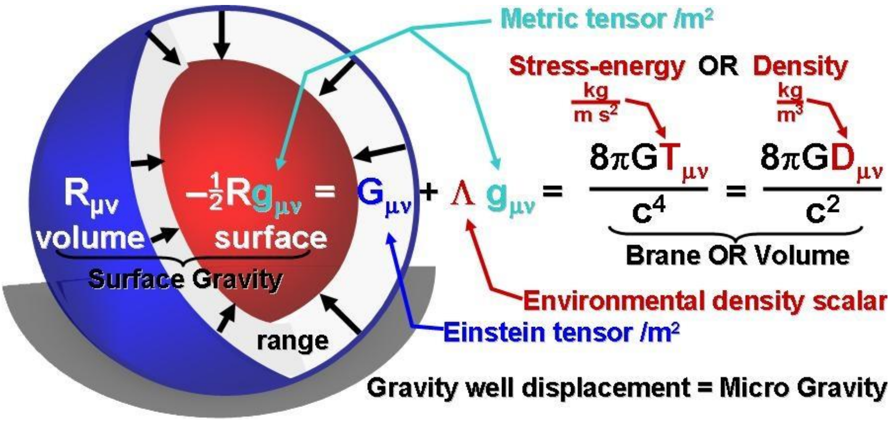
The macrostate concept is important not only for understanding the transition from latent to relativistic, but how relativistic things have their plethora of qualities. Ironically, that plethora also generalizes, simplifying the nature of matter as you go up the generations of matter.

We tend to think too much of things as having only one macrostate, like everything is put together from a fixed set of blocks. We forget that every whole has systems and can be broken down in a variety of ways, all of which are true and relevant. We look at the surface of the Earth and see distinct things, forgetting most of Earth is a confined set of field dynamics. All macrostates are relevant.

Macrostates also remind us that each value serves multiple roles. It can be difficult connecting these roles at times, as with hypersphere contexts. A change axis is distinct from the temporal density distribution affect the metric scale. A hypersurface as part of a complex axis applied as a 2-sphere volume frame is significantly more dense than its 1-sphere plane frame. A local variable like a geodesic manifold thus becomes significant to ranged interactions like orbits.

Gravities

Habit constrains General Relativity to a vague notion of geodesic surface gravity without boundary conditions. Like everyone else, Einstein also struggled with cultural habits short circuiting scientific reasoning and mathematical logic. Habits are the main obstacle to learning and evolving understanding. Here the habits are classical interpretations and a failure to break down the variables in a way that reconstructs their mechanisms.



13.2 Field Equation Manifolds

The field equation variables are manifolds. They adapt to context. You can't just look at them in one way. The variables ultimately account for all six types of gravity beyond the obvious and often misunderstood **surface gravity**. All we need is a better understanding of how the variables work.

Some are fairly easy to identify like **microgravity** or **surface tension** ($T_{\mu\nu}$). **Energy density** ($D_{\mu\nu} = T_{\mu\nu}/c^2$) takes a little more digging. Aside from linking to distribution, they are the reduced singularity forms of Ricci hypervolume ($R_{\mu\nu}$) and scalar hypersurface ($Rg_{\mu\nu}$). They further apply contextually to things like **specific gravity** within the range of surface gravity or **generalized** environmental effects ($\Lambda g_{\mu\nu}$) like orbital gravity takes a lot more savvy.

The worst habit is the expectation of gravity behaving one specific way. Contraction toward the origin is an expectation easily misconstrued. For surface tension (brane or quantum gravity), every point is an equal point of origin relative to every other point, and all the points contract toward each other. This combination of points can be constructed into or applied to a geometry, but is not itself a geometry.

Likewise, surface gravity does not conform to expectations. It only applies within a narrow range—a membrane between the interacting geodesics. It doesn't go all the way to the geometric origin or infinitely beyond fitting 18^{th} century reasoning of object permanence. Some of those theories were even clever enough to realize it would begin to work against itself. Some continue to linger in popular thinking.

The "infinitely beyond" is an inaccurate way to describe displacement in the fabric of spacetime causal of the microgravity effect and its related role in long-range interactions. This chain of effects without contemplating the mechanisms hasn't helped popular habits.

The assumptions were and are what went wrong with Einstein's cosmological constant "blunder." The displacement is not just limited to surface gravity. The environment sets a minimum boundary condition separating things in the environment from the generalization of the environment. In simple terms, it separates things from the background and the difference is the interaction between those things and the background.

The universe provides pressure and volume as a hypercomplex field. Complex displacements parse that field causing a complex action applied to a complex displacement. And the pressure field does not need to be cosmological. It is the static generalized effect of transitive interactions gloming (mixing) in a volume. Barometric or specific pressure has a limited range within the geodesic membrane and direction parallel to a surface. On a cosmic level the range is all but discrete exclusions and directions are contextually convenient.

This likens static pressure as a volume to Weyl fermions. Like surface tension, this is equal contraction relative to all points. In the GFE it is generalized as the Ricci curvature. Its nature suggests we can use the generations of matter to help sort the sequence of gravity types: brane tension, static volume, geodesic surface, specific, micro, and generalized dynamic volume. This has an added bonus of showing differences in magnitude.

For example, the mass of a proton (1.6726E-30g) is ~103 times greater than the masses of the two up (2×4.117=8.234E-33g) and one down (8.592E-33g) quark combined (=1.6826E-32g). Or expressed in electron volts, a proton is $938\approx103(2\times2.2+4.7)$ MeV/c^2.

The local (micro) effects of quarks by themselves are really small, but in a larger context, generalize together to a hundred times their micro-values. Fritz Zwicky's 1933 observation of the Coma Cluster having 100 times the expected mass sound familiar?[2] Zwicky was observing kinetic mass, the result of all these objects moving, which also fits the static condition of generalized gravity discussed here.

Gloming has a kinetic effect, as with combining quarks into protons and neutrons. The results are the same: increasing mass magnitude by about 100x. Habits of course insist the quarks remain in motion.[3] Problem is that a degenerate (nuclide) density defines a fully occupied point of spacetime leaving no space available to move.

You know there isn't room for one simple reason: any added value increases the volume to sustain the density. There is no room for motion or anything else even vaguely real. The closest thing to extra space is the electromagnetic "quantum foam" axis. It is a forced variable hypercomplex change axis. Extra value cycles relative to, channeled by, but not in the occupied space.

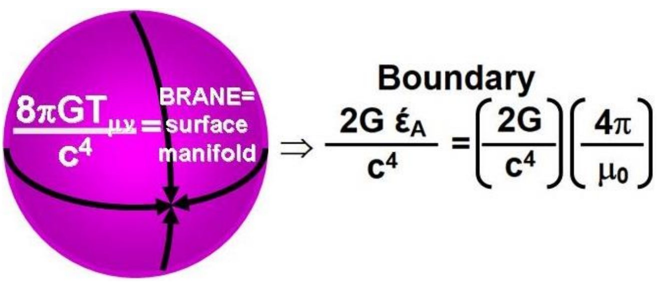
Gloming stores kinetic energy in a static set of macrostates. Among these with microstate potentials in the available band spaces identified as the "quantum foam" macrostate. This is the tiny bit of levity among the macrostates of a degenerate density. It makes active bosons possible and generalizes transient kinetic energy into momentum externalizing the effect as simple motion.

The static conditions make seeing the role of motion (kinetic energy) more difficult. Few would think to quantum-reconstruct spacetime and translate that into gloming then renormalize the kinetic into motion of the whole. Most follow Zwicky's lead looking past the definition of kinetic for something more tangible like a dark matter mystery aether. Only recently has anyone thought to relate the particle mass difference to motion. The math and observations are fine. Antiquated habits are in the way of right understanding.

Brane Tension

Gravity comes up last in order of intensity and first in sequence of fields. At the most fundamental level, the first strongly interacting field is a **brane**: true quantum gravity where, as Rovelli puts it, "quantum effects cannot be disregarded."[4] Einstein's universally accepted theory simply needs to be framed in a quantum perspective.

Contextual adaptation is a key quantum effect we cannot ignore. By itself, a brane is subject to hypersphere modes and their differences. The jump from mode 1 to 2 causes annihilation and confinement consistent with strong interaction. This context has an external dynamic perturbation such as the angular momentum ($T_{\mu\nu}$) of Virial theorem when Einstein's brane perturbs a **linear surface tension**.



13.3: Einstein's Brane Field Equation (BFE)

Einstein used the BFE to give value as stress energy (of gloming) curving spacetime into gravity.[5] Einstein made regular use of 2-sphere branes making spaces action containers ($/m^2$). This generalization leads to a habit of regularly ignoring the other hypersphere modes despite mathematical red flags. Stress energy being in units of angular pressure ($kg/m\ s^2$) and the metric tensor having to force the mode are red flags. Another is distribution.

The BFE is derivative of the Poisson-Gauss field equations. The brane and **density** approaches assume static fields, whereas distributions are dynamic. Gauss's field ($g_t=/s^2$) follows the traditional interpretation: a temporal container dilating a Laplacian distribution (∇=meters).

Gauss' $\nabla \bullet g_t = 4\pi G\ \rho_m$ distributes Newton's acceleration of gravity valued by mass density (ρ_m=mass/V) applied to linear permeation (G).[6] The GFE, as we will see, gives this surface gravity boundary conditions.

Poisson used scalar potential ($\phi=/ms^2$), setting $g_t= -\nabla \bullet \phi$. This gave $\nabla^2 \bullet \phi = 4\pi G\ \rho_m$, a complete Laplacian to distribute the acceleration of gravity.[7] GFE manifolds are distribution containers, making a group space the active component. A group space is a flux distribution of time in space. Flipped around to angular momentum of a distribution in time on a space creates singularity.

$M_{mn} = i(x_m\partial_n - x_n\partial_m)$ is a Laplacian generator symmetry.[8] It coincides with our change function chirality (imperfect mirroring) and symmetry, such that $\mu\nu$ is chiral of $\nu\mu$. For us, $\mu\nu$ = disorder:order = cyan. The difference affects the shape of local fields and details of strong interaction.

A straight-forward m^2 Laplacian is a distribution in 3-D space easily defining a spherical volume. The differential distribution is a temporally normalized change function containing the space.[9] A distribution requires gloming (mixing) the axes into a common space. Geodesic/surface gravity requires this mixing. The space is then the container of temporal distribution, its axes rotated into each other giving curvature of action Einstein envisioned.[10]

The GFE, by default of its elements, is a glomed mixture of axes. The internal perturbation is a static group defining a discrete 2-sphere metric tensor ($g_{\mu\nu}$). The resulting hypersurface is the natural container of the group which is why it is static. The statically induced brane renormalizes as the scalar value R, a geodesic element of surface gravity ($Rg_{\mu\nu}$). In this book we use R as a hypersurface manifold, an element of both $Rg_{\mu\nu}$ and $T_{\mu\nu}$, not just a scalar.

As Hawking observed, singularity is "geodesic incompleteness."[11]. The term $G_{\mu\nu}$ as a manifold has contextual shape. Rovelli is not the only one who fails to see quantum is built right into the EFE. Einstein's focus was trying to connect his theory with traditional field theory. His success diverts attention away from the other way to apply the same function without a contained distribution: when entropy is S=0.

$G_{\mu\nu}$ set equal to both the brane and geodesic functions doesn't mean they have the same shapes all the time. Both branes have a common temporal context shape with curvature action. The likeness ends there. A black hole's linear brane is perturbed by angular momentum leading to dynamically filling its angular volume. Even when the perturbation is internal, it is still dynamic.

As discrete spatial entities, branes are subject to hyperbolic effects that change their otherwise static (conserved) unit values. Because branes are so ambiguous, let us simplify the problem. A brane as focal scale (ν) of one magnitude (n) contains values of lesser magnitude (n-1). The frequency (υ) reflects the inefficiency (1-η) on a distribution (∇) in time (t) of the group (m) defining a contextual focus (μ).

mu at least = lesser m^2 in   Laplacian spacetime units

$$\upsilon = \frac{1-\eta}{h}\left(\mu_{n-1} = \frac{m_{n-1}^{2}}{\nu_n}\right)\left(\frac{\nabla^2}{t^2} = c^2\right)$$

upper magnitude singularity

thermodynamic efficiency $$\eta = \frac{\delta W = PdV}{\delta Q = TdS}$$

13.4: Value Redistribution Function

This function is important to comprehending not only the behavior and changing scale of singularities, but also the anomaly of gravity. The anomaly gravity is variations caused by changes in distribution. It is easy to look at this and assume m must be the discrete mass of matter, but really it is mass generally to include latent field values.

In a greater field dynamic, these latent values eventually become part of a discrete whole and the roles become significant. Variations as with Earth's mantle, crust, surface, and atmosphere locally affect the scalar geodesic variable contributing to the anomaly of gravity. We like to think of gravity as a smoothed manifold. Eventually it does smooth. The anomaly between is unmistakably a quantum mechanical effect.

Ricci Hypervolume

A hypersurface can be visualized as an axis, a plane, or like a balloon applied to a volume. A hypervolume is still an incomplete concept of space. Normally when we think of a volume, we tend to think of a geometry with a surface like a cup, but really all we mean by hypervolume is the space in that cup as an active thing. A key point of Relativity has always been that space is not just a passive way to map positions.

If gravity was a pastry, the Ricci volume would be the gooey middle. It isn't rigid or liquid or doing anything other than defining a space by itself. Its qualities make it semi-viscous field condition perturbed by group dynamics. The only significant differences between Ricci volume applications are the degree of energy density and the degree to which the field is made of discrete points.

The Ricci curvature is a hypervolume axis in one macrostate that can be deconstructed into hypersurface axes in another. The axes are complex and rotated into a common mixture. One complex axis is contraction and the other is expansion relative to every point. Each complex axis comes with its own available linear or angular hypersurface. When the GFE are satisfied with degenerate density, only an angular hypersurface remains available.

Hypersurfaces and hypervolumes are easily constructed from a singular value forming an axis. A hypervolume can also be deconstructed into hypersurface axes. The stress energy tensor is an angular pressure hypersurface ($4\pi/\mu_0 \Rightarrow$kg/m s^2). The hypervolume form is static angular density ($4\pi\varepsilon_0 \Rightarrow$kg/m^3).

There are two types of singularity. The stress energy tensor accounts for one (**brane gravity**). **Static density** ($D_{\mu\nu}$) is the other reduction to a hypersurface singularity as $G_{\mu\nu}=2GD_{\mu\nu}/c^2 \Rightarrow R_{\mu\nu}$. Mass density and stress energy are different ways to say the same thing. Noting $\varepsilon_0\mu_0=1/c^2$, putting stress energy in the mass density tensor ($T_{\mu\nu}/D_{\mu\nu} = c^2$) creates a whole spacetime proportion.

This is something like jelly-filling a balloon. You are thinking to yourself that I mixed my metaphor, but I didn't. The jelly-filled doughnut is the level of diversity and functional emptiness you want. It has available spaces like we have described with quantum foam. Like atoms, the filled doughnut isn't perfectly differentiated even though to some degree it is differentiated. You need enough differentiation to interact with, otherwise you simply have static conditions. You also need different axes lest their similarities inadvertently conflict.

For field dynamics, filling without providing the available space is an exclusion violation. The balloon will squeeze out any filling that isn't intrinsic. A pulsar is a prime example of a system with an intrinsic filling that contains a singularity feature. The intrinsic volume doesn't get emitted when exclusion applies. Contact with the event horizon simply adds to the "atmosphere" of the neutron star surface, which upon exclusion is emitted en masse.

"Neutron" better fits the pulsar because eventually it breaks down into a stable state like a proton. The charge then makes adding more value directly difficult. The kinetic effects of gloming enhance the mass effect of neutron stars by about 100 times as we have already discussed. It is how something so massive can be formed as a stellar remnant, and helps explain why degenerate densities stay within the Tolman–Oppenheimer–Volkoff limit (2.17 solar masses).[12] The Chandrasekhar Limit (~1.4 solar masses) is for white dwarf degeneracy pressure.[13]

One thing we seldom think of is the fabric of spacetime, a distribution of discrete points, being a composite of volume and pressure conditions. The background temperature defines a hypervolume to which hypersurface pressures consistent with gravity applies. This is the ratio (e:1) of dark energy to dark matter respectively. It not only makes spacetime functional, it defines the sixth form of gravity: a **generalized density** of background energy.

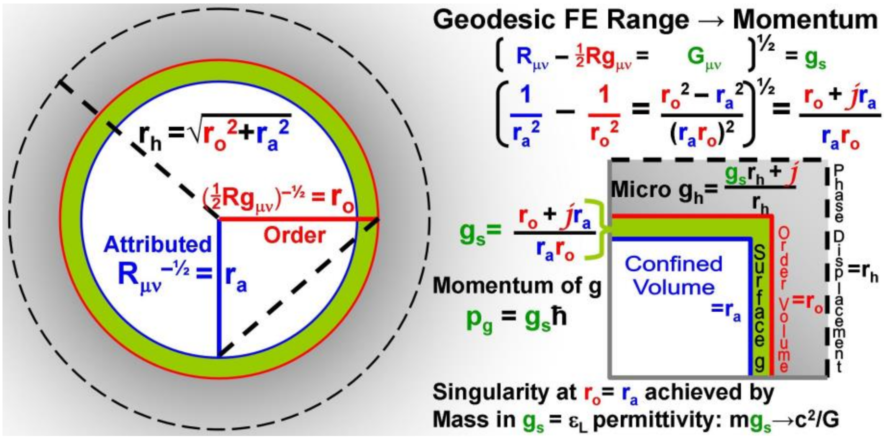
It is the shape and behaviors of this generalized background density that establishes long range high-level interactions like orbital gravity. Fluctuations in this field are longitudinal like sound waves. LIGO awkwardly refers to these photons of energy fluctuation as "gravitons." Basically a graviton would be the chiral form of a photon. Instead of transverse propagation of volume into frequency surface it is longitudinal propagating surface into wavelength volume.

A collision style gravitational wave is like a splash in the fabric of spacetime. LIGO (Laser Interferometer Gravitational-Wave Observatory) uses a split laser beam to observe dilation differences in otherwise equal lengths at right angles to each other.[14] Low density makes these waves hard to observe, but as long-waves they have wide regional effect from local orbits to galactic filaments.

Geodesic Interaction

Einstein's geodesic field equation (GFE) consists of interacting rectilinear surfaces.[15] If we were to migrate 4π from the BFE curvature to the GFE side, these surfaces become spherical. Rectilinear (Euclidean) is a quality of the Laplacian.[16] Each of the GFE manifolds is a Laplacian generator, which confuses things.

Here, **surface gravity** emerges from the interaction of two surfaces that confine (conceal) their origins. The problem with Einstein's GFE is common in physics: ambiguity and the human desire for simplicity. It is incredibly easy to get lost in the abstractions and miss the multiplicity of their forms. The brane quality of these manifolds does not exclude the volume, we just confine it. The content of the volume is then irrelevant.



13.5: GFE Boundaries and Conversion to Momentum

By confining the volume, we now see the GFE consists of interacting surfaces ($/m^2$)—a Riemannian is "made up of an infinite of Euclidean spaces."[17] The linear values derived from these surfaces are radii of order (o) and disorder (a= attributed). The geodesic function is gravity attempting to quantize into the perfect S=0 order of singularity.

Quantizing requires differentiating EMR as + (contracting) and EMA as – (expanding) values into the ± distribution (confinement) of j -entropy. It also requires either equalizing them or satisfying another boundary condition. Equalizing them zeroes the GFE out. What remains is the enfolding effect of $r\sqrt{2}$ displacement. The GFE manifolds can be made semi-conventional to illustrate this.

Without forgetting their origins, we can reduce each segment of Einstein's GFE to a radius by taking its numeric square root. Those radii translate perfectly into ordinary spherical topology to show what part is confined, what part is loose with directional surface, what exactly is being displaced, microgravity and continuity into generalized gravity with no upper boundary.

This breakdown is a lot easier to convert into other applications like momentum. We can relate this to distribution ($g_S{}^{-1}=\nabla$), from there to Gauss and the acceleration of gravity: $g_t/g_S= 4\pi G\ \rho_m$ (noting dilation=g_t=$/s^2$ and mass density=ρ_m). For the sake of radial symbolic consistency we can say $r_k \equiv g_S{}^{-1}$ to reflect influence of confined change variables (k).

It also links directly with linear permittivity (a Schwarzschild $\varepsilon_L=c^2/G$). Permittivity is typically used in electrodynamics to indicate "the capability of the vacuum to permit electric field lines."[18] Generically, permittivity is the capacity of space to receive value. It shows we can fill this space with mass ($m \bullet g_S$) to permittivity.

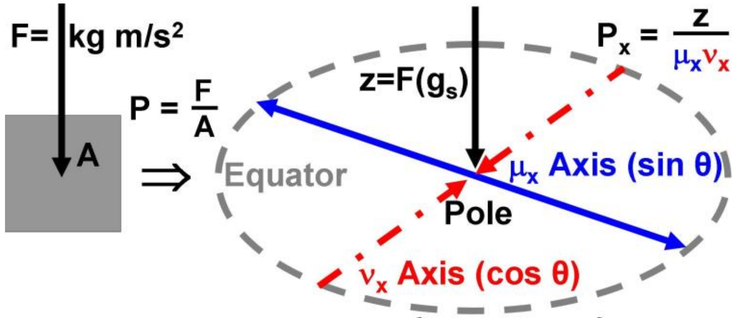
There are two immediately obvious paths to singularity: mass accumulation and equality of ordered and attributed values. The energy of momentum ($E=g_S\hbar c \rightarrow mc^2 \equiv h\upsilon$) opens the GFE to the full range of applications and permittivity quantizations. Hiding in the midst of this are two more major fields, only one of which is properly a function of gravity.

There are two degrees of microgravity. The first degree is a localized effect of the electroweak field. The second is the continuation of that as an open-ended long-wave. Microgravity and the Fermi surface are tricky and require us to resolve the electroweak field first.

Specific Gravity

As a group dynamic, the most familiar examples of weak interaction are exhibited by large scales of gases and liquids subject to surface gravity. These membranes layer into **specific (e.g. barometric) pressures** that consist of the force of gravity (F in Newtons) acting on a complex surface (A). The complex surface consists of the diverging (μ) and converging (ν) linear axes kinetically conformed to a spherical elevation (z). The proximal effect is about 10^{33} more powerful than micro gravity.

The mixing angle (θ) is the kinetic effect of combining the two axes into a relative proportion. In context of weak interactions, z is the static common value and the other axes would be dynamically interacting. The proximal pressure region is the active zone of weak interaction. The **specific pressure** is the resulting hypersurface ($P=kg/m\ s^2$).



$$\begin{pmatrix} d' \\ s' \end{pmatrix} = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix} \begin{pmatrix} d \\ s \end{pmatrix}$$

13.6: Specific Gravity

The weak interaction is a set of conditions enabling flavour change (charge-parity/CP violation). It derives from Fermi's theory for contact particle exchange responsible for radioactive decay and subsequent atomic fission.[19] The phenomenon divides into mediation particles and the field space defining or otherwise modulating the interaction.

The 1979 Nobel Prize was awarded to Sheldon Glashow, Abdus Salam, and Steven Weinberg for linking the weak interaction to electromagnetism.[20] Electromagnetic fields are hypercomplex—order-disorder change function interactions. The spacetime potential for weak interaction (w_{kh}) is a temporal Lorentz group:

$$w_{kh} = i(r_k\partial_h - r_h\partial_k) = s^2/m^2$$

The group is generated from radial phase space information ($r_h^2=r_A^2+r_O^2$). The difference squeezes (dilates) into the attributed value sub-spacetime ($r_k=g_S^{-1}=\nabla$). The respective confined change elements (h,k) interact to define time (s^2) resisting change. The confined volume of (r_A) is space excluded from the group. Its confined change function relates to the general container ($j_A\, j_O = 1$) we expect.

Time emerges here in the renormalization of weak charge. The weak charge sign is set by $i/j_O = ij_A = \pm \rightarrow s^2$ otherwise washing out in the equivalent s^2. Temporal abstraction isolates the charge unit to relative scale, like we used with microstates. Weak bosons and leptons contain the same degree of scale (e.g. parts and interactions). They set the normalized unit reference.

Charge from this point simply adds and subtracts—just as strong interactions affect mass up to hadrons, then they simply accumulate additively. A Weyl fermion as a strong volume is a magnitude greater than gluons and photons. None of these has a weak charge by itself though. Put into a weak context, Weyl fermions get ½ where gluons and photons get ⅙ charge equivalences.

This charge is temporal (renormalized). It sets the aspect perspective. It doesn't redefine the band identities, but does affect orientation of matter created in those bands. In electroweak theory this is the "weak mixing angle" applied to Cabibbo's matrix to compute spontaneous symmetry breaking.[21] This accounts for complex angles flat diagrams cannot show, like why an antineutrino (chiral isospin) occurs in down decay.

The density of this space is its "force." That density contains intrinsic ($\nu_x = j mG/c$) and transient qualities (e.g. heat). The intrinsic value can be described as linear (x) mass value. The field is an elevation-related horizontal mass density consistent with specific weight.

Like heat, this is of a lesser magnitude than the force of gravity. Heat density is also fairly simple mathematically ($\mu_x = i Tkc/\hbar$). We find using standard kg m s units best for purposes of compatibility and reducing confusion. Boltzmann's constant ($k = 1.38064852 \times 10^{-23}$-23 kg m^2/s^2K)[22] converts heat in Kelvin to kg m s units, with a consequence. Again, constants are not just numbers. They actually do things.

The imaginary elements are added to show time emerging in $ij = s^2$. This is particularly significant to Fermi surfaces and the effects of super-cooling on friction, conductance, etc. Reducing heat also reduces the temporal resistivity of this space. It becomes less resistant to i-entropy (e.g. disorder and electrical current).

The imaginary elements are also relevant to the fact that you can't just convert everything willy-nilly to basic SI units (kg m s). There are consequences, you just need to understand which axes rotate and how. These complex forms are made real by confining context.

The densities focus more intensely than gravity alone. The strength of the weak interaction is 10^{-6} that of the ordinary strong interaction.[23] Coupling constants are used to describe the strength of interactions. A coupling constant of $g<1$ is considered weak. Fermi's is computed using muon life and W-boson mass: $G(F)/(\hbar c)^3 = 1.1663787 \times 10^{-5}$ /GeV^2.[24]

The electroweak spacetime ($w_{kh} = s^2/m^2$) is a directional density potential. Populated with substance, the substance interacts with itself as an area $A = \mu_x \nu_x$ defined by heat (μ_x) and order (ν_x) axes. While circular, we tend to look at these as rectilinear (x). They provide the sine and cosine quadrant applications in the Cabibbo matrix.

The force of gravity (shown as the z-axis) put into this area defines the actualized system pressure (P_x). Applying this pressure to the electroweak spacetime potential provides a degree ($U \leq 1$) of electromagnetic permittivity ($U\varepsilon_0 = w_{kh} P_x$) as the electroweak vector field value. At U=1, the electroweak field quantizes.

The electroweak field fluctuates with change in heat and content. The charge sign is the native identity predisposition toward balance: +($\nu_x > \mu_x$), 0($\nu_x = \mu_x$), –($\nu_x < \mu_x$). Ideally you want a perfect balance that can manage imbalance without losing identity. Too positive and it enfolds out of existence. Too negative and it unfolds out of existent. Too neutral and it triggers either way with little provocation.

This is essentially why the universe is dominated by atoms. Atoms keep their electron disorder fields on the outside held in tight conformity by the weak charge interaction with a proton. Energy changes affect how tightly packed these relationships are. New electron orbit groups compact existing orbit groups, and new members to a group enlarge the group size.

Displacement and Microgravity

Between the geodesic fields and their displacement in phase space is another boundary. When the group can't expand or contract due to structure and pressure conditions, and especially at boundaries, new qualities become evident. One of these is the creation of a space called a Fermi surface—a quantum-free (available) weak field remnant.

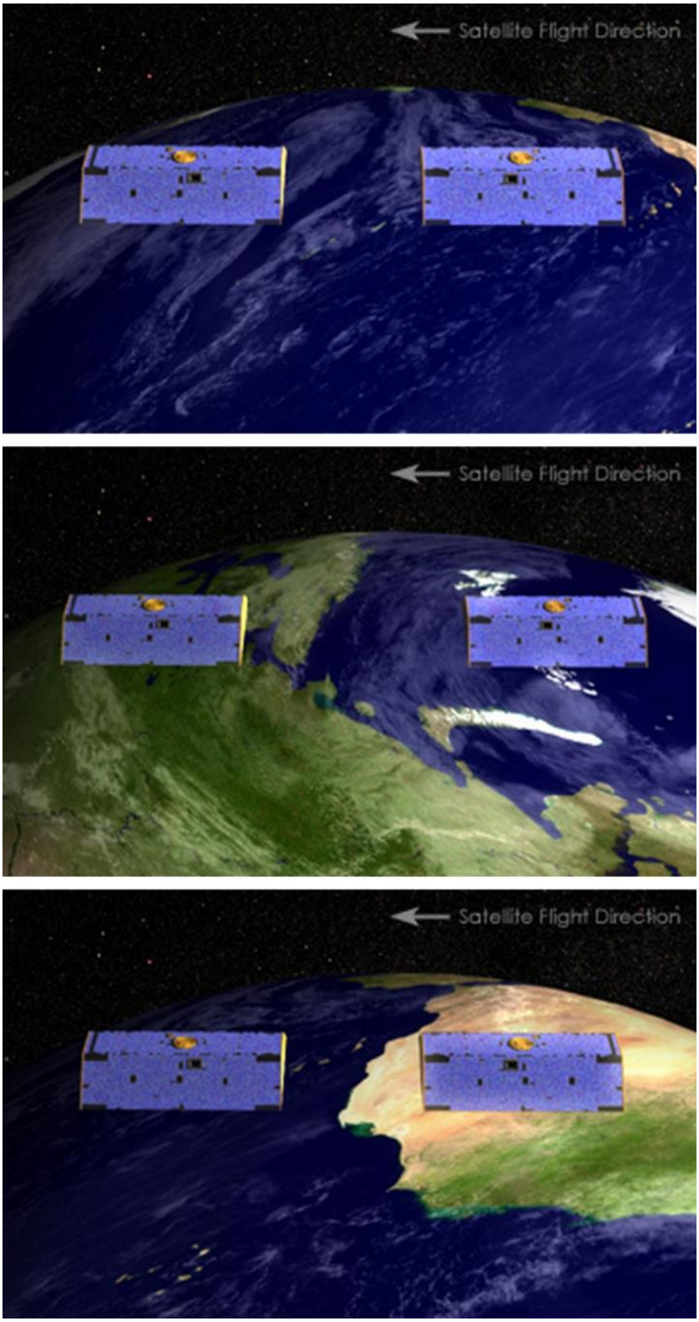
The most notable Fermi surface applications in material science are viscosity, phase states (solid, liquid, gas) and resistivity in electrodynamics.[25] We have generally classified these as primordial hypersurfaces representing change functions. It is easier to see the change functions with cosmic displacements like accretion disks of active singularities like black holes and pulsars, or ring systems of planets with profound effect on orbits.

When we think about the long range effects of gravity, what we are really thinking about is the displacement effects of microgravity. It is micro when you are in it because only part of the long wave can act on you, as relative to surface gravity with a shorter wave that mostly acts on you. The term microgravity is also applied to the reduction of the effects of gravity in freefall.[26] For our purposes, we are strictly speaking near orbit.

Because it derives from geodesic displacement, it is easy to forget that microgravity is not the same as surface gravity. The vector direction of microgravity is parallel to the surface whereas surface gravity is perpendicular to the surface. Surface gravity is also confined to its boundaries of interaction. Microgravity as displacement in phase space (the fabric of spacetime) is bounded by the fabric of spacetime.

The effect of displacement is often characterized as having infinite range. Nothing has infinite range since there are minimum values in the universe of wave functions. But of all the intrinsic interactions, this one comes closest to potentially infinite.

Electromagnetism is also described as having infinite range. There are many forms of electromagnetism including the strong and weak interactions. Electromagnetism is a generic term to describe a hypercomplex system with feedback. To have feedback requires finitude. Light is closest to infinite, reaching the extent of minimum wave values creating the fabric of spacetime subjected to geodesic displacement. We have to be careful of making overly generalized statements.



13.7: GRACE Satellites Ride g-Waves

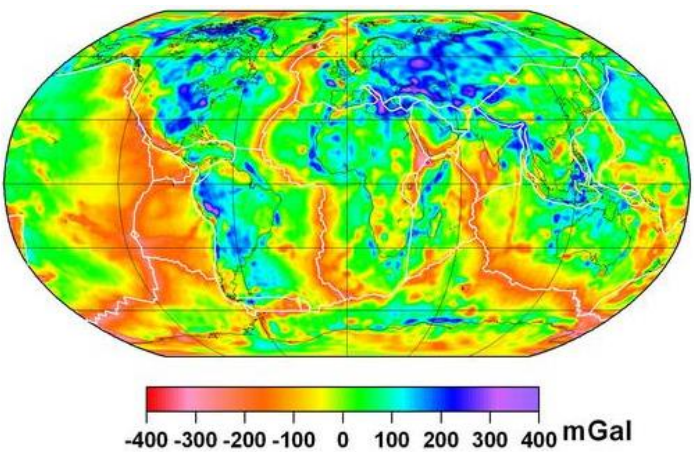
Thanks to microgravity, the electroweak field as a volume effect extends beyond the region of surface gravity. Beyond the range of surface gravity, the axes rotate so z becomes pressure parallel to the surface instead of diverging μ and converging ν. These are replaced by the function of phase displacement. Microgravity appears in the EFE at what Einstein referred to as his greatest blunder: $G_{\mu\nu} + \Lambda g_{\mu\nu}$.

Microgravity consists of relativistic displacement ($G_{\mu\nu}$) acted on by environmental phase density ($\Lambda g_{\mu\nu}$). I used + not to suggest contracting pressure on, but to not exclude the effects of unfolding volume or other complex features. While the EFE accounts for this, it does so awkwardly mainly due to human habitsinclined to try and interpret the cosmological constant too simply.

We must not forget that these manifolds have complex and hypercomplex features that affect the way space is shaped by the specifics of their interactions. The displacement makes microgravity quasi-directional. Quasi-direction acts to put objects into contextual aspect that can eject, draw in, or form balance. Between this and anomaly causing horizontal interaction, near orbits easily become trajectories toward or away from the displacing object.

Microgravity acts horizontally on objects within weak space proximity (about 0.1% added to the displacement diameter[27]=mid-exosphere just beyond the thermosphere). Because this effect is a hypersurface, it is easy to perceive and treat this as ordinary surface gravity. As a complex field, it is significant for its charge effects, as with layering of the atmosphere and UVC deflection. The direction of this field is shown by GRACE.

GRACE is a pair of NASA satellites connected to each other (see above). They orbit at 220 km (137 miles). The distance between them is a measure of horizontal field differences resulting from density variations. The lead satellite is slowed by increased density causing the distance to contract, and then accelerates by decreased density causing distance to expand. [28] Something like roller coaster cars adjusting to the terrain.



[29]

13.8: GRACE's Mantle Gravity Anomalies

They are accurately observing horizontal fluctuations of substantive order (ν_x) and heat disorder (μ_x). The fluctuation is mapped as the anomaly of gravity. The pressure of the electroweak field affects the rate of local surface gravity intensity—specific weight. The surface of the mantle is the confinement surface. Take away everything else and surface gravity is smoothed into a constant.

The anomaly of gravity shows changes in the ordered brane from which disorder is subtracted to define surface gravity. This subtlety is like being subjected to an error function while in near orbit. Generalized gravity from phase displacement has no direction without interaction. The region of microgravity provides degrees of incidental interaction. You can orbit in this region, but the anomaly will act as friction eventually causing orbital decay unless you can follow the geosynchronous ring of a charge path.

Endnotes

[1] Wheeler, J.A. & Ford, K. (1998). Geons, Black Holes, and Quantum Foam: A Life in Physics. NY: W.W. Norton & Company, Inc.

[2] Zwicky, F. (1933). The Redshift of Extragalactic Nebulae. trans. Andernach, H. https://arxiv.org/abs/1711.01693.
Zuhone, J. (June 21, 2015). Bullets and Wine Glasses: The Exciting Encounters of Galaxy Clusters. Eastern Illinois University. https://www.slideshare.net/jzuhone/bullets-and-wine-glasses-the-exciting-encounters-of-galaxy-clusters.

[3] Conover, E. (Nov. 26, 2018). Physicists finally calculated where the proton's mass comes from. https://www.sciencenews.org/article/proton-mass-quarks-calculation.

[4] Rovelli, C. (2008). Quantum Gravity. scholarpedia.org/article/Quantum _gravity.

[5] Johnston, W.R. (Nov. 3, 2008). Calculations on space-time curvature within the Earth and Sun. www.johnstonsarchive.net/relativity/stcurve.pdf.

[6] Carroll, S.M. (Dec. 1997). Lecture Notes on General Relativity. UC Santa Barbara. https://arxiv.org/pdf/gr-qc/9712019.pdf.

[7] Brown, K. (2017). Poisson's Equation and the Universe. mathpages.com/ home/ kmath711/kmath711.htm.

[8] Di Francesco, P.; Mathieu, P; & Sénéchal, D. (1997). Conformal field theory. Graduate texts in contemporary physics. Springer.

[9] Grinfeld, P. (Feb. 12, 2017). What is the Laplacian? Philadelphia, PA: Drexel University & Lemma. youtube.com/watch?v=4J74tquQ7jU.

[10] Overduin, J. (Nov. 2007). Einstein's Spacetime. einstein.stanford.edu /SPACETIME/spacetime2.html.

[11] Hawking, S.W. (June 23, 2014). Singularities and the geometry of spacetime. https://www.epj.org/images/stories/news/2014/10.1140--epjh--e2014-50013-6.pdf.

[12] Bombaci, I. (Jan. 96). The Maximum Mass of a Neutron Star. Astronomy and Astrophysics. adsabs.harvard.edu/abs/1996A&A...305..871B.

[13] (ret. May 28, 2019). Chandrasekhar Limit. astronomy.swin.edu.au/cosmos/C/Chandrasekhar+Limit.
[14] (ret. Apr. 3, 2018). What is an Interferometer? https://www.ligo.caltech .edu/page/what-is-interferometer.
[15] Hitchin, N.J. (1974) Compact Four-Dimenstional Einstein Manifolds. projecteuclid .org/download/pdf_1/euclid.jdg/1214432419.
[16] Holloway, R. (Nov. 7, 1999). The Laplacian in different coordinate systems. personal.rhul.ac.uk/uhap/027/PH2130/PH2130_files/laplacian.pdf.
[17] Besse, R.L. (2000). Einstein Manifolds. Berlin, Germany: Springer-Verlag.
[18] Serway, R.A. (2017). College Physics. Vol. 2. 9 ed. Content Technologies.
[19] Wilson, Fred L. (December 1968). "Fermi's Theory of Beta Decay". American Journal of Physics. 36 (12): 1150–1160.
[20] The Nobel Prize in Physics 1979. Nobel Media AB 2014. nobelprize.org/nobel_prizes/physics/laureates/1979/.
[21] Cvavb, C.R. (June 2000). Is the Cabibbo Angle a Function of the Weinberg Mixing Parameter? International Journal of Theoretical Physics, Vol. 39, Issue 6.
[22] (ret. Feb. 22, 2018). Boltzmann Constant: k. https://physics.nist.gov/cgi-bin/cuu/Value?k.
[23] Nave, C.R. (2017). Fundamental Force. Georgia State University. hyperphysics.phy-astr.gsu.edu/hbase/Forces/funfor.html.
[24] (June 2015). "Fermi coupling constant." The NIST Reference on Constants, Units, and Uncertainty. physics.nist.gov/cgi-bin/cuu/Value?gf.
[25] Dugdale, S.B. (Apr. 18, 2016). Life on the edge: a beginner's guide to the Fermi surface. The Royal Swedish Academy of Sciences. iopscience.iop.org/article/10 .1088/0031-8949/91/5/053009/pdf.
[26] Dunbar, B. (Aug. 7, 2017). What is Microgravity? https://www.nasa.gov/centers/glenn/shuttlestation/station/microgex.html.
[27] Nave, R. (2017). Fundamental Forces. hyperphysics.phy-astr.gsu.edu/hbase/Forces/funfor.html.
[28] Ward, A. (Mar. 30, 2004). Gravity Recovery and Climate Experience (GRACE): "The Workings of GRACE." earthobservatory.nasa.gov/Features/GRACE/.
[29] Reigber, C. (Jan 20, 2004). First GFZ GRACE gravity field model EIGEN-GRACE01S released on July 25, 2003. op.gfz-potsdam.de/grace/results/grav/g001 _eigen-grace01s.html.

14. Confined Morphology

Confinement in chromodynamics describes identities being lost in the convergence of forming another identity. In the first stage it is simply describing the formation of new matter from light coming into a degree of discrete focus. It then proceeds to construct spaces with increasing focus until a point-space is established.

I say point-space because it is a complete unit (quanta) of space. When we describe gravity, as an example, contracting toward a point, this would be such a point. It is not a mathematical point describing position without having any valuative quality of its own. It is a finite non-zero value applied to multiple axes.

To be clear, there is an axis without value, and its distribution categorizes how it can interact points into a semblance of geometry, etc. It is in this stage where the material universe steps out of the virtual frame and into the distributive discrete frame. Taking this step did not make all the virtual features go away, it just made them more ambiguous to observe as macrostates of group dynamics components.

Complementarity

The Copenhagen interpretation developed between 1925 and 1927 basically states a field cannot be described as having a specific configuration without putting it into a context wherein the probability of a configuration can occur. Until then, all possibilities simultaneously exist.[1] It is called complementarity because anything that can be true has a probability of being true given the right context. Seems pretty simple right?

The configurations must be valid working constructs or deconstructions. This means only the working parts of a premise apply. For example, Wheeler's geometrodynamics tried to develop an evolving system of renormalizing spaces. While the concept holds true as we have shown, many of the sub-ideas were abysmal failures. Every perspective bears a degree of merit to the limits of its empirical practicality.

Complementarity is a working theorem, so it really should be renamed the Copenhagen or complementarity theorem. It just happens to occur within a statement of Bohr and Heisenberg's core science values and methods for QM briefed below.[2]

1. Interpretation has to rely on experimental practice
2. which presupposes description and norms of methods, apparatus, and what is scientific experience
3. of separating, orienting, identifying, and re-identifying
4. by categorizing into position, change, duration, sequence of cause and effect, and common use of language

5. to objectify knowledge, and any conceptual description.
6. Classical physics concepts provide exact specifications
7. making classical concepts necessary in comprehensible and communicable description of any phenomenon.
8. Planck's quantization of action must be negligible for classical concepts to apply (e.g. renormalization occurs).
9. In renormalization, classical concepts generalize into kinematic and dynamic properties.
10. Thus limiting classical concept application to factors of observation and apparatus.
11. The QM description diverges from classical instrument effects, requiring separate handling even when they converge.
12. Schrödinger's unit ψ-function provides an absolute root probability ($|\psi|^2$) amplitude for the outcome; noting an imaginary quantity in the ψ-function affects the probable outcomes.
13. Experimental context provides the affective kinematic and dynamic defining conditions. In other words, context defines outcome.
14. They are found complementary where their mutual manifestations are exclusive and assuming all alternatives are exhausted.

Copenhagen Objections

What this theorem is trying to achieve is an understanding of resulting qualities that emerge in contexts due to how the spaces are constructed as matter forms by confinement from light, interacts and systematically constructs discrete distributions that can then form geometries. He is asking where all these qualities come from and laying out a map for how to solve the problem. Many will look at it from a very narrow specific perspective, like that of quarks or charged particles and object.

They object for the simple reason that they haven't stepped far enough back to see the bigger picture. They are too close to one perspective—typically an already renormalized condition—and not asking how they got there. Basically they aren't asking the Yang-Mills mass gap problem to see the differences between latent, discrete, distribution and geometrization. They are also missing macrostates: the different ways to deconstruct and show the various qualities of complex matter.

And then there are those who flat don't understand the language and construe it either into the vernacular or the absurd. They play off the vernacular meanings of the words imaginary and real, unable to comprehend these are technical terms of the mathematics that have nothing to do with idea, ideations, imagination, etc. Ironically, this level of thinking seems to also land on a multiverse/many world interpretation that shows a complete failure to comprehend context-based logic.

Ironically, in this book we reach the Copenhagen theorem not as speculation but as a conclusion. Bohr and Heisenberg were right. Others can and are also right. This seems to be another serious difficulty for the modern mind to grasp. All legitimate perspectives are correct in their contexts and do not negate each other. That means all objection sources may be right with their perspectives while wrong in their objection—hence "complementarity" theorem, not "exclusivity" theorem.

Quantum-ness is really just about the probability of a configuration emerging given the right context. Einstein's objection was simply regarding completeness: QM isn't tidy like classical physics.[3] And yet in a way it is. Each thing simultaneously has many qualities, and each of these qualities emerges in context based on hidden intrinsic qualities. Until you can reconstruct some of these things as we have here, QM has nothing even remotely tidy.

Complementarity isn't a difficult concept, though many sure do a good job making it difficult. It is a matter of group logic with countless variations generalizing into specific forms. We humans assume contextual definitions (specific forms) multiple times a day just by stepping into different social roles. You cannot describe a person in social terms without first applying the respective social context. There is no guarantee the context fits. Not everyone has a sibling for example, or has married or parented. You have a probability density of these social perturbations in the field of humans.

The moment you apply an exclusive quality like rank or charge, you also eliminate all candidates who do not fit that category from the sampling. If you listen to the objections, one of the most common is exactly this refinement of the sampling. Bohr is saying to do this, but not to marry to that one perspective as the only perspective until you have eliminated all other possibilities. Such narrow interpretations of the Copenhagen theorem make it exclusive, not complementary, land mining it and leading to failure.

Given multiple contexts, all the configurations can apply in whole or in degrees. We can look closer at the details of the ψ-function and remove a degree of probability on one hand, but as Bell's theorem points out, there are too many other variables. There will always be a degree of probability going another direction. Only in idealized conditions and thought experiments can we eliminate all the divergences.

As an undergraduate, I took an interest in physical chemistry. My interest was finding the mathematical relationship among the various quantifiable features of atoms. My approach focused on topology. How could I arrange the components of each atom in ways that explained the qualities exhibited? I had no concept of macrostates or that nuclide density is constant. I was basically in Bohr's position of numbers going every which way and no idea how to tame them.

That is the most frustrating part of QM, QCD, and field theory. It seems like any number can fit, and truly they can. But then there is context. The universe provides basic foundations of context that sets boundaries. They remain incredibly loose until you finally reach degenerate distributions like baryons. And it is from the perspective of baryons and resulting atoms that we characterize everything else. It is a singular perspective in a universe of diverse perspectives actualized by context.

I clearly did not stop with topology. I kept digging. What I found was so disturbing, I am inclined to think Bohr and Heisenberg were seeing the same things when they made this Copenhagen list. We all just took different directions from here. Doing our own things then coordinating together is precisely what complementarity is all about.

Electron Geometries

We humans like things simple on our terms. Simple on our terms means relatable to our ordinary perceptions, like having a geometry. The quantum universe's idea of simple is to construct definitions in degrees, so you start with a value and evolve through forms without intrinsic shape and eventually arrive at a clearly defined point that can then be put together with other points into a geometry.

It is our want for simplicity on our terms that leads to most objections, misunderstandings, and distortions of Bohr and Heisenberg's Copenhagen outline of QM. There is also the ego's want for being exclusively right that gets in the way of such "every legitimate view is right" perspective. Once in a while we get a reminder that this actually a very serious problem of physics, not just something we made up to sound clever.

Take the geometrizing of electrons put into a virtual atom/quantum dot perspective as an example. An ion field is subjected to magnetic field lines to create an artificial focus, observe and potentially shape the otherwise shapeless.[4] Surprisingly, we still see terms like "electron gas" to describe an ion field, despite the significant differences in meaning.

A gas has specific discrete points which would itself be causal of a group behavior. A field assigns value to all its points no matter how you divide or quantize those points. What inspires the term gas is the failure of a field to necessarily use all its axes. Other things can conditionally share that space. As the QM outline suggested, we must use relatable language, but also be careful with language choices.

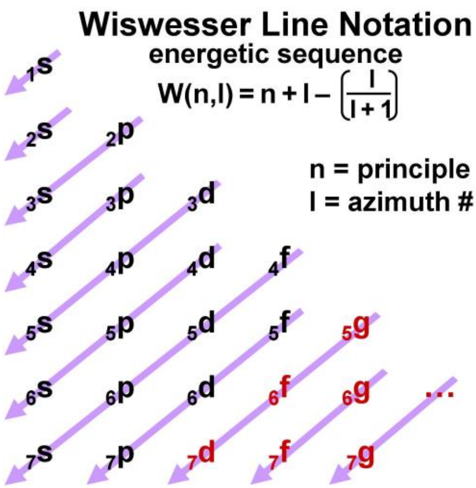
An object is all its macrostates and the qualities that quantify in context because of those macrostates. While some macrostates create contexts invoking other macrostates, we need to be very careful with how we interpret these deconstructions. As deconstructions that does not mean the object was created by first creating and assembling those things.

It may not even be possible to assemble or disassemble along those lines. Those lines exist simply because they could have happened but didn't because the focus of perturbation did not abate. How the object was constructed or will actually break down are whole other stories of contexts. While one subject may itself have a simple solution, that does not mean all subjects in the group have that solution in common. If anything, in the quantum universe there are many paths to the same thing.

We've all heard of the ancient philosophies of monism and atomism. With QM these interpretations are no longer easily dismissed because they actually have places in physics. Monism argues that everything in the universe consists of the same thing. Let us argue it is a combination of the same thing (e.g. kinetic value) and its strategic absence (dynamic absorption value). Assemble these to create and interact spaces and eventually you reach a universe of fundamental discrete points. These discrete points geometrize and are commonly referred to as atoms.

It was our discovery of physical chemistry that led to the obvious idea in QM of one thing having contextual values. Bohr's 1913 model for electron shells provides a useful macrostate in common use today.[5] We forget there are other geometric contexts involved, like individual spherical point (formless geometry) and lattice structure ordering the arrangement of atoms or molecules. It doesn't even account for other geometry issues like the relationship of octonions to octets and valences. Point geometries aren't just simple points. They are quantum.

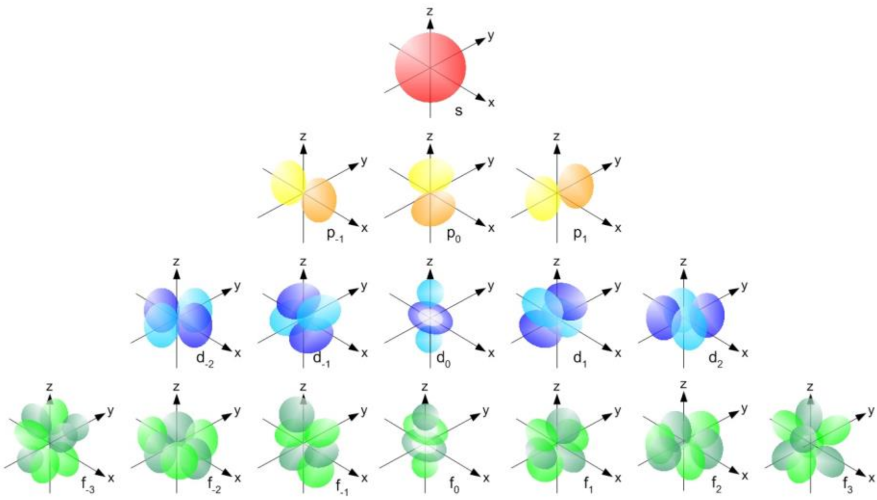
While a whole like an atom can be described as renormalized, its macrostates provide its quantum properties. Our renormalized perspective of electron energy sequence is Wiswesser's system (below).[6] It groups electrons according to Bohr's model (n=principle quantum number/energy level) and orbital angular momentum (l=azimuth quantum number=0→3).



14.1: Wiswesser Notation & Equation

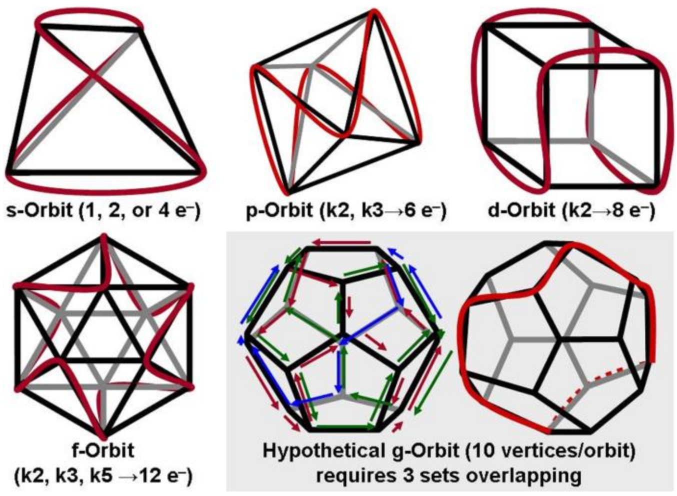
These quantum numbers are integers whose units renormalize a macrstate of confined quantum variables. This system of electron orbits has two more "quantum number" identifiers: magnetic (m_l=±0→3 orbital positions in s=1,p=3|x,y,z,d=5,f=7) and spin (m_s=±½ parameter direction). Put together, the eigenfunctions provide the so-called "electron cloud" or Eigenstates maps (below).[7]

Renormalization confines not just the identities of the parts but all the possible configurations. The rules governing these quantum numbers are specific to the energy sequence but do not account for all qualities of electron "orbits." Our outer perspective tells us most of how we interact and observe relativistically, but not everything. There is a reason for every physical attribute from thermal conductivity to the octet rule.



14.2: Electron Orbit Eigenstates

We need to differentiate our practical level thinking perspective from the confined quantum levels the qualities and rules emerge from. Electrons see themselves quite differently pre-renormalization. They see themselves the same way nuclide groups do: as equal regular lattices. Because they are quantum, they enjoy the QM aspect potentials (see pg. 233).



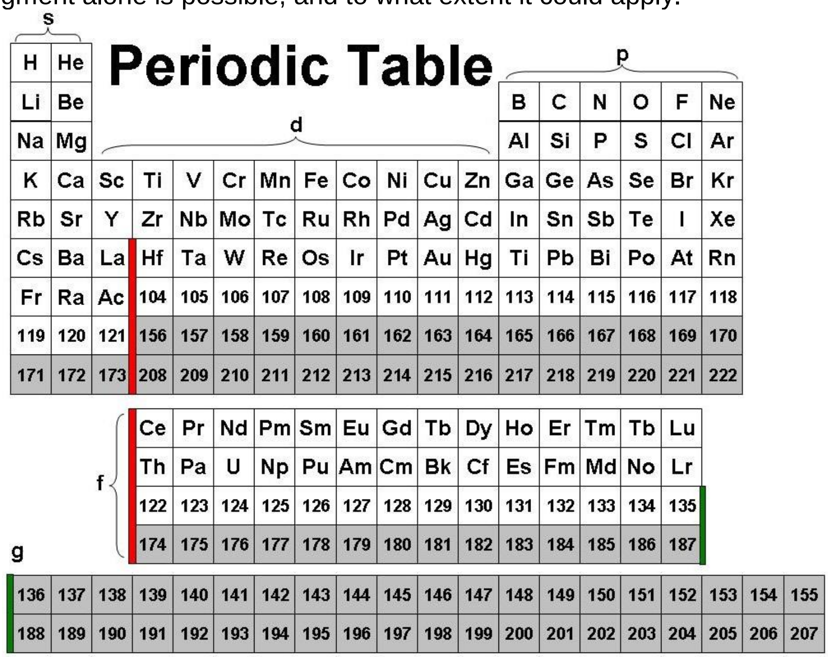
14.3: Electron Orbit Paths in Quantum Solids

Solid geometries account for valences and orbital limits restricting atomic numbers. The s-orbit illustrated above has four vertices. Each electron consists of an entangled pair, dividing themselves across two vertices. Those same two vertices can be occupied by another electron by changing the spin quantum number. Another pair of electrons can be added at the remaining vertice pair by adapting azimuth to vertice.

This is like having four pit stops on a racetrack. Each electron occupies two while redefining its space in a fixed direction. There are two sides to the track, so two electrons can be at the same pit stops, and two more can be at the other two pit stops. Later orbitals often “drop” electrons down to this level and appear in two qualitatively different ways.

As a mechanical system, balance is required so you can have 1, 2, or 4 electrons in s, but not 3. Likewise, an orbit has to flow along one continuous line in one cycle without crossing over itself connecting all the vertices. The g-orbit is the only regular solid this cannot be done with. The best one continuous cycle can intersect on g is ten vertices. Additional paths cross over each other causing exclusion violations.

Traditional electron orbits fill in the Wiswesser sequence. Here they fill by vertice order limitations. This creates an entirely different set of possible configurations that can become incredibly ambiguous, but accurately predict valence states. It remains unclear, however, whether a g-orbit segment alone is possible, and to what extent it could apply.



14.4: Periodic Table Limitations

If g could be entirely satisfied, we could also expand the possible periodic table (above). The grayed parts of the illustration require the g-orbit. Without the requisite environmental factors, related nuclides are unsustainable. Protons provide order in the nuclide, which requires the sustaining disorder of electrons. As such, complex nuclide stability depends partly on electron stability.

Nuclide Basics

To reiterate, nuclides have degenerate density which applies as much value as is possible to spacetime, leaving only a projecting axis available. Any value added requires an increase in volume to sustain that density. Acceleration dilates the scale which exposes confined value to latent roles like propagation.

Degenerate density is a spacetime limit, and because nuclides always have the same density, any attributed shapes and internal interactions are quantum macrostates. You cannot think of these in terms of ordinary motion, spatial distributions or interactions.

There are several approaches to nuclide structure. When one problem produces a class of working solutions, one must conclude the problem itself is a contextual complex to be analyzed in quantum terms. Elements of multiple approaches hold simultaneously true. Watkins lists several:[8] These all contain valid elements or concepts. The numbers correlate the macrostate structure to a generation of matter.

QM Forms

Fluctuating Combinations Model—oscillation among combinations.

Lattice/Monte Carlo is an exhaustive method of contextual computation.

Substructure/Cluster model—n-body problem contextually forms m-groups, again fitting quantum contexts.

Basic Macrostates

1. Collective model—shape arises from collective motion.
2. Liquid/quantum drop model—a Gamow idea enhanced by Bohr-Wheeler to describe the nucleus as a smooth but fluid consistency (like a water drop). Their nucleus would be confined, contiguous, and non-compressible.[9] This fits the Ricci volume concept of the field theory.
3. Interacting Boson model—is among the most relevant and shell-related;[10] the electroweak spacetime component paths to magnetic susceptibility, induction, and degeneration.

Confining Macrostates

4. Model of Independent Particles—treats the nucleus as an n-body problem without specifying arrangement (no geometry).
5. Glommed—the n-bodies are indistinct, mixed (not listed by Watkins).
6. Point Geometrizing—ways to combine n-points into one:
   a. Shell models—follow electron orbit-like shapes or renormalizes away from those shapes.[11]
   b. Alpha Module—alpha particles (α=2p+2n) compact into a structure of lattice points.

Collective Macrostates

7. Octal Compounding—nuclides in elemental context interact as points to form molecular geometries.

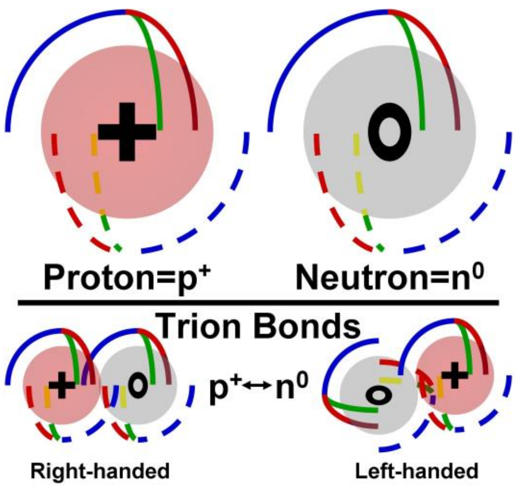
This list naturally continues to grow as we progress through the generations of matter. 1 & 2 are strictly kinetic, 3 & 4 are dynamic, 5 & 6 point geometrize a group, then 7 connects those points. Point geometrizing begins with glomming what can be discrete points, then proceeds with merging n-points into one by means of strong interaction. The sub-geometry of can be described as trionic.

A lattice cell is the interaction and arrangement of discrete points into a regular geometry.[12] A nuclide is the set of protons and neutrons defining a nuclear isotope.[13] A nuclide lattice is thus the specific geometric arrangement of protons and neutrons. The rules of arrangement show emergent physical properties like magnetic induction, susceptibilities, and isotope limitations.

Nuclear structure is typically depicted as a random mix of nucleons in a ball shape. The assumption is that nucleon interactions are quantum, so it doesn't matter. Nearly everything quantum in nucleons has renormalized. Spacetime specifically has been renormalized such that intrinsic interactions are no longer defining space from scratch, but rather defining points in space.

The only quantum components not entirely confined are the trionic band edges and surfaces used to strongly interact with other nucleons. These bands and resulting strong interactions (type VI) are subject to uncertainty including microstates and color changes. Those uncertainties enable renormalized qualities like weak charge, but do not violate them.

The rules of type VI strong interaction are regulated by the color configurations of trion geometry. For this reason, we call them trionic bonds. The original strong bond formed flavour volumes and could occur in pairs (rg|cm, gb|my) or triplets (rgb|cmy).



14.5: Trionic Band Edge-Surfaces and Bonds

Through the stages of development, triplets became the stable preference for space-sharing strong bonds. Confinement has also created an unusual band condition. These define edges and between the edges is an anti-band surface.

If the bands are colors, the surface is the subtractive combination of neighboring colors. For example, between r & g bands is a y surface. Leptons also have surfaces like this, but their context renormalizes that surface into temporal.

The trion surfaces are attributed spaces. As a consequence, the space of this interaction is both electroweak and strong. The electroweak role is generally restricted to charge, though energy changes can evolve that to nuclear reactions affecting trion bonds. Each trion bond is actually a double bond between two bands with opposite edges and their complementary band surfaces.

Right-handed bonds join the in a common $\acute{j}$-spin direction. The left-handed bond causes the sinusoidal s-shape of disorder ($\acute{\imath}$). Left-handed reveals how these bands function.

In the sequence of microstates, bands become real while the main identity parts become null. Without this actualization of value, there is no interaction. With actualization of band values, the left-handed bond risks breaking. Energy change affects frequency, and a complex oscillation can have significant consequence.

Each trionic bond uses up one band and one surface for each member's trionic geometry. That geometry allows for only three bonds of this nature. As a renormalized interaction, the trionic bond is also subject to ordinary energy distribution.

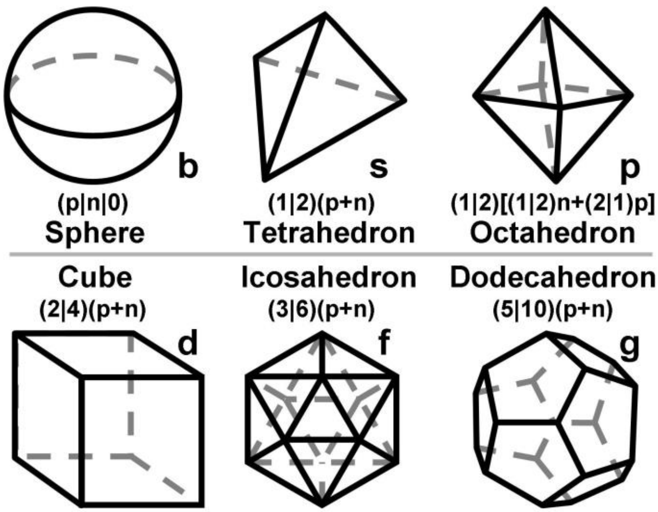
In microstate evaluations we smoothed quantum numbers by rounding e up to 3. Here we can't round due to renormalization. It is no longer just a quantum number to smooth. It is an ordinary real value we cannot ignore because it is defining a boundary condition. Without this boundary, nuclides would not need structure.

Structure Groups

Geometric structure is a classical concept we can all relate to easily. Structures are vital to functionality. Nuclide structures are classical solid geometry concepts that are held together by quantum elements confined in the process (renormalized). A regular geometry optimizes the energy use of the parts but can affect other functions.

In engineering, spheres are ideal structures followed by triangles and squares.[14] Regular/Platonic solids are generally considered to be Euler's with 4, 6, 8, 12, and 20 faces. The sphere is also a regular solid, except it represents the quantum concept of a point-surface. In mathematics, points are generally brushed aisde by assigning infinite points to a line, then line/edges enclose surfaces that enclose volumes.

Pentagons aren't remarkably sturdy, but in an icosahadron they form an approximation of a sphere. This is the one regular solid you cannot connect with a continuous non-crossing line. If there were such a thing as a g-orbit for an electron, it would attempt to follow this shape and fail. The dodecahadron is a near approximation of a sphere with triangles.



14.6: Regular Solids Give Structural Rules

These are in order of vertices, which roughly coincides with ideal structure sequence. Hyper-hadrons are a variation of these. Hyper-hadrons are connected internally like a building architecture. Baez provides hyper-hadron[15] illustrations that are very stable because they build up with triangular structures.

Nuclides can certainly structure themselves this way too, but at significant cost. It would dramatically affect the emergent fields and create other complications, but a worthy pursuit to explore. It would also be more consistent with pure quantum interactions than this level of renormalization.

The trion suggests hyper-hadrons are the exception rather than the rule. Trions are more conducive to surface vertices and edges of polyhedrons forming into layers. Thanks to microstate energy exchanges, they don't need to provide all the edges simultaneously.

Due to renormalizing in structure, energy can be treated as distributed in equilibrium across the edges as if they were simultaneous. Things get a little trickier when the nucleon structures form layers of nuclide shells. Each solid describes a symmetric or asymmetric nuclide. The asymmetric nuclide would consist of half the points of its symmetric cousin, or with hyper-hadron like connectivity.

Ordinarily we may assume that an asymmetric must be set upon a symmetric and that they would occur in the order of sequence stability. They definitely occur in order of sequence stability, but not necessarily by symmetry or handedness. For example, a lone or randomly injected left-handed would be considered unstable. As part of a nuclide core, however, left-handedness is an expectation.

Each of these is shown with possible architecture contents and assigned an orbit-compatible sign (b, s, p, d, f, g). A lone neutron in the core could be shown as ${}_0b_n$. A proton+neutron pair as ${}_1s_1$. A p-shell can be single right or left-handed (l=2n+1p→ ${}_1p_{1n}$) or a double (${}_1p_2$).

Nuclide shells consist of unlike parts, so they will configure differently. A lone proton (H) is ${}_0b$; none explicitly is ${}_0b_0$. Assuming one neutron per proton, He fills ${}_0p_1$, and B fills ${}_0g_1$. The spatial requirements, however, limit the number of core components in a complex to 0, 1, and 2 protons—up to ${}_0p_1$. If there is a proton core, it must be H (1=${}_0b$,2=${}_0s_1$, or 3=${}_0p_{1n}$) or He (3=${}_0p_1$or 4=${}_0s_2$). The iron structure illustrated on pg. 241 could be written:

$$\text{nuclide} = 52,\ \text{protons} = 26\quad {}^{52}_{26}\text{Fe}\qquad \text{Nuclide Structure: } {}_0b_0+{}_1g_2+{}_2f_2+{}_3g_2$$

This structure is confined in an extreme mass density condition of $\rho_m=3N_m/4\pi r^3$ (nuclide mass per spherical volume).[16] The spherical radian $1/2\pi\equiv s^2$, makes nuclear density a function of magnetic (μ_0) and linear (G) permeability in a change distribution ($s^2=k^{-2}$). The available space is a function of angular permeability ($U_A=f\acute{\varepsilon}_A=4f\times10^{-7}$ kg/m s^2) in a distribution of the remaining change ($/k^2$):

$$\boldsymbol{\rho_m= [U_A/k^2]\ [\mu_0/2G=2.34378270633671\times10^{17}\ s^4/m^2]}$$

$U_A/k^2=$ kg/m s^4 is the “emptiness” in quantum foam. The foam container is idealized by $\mu_0/2G$. The proper container is /2G. Magnetic charge projection is a significant part but is non-local, complicating everything. Only part of this non-localizing factor can participate in containing localized angular value ($f\acute{\varepsilon}_A$). That is one challenge of realizing this idealization.

Foam is a relatable concept to understand how degenerate density works. It can be formed with trapped impurities adding to emptiness or removing from the container. The structure defines where what can go to manifest and trigger changes like neutron decay.

Presumably only part of U_A/k^2 is available. Satisfying the angular quantum number $\acute{\varepsilon}_A$ may be localized, made ambiguous, and trigger only a partial discharge. Neutron star observations suggest a quantum number is satisfied where $f\acute{\varepsilon}_A=1|e$ kg/m s^2 (π is already used by μ_0). Achieving 1 is the idealization fulfilled from a lesser ground state density, and e is the maximum for ground state densities numerically $\geq\mu_0/2G$.

This idealization and related functions can help establish G. Diverse and contextual functions connect at idealizations like this by arriving at the same values. For example, we can use the Schwarzschild with an electroweak disorder of:

$$\boldsymbol{U=2\pi\ [w_{kh} = i(r_k\partial_h - r_h\partial_k)\rightarrow c^{-2}] = (c\hbar/\delta Q)^2 = /m^2}$$

$$\boldsymbol{\rho_m = [2\pi w_{kh}]\ [c^2/2G]}$$

Electroweak spacetime renormalizes into ordered nuclide density. This enfolds the structure with a distribution of disorder into a complex function.

Quantum Dynamo

Nuclide structure is a quantum phenomenon renormalizing mass density. A lot of features are confined (hidden) in the process. Confinement also means we cannot think of our shell structures classically. They emulate classical mechanics, but in a quantum way—hence quantum mechanics.

As QM, we can go through all our conventional mechanical thinking and computations. We absolutely cannot forget that these measurements are applied to an imaginary axis in the system. This QM system can form a dynamo effect in degrees or perfectly (e.g. ferromagnetism).

The **dynamo effect** focuses angular momentum through the intrinsic charge field (μ_0) projection found in the degenerate density function (ρ_m= [U_A/k^2] [$\mu_0/2G$]). This allows energy to be kept in the system as a projected cycle that would locally violate density or other scale limitations.

The dynamo-effect is a geophysics theory in which spinning interactions of the core generate magnetic field lines. In contemporary thought, ferromagnetic elements with weak magnetic fields excite electrons in the convection currents of the mantle and core.[17] This is based on inducing electrical current by rotating a coil in and out of magnetic fields.[18]

Electromagnetism covers a very large group of cross-phase interactions—namely interactions between order and disorder on quantum change levels. The result is bi-directional quasi-temporal fields consistent with $\hbar$-entropy (phase).

Electrons and electrical current certainly play a role in energy conveyance and related fields. They are not the actual source of magnetism. The source is in the structural interactions of the degenerate nuclide. In part this can be viewed as extra-temporal transient weak charge interactions. While incomplete by itself, it gives a starting generalization.

The neutral charge in passes through the same electroweak space as the positive charge and conveys the expansion of both into a projected angular field. The conversion from angular to magnetic is simply a change in orientation relative to the origin (around becomes adjacent, recall constants on pg. 81). For this reason, Coulomb's angular and Maxwell's electromagnetic constants are inversely related: $4\pi\varepsilon_A=\varepsilon_0^{-1}$.

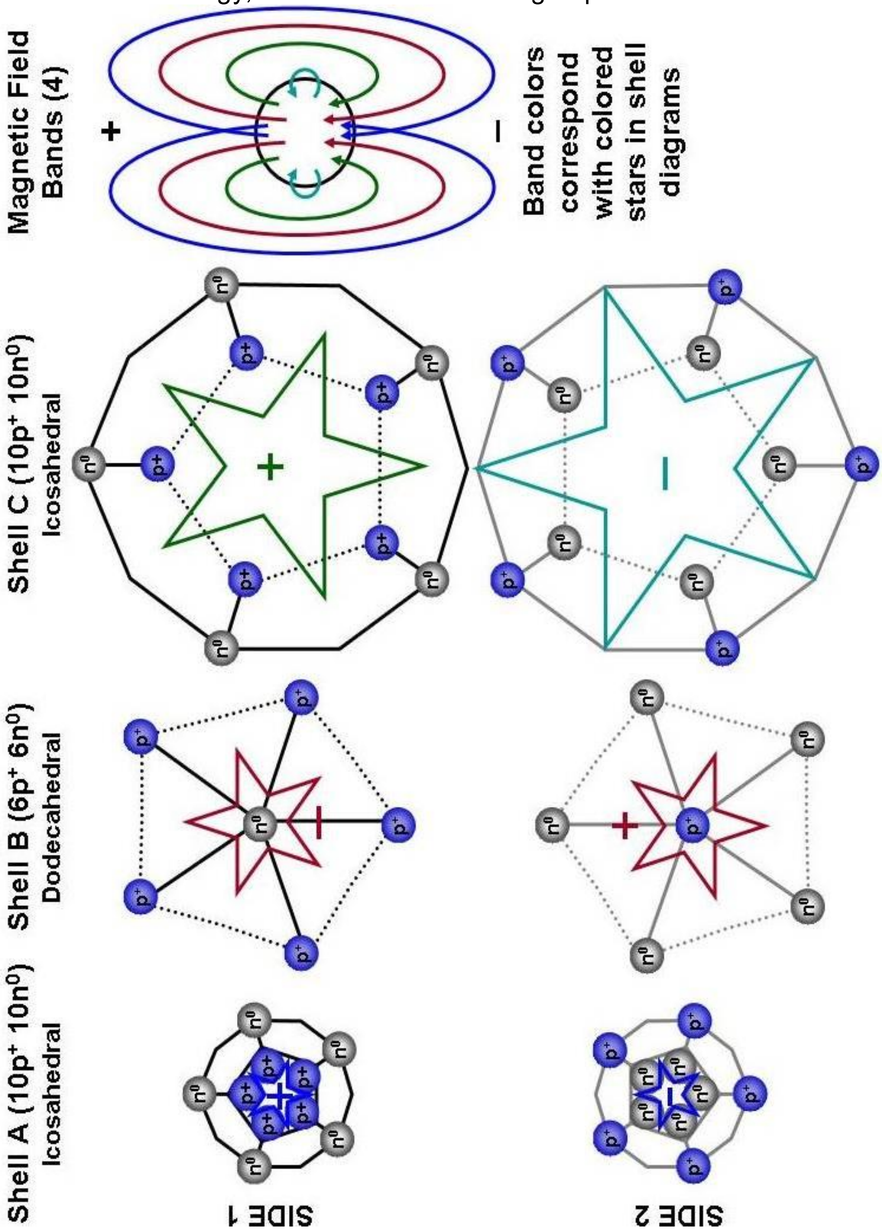
The linear expansion in time becomes angular. Angular force is object contained (m^3/kg). Neutralizing charge passing through that electroweak space swaps from object to volume oriented (kg/m^3).

The energy of magnetism is the energy in the electroweak spacetime. This includes intrinsic values from trion bonds, extra charge values,[19] and transient energies, like the force of electrical current in the solenoid of a bar magnet.[20]

Earth's magnetic field is most likely a product of weakly interacting (super) massive (degenerate) iron-like particles (WIMPs) excited by the active core and even more complex field conditions. Electromagnetism includes intrinsic and environmental influences.

How magnetism works technically….

Let us assume energy acting on a nuclide affects the entire structure together. This means energy going in or out of the system is treated as acting uniformly in time across the system. Aside from proportional distribution of energy, it will be as if the other groups aren't there.



14.7: Ferromagnetic Nuclear Shells to Field Lines

Energy gets divided between angular rotation and linear expansion at contextual convenience. These act on the system as surface containers/ manifolds: $U=(c\hbar/\delta Q)^2 \to 2\pi w_{kh}$. The electroweak spacetime (w_{kh} see pg. 221) consists of both intrinsic and transient (heat) values.

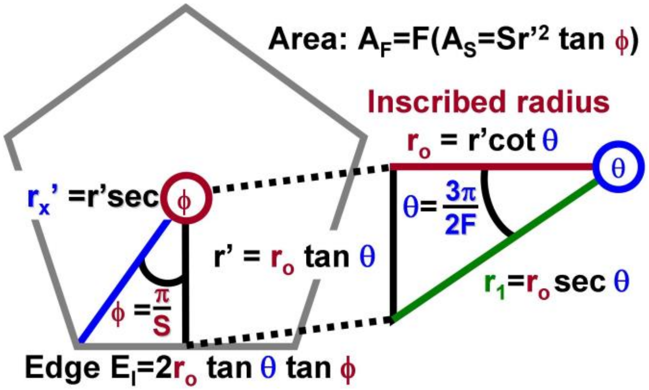
Our QM system is a quantum foam degenerate distribution. It undergoes an imaginary linear surface expansion. It is imaginary in that the change function is the sub-temporal distribution. If it were temporal, it could not function in this already occupied space. Ordinary solid geometry applies but under imaginary conditions.

		F	V=FS/J	E=F+V−2	S=2E/F	J=2E/V
Trionic Point*	–	1	2	1	2	1
Tetrahedron	s	4	4	6	3	3
Octahedron	p	8	6	12	3	4
Cube	d	6	8	12	4	3
Icosahedron	f	20	12	30	3	5
Dodecahedron	g	12	30	20	5	3

*renormalization of color charge shaping to spherical point.

14.8: Regular Solid Features

Mensuration formulas (below) for regular solids utilize Euler's and related variables (above). S=sides per face is easily computed by dividing F/360 then find the median of the listing of all the 3s, 4s, and 5s; or S=2E/F. J=number of edges joining a vertice, each edge joining two vertices.



14.9: Mensuration of Regular Solids

Polyhedron evaluations renormalize into spheres but are enormously helpful in QM. Our focus is total area=A(F)=A. Each structure group/shell has its own proportion of the electroweak spacetime (manifold) of the whole: $u_A=U\ A/\sum A_n$. We used u_A here to avoid confusion with the angular U_A used in the density function.

$$\frac{\text{Exscribed}}{\text{Inscribed}} \quad \frac{r_x}{r_o} = \sqrt{\tan^2\frac{3\pi}{2F}\ \sec^2\frac{\pi}{S}}$$

Tetrahedron	s	4.930 893 275 967 83
Octahedron	p	1.669 086 806 815 86
Cube	d	1.732 050 807 568 88
Icosahedron	f	1.109 302 142 000 00
Dodecahedron	g	1.123 450 055 497 63

14.10: Regular Solid Ex-Inscribed Radial Ratios

While treated as polyhedrons relative to each other (e.g. squeezing r_X of one into r_O of another), linear expansion smoothes into angular. To retain density and conserve value, the angular gets projected as magnetism. Squeezing consists of increasing the areas proportionally together until one can fit inside the other. Rescaling takes energy that could be magnetic force—inefficiency in the system. Radial ratios show p goes easily into d and f into g.

Endnotes

[1] Clark, J. (Oct. 12, 2007). How Quantum Suicide Works. https://science.howstuffworks.com/innovation/science-questions/quantum-suicide4.htm.
[2] Faye, J. (July 24, 2014). Copenhagen Interpretation of Quantum Mechanics. https://plato.stanford.edu/entries/qm-copenhagen/.
[3] Reid, M. (June 13, 2014). Einstein vs quantum mechanics, and why he'd be a convert today. https://phys.org/news/2014-06-einstein-quantum-mechanics-hed-today.html.
[4] Camenzind, L.C. et al. (May 22, 2019). Spectroscopy of Quantum Dot Orbitals with In-Plane Magnetic Fields. https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.122.207701.
[5] Williams, M. (July 28, 2016). What is Bohr's Atomic Model? https://www.universetoday.com/46886/bohrs-atomic-model/.
[6] Wiswesser, W.J.; Konier, D.A.; & Usdin, E. (June 30, 1972). Wiswesser Line Notation: Simplified Techniques for Converting Chemical Structures to WLN. Science: 176(4042):1437-9.
[7] Carolina, N. (Nov. 30, 2017). 5 Ways to Learn Orbitals in Chem 130 at University of Michigan. oneclass.com/blog/university-of-michigan-ann-arbor/ 26649-5-ways-to-learn-orbitals-in-chem-130-at-university-of-michigan.en.html.
[8] Watkins, T. (ret. Feb 25, 2018). Models of Nuclear Structure. San Jose State University. http://www.applet-magic.com/nuclearstruct.htm.
[9] Shupe, C. (2015). Nuclear models: The liquid drop model Fermi-Gas Model. atlas.physics.arizona.edu/~shupe/Indep_Studies_2015/Notes_Goethe

_Univ/A2_Nuclear_Models_LiqDrop_FermiGas.pdf.
[10] Elliot, J.P. (1985). The interacting boson model of nuclear structure. iopscience.iop.org/article/10.1088/0034-4885/48/2/001.
Cejnar, P. & Jolie, J. (July 22, 2008). Quantum phase transitions in the interacting boson model. https://arxiv.org/pdf/0807.3467.pdf.
[11] Dayou, C. (Feb. 6, 2018). Statistical Model of Nuclide Shell Structure. NW University, China. medcraveonline.com/PAIJ/PAIJ-02-00050.pdf.
[12] Gross, R. & Marx, A. (2014). Solid State Physics (Festkörperphysik). Berlin: De Gruyter Studium. German language.
[13] Chieh, C. (Jan. 21, 2004). Nuclides. University of Waterloo. science.uwaterloo.ca/ ~cchieh/cact/nuctek/nuclide.html
[14] Chinnis, D. et al. (2013). Exploring Structural Engineering Fundamentals. teach engineering.org/content/cub_/lessons/cub_trusses/cub_trusses_lesson01_presentation_v5_tedl_dwc.pdf.
Fyon, A. & Ginn, E. (1999). Professor Beaker's Everyday Structures and Systems. steps.ie/StepsToEngineering/media/StepsToEngineering-medialibrary/ Volunteers/Activities/Everyday-structures-and-systems.pdf.
[15] Baez, J. (Nov. 12, 2006). Platonic Solids in All Dimensions. math.ucr.edu/home/ baez/platonic.html.
[16] Nave, R. (2017). Nuclear Size and Density. University of Georgia. http://hyperphysics.phy-astr.gsu.edu/hbase/Nuclear/nucuni.html#c4.
(2018). The Atomic Nucleus. cyberphysics.co.uk/topics/atomic/nucleus.htm.
[17] Guzman, R. (Oct. 15, 1997). Dynamo Effect. astro.ufl.edu/~guzman/ ast7939/glossary/dynamo_effect.html.
Bettex, M. (Mar. 25, 2010). Explained: Dynamo Theory. news.mit.edu/2010/ explained-dynamo-0325.
[18] Tilgner, A. (Apr. 2, 2012). The Twists and Turns of the Dynamo Effect. https://physics.aps.org/articles/v5/40.
[19] Kawanaka, H. et al. (2016). Enhancement of ferromagnetism by oxygen isotope substitution in strontium ruthenate $SrRuO_3$. nature.com/articles/ srep35150.
[20] Nave, J. (2017). Bar Magnet and Solenoid. University of Georgia. http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/elemag.html.

15. Degenerate Distribution

Degeneration is reduction of a set into arrangement-independent common variables; or a limitation that reclassifies to a simpler nature.[1] In chromodynamics we used confinement to contain value in change operator defined spaces. Degeneration describes higher levels of confinement where mixing renormalizes the information into axes. The variety of deconstructions—ways those spaces could be assembled—account for the contextual qualities of the identity.

With degeneration, a complex of information reaches a critical point where it simplifies its change functions, redefining space. The original information is lost, such that only given contexts evoke the effects of separate deconstructions, but the whole doesn't necessarily break apart that way. Breaking provides a new set of contexts.

The whole describes an intensive unit that can be combined with other intensive units extensively until so many are put together that those units cannot be individually accounted for except by mathematical inference. Degeneracy again applies to create a group identity with intensive and extensive properties. To understand and reconstruct field dynamics starting with hadrons and atoms, we need to think in a range of terms from uniform fields to group dynamics.

We like to think of quantum mechanics as describing esoteric ideas of physics. QM isn't esoteric at all. It is simply asking how one seemingly indivisible object can have many contextual qualities. QM asks what are the mechanisms involved? As bizarre as it sounds, it is actually our normal world, not the exception. The exceptions are the simple, tidy solutions. QM applies all the tidy solutions, you just need context. To understand the mechanisms and relations of those solutions, you need to understand distribution constructs and ways they can be deconstructed.

Beyond Wonderland

Step through the looking glass of geometrization that describes less than 5% of the observed universe. And what you and Alice find among the metaphors of a children's story over sixty years before Bohr, Heisenberg, and Schrödinger are the rules and processes governing our universe. Our rules don't govern the rest of the universe. The Cheshire Cat[2] foreshadowing Schrödinger's is commonplace. It is the rule, not the exception. It is we who are peculiar, out of place.

15.1 Tenniel's Cheshire Cat

Our perceived reality is geometrized and uncountable. Our perspective is one of numbers we can only statistically infer, shaped into mechanisms but themselves made of myriads of qualities for which the mechanisms are unclear. The virtual and latent universes to us invoke the word quantum, but really they are far simpler.

We live in the exception, the convoluted Wonderland of peculiarities. It isn't our perspective of rules that govern everything, but the rules of everything else that governs us. All other levels, including our own, is either building up to geometrizing or breaking it down. The numbers enable mechanical shaping by arranging discrete points into geometries we can control. But as quickly as we can build a geometry like a motor, it either breaks down or gets added to an abundance of dust balled into yet another degenerate generalization.

Our realm is quantum mechanically complex. In that complex are simplifications that look and can be studied as classical. Classical derives from them. Everything is simpler relative to us. If we stop trying to make everything cosmically significant for a minute, we realize we understand a lot more of everything outside our middle geometrized realm than in it.

We are the weave. Everything one direction is weft, the other is warp, and the weave is where the generations of matter transition from one to the other. How? Our first definite clue was Avogadro's hypothesis.

Avogadro's hypothesis stated that different gasses of equal volume and temperature are also equal in number. Today, Avogadro's law applies specifically to ideal gases (V=nk or volume = number at pressure and temperature). The law works simply because the kinetic interactions (e.g. motion bouncing off each other) aren't made more complicated by other interactions. This provided the basis for Cannizzaro's first logical theory of chemistry in 1858.[3]

Using this and its related laws, one quickly finds mass differences among ideal gases. If you adapt for the field dynamic interference, you can then apply the same principles to other elements and molecules. Under these conditions you now have a space consisting of an uncountable number of discrete points. Their distribution in phase space (their environment) is another story.

Avogadro's hypothesis leads later to the number named after him: 6.0221409×10^{23} atoms/mole. A gram of hydrogen atoms should contain exactly this number of protons and an equal number of electrons. Nobody actually counted them. There could be other isotopes of hydrogen in there that would significantly affect the number atoms. There are simply too many to reasonably count. It is an **uncountable degeneracy**, the number being inferred by statistical means.

Uncountable degeneracy is even too numerous to count mechanically. Earth is estimated to be 5.972×10^{24} g,[4] estimating the number of protons and electrons at 7.19285×10^{48}. That is an inconceivable number of points whose arrangement is practically irrelevant. Another way to think of Avogadro's number is by grains of sand. Lining up that many grains of sand spans about 75,000 light years. That is roughly three trips to the center of the Milky Way.

We struggle to comprehend both uncountable numbers and uniform fields. A set of things has two dynamics: the dynamic among its parts and the dynamic as a whole. These act on separate bandwidth magnitudes—one with a degree of individual displacement effect and the other with collective effects as the generalized field. Surface gravity provides an excellent example focusing locally into density, then generalizing to another level of field dynamics.

Distribution consists of three parts: a value and the map of that value into density. The entropy (S) of an uncountable is the wave energy (frequency=value) expression of its probability density (ω). Complex elements map the likely positions. Dilation of an environment affects density (e.g. brightness) by changing the scale of spacetime acting on things as a reference frame for the group. It doesn't change the size of objects in the group.

When thinking of scale, it is also important to remember the fixed features. Just as the speed of light is constant in all reference frames, so too are all the other spacetime constants. They work together in proportions fitting specific roles. Deviations from proportions become hyperbolic potentials for absorption or emission that are also subject to proportional requirements.

The distribution probability for individuals is specific to them, distinct from the group. The change in the group defines potentials for interaction among the parts, group energy, and density. Group energy is kinetic and latent value within the group relative to the parts affecting group mass. As Zwicky showed, you can't just add up the parts to find the mass of a group. Likewise, the effect of mass in terms of gravity is modified by Newton's constant, which is affected by distribution variables.

Put into the context of an identity consisting of a group of n parts, ω is a real number mixed (φ) by triangulating interaction ($\frac{1}{n}\Sigma\omega_n^2=\cos^2 \varphi$). Newton's constant depends on this computation, linking $F_g=m_1m_2G/r^2$ and weight ($w=F_g=mg$; the force of gravity on a mass[5]) to entropy and mixing angle. No configurations apply at $\omega=0$. At $\omega=1$, the distribution is statistically uniform (ideal) like degenerate density or the cosmological principle. All possible configurations are equally true/possible in context.

An identity is subject to a common change function. Spacetime resists local distribution (space) and transformation (time). The displacement of spacetime is the probability density, which can be real or complex. From a group of points coming into the form of an object's perspective, the density is real. From the perspective of axes defining the spacetime of the whole as a field, the density is complex. That whole, no matter its size or shape is a point with dimension that may or may not be able to share its space. When spatial sharing becomes restricted, these points geometrize.

Point Geometry

I see others in the physics community drawn to String Theory for its "elegance," and repelled by what is perceived as classical point geometry. We've applied the "vibration" concept of String Theory to Chromodynamics by means of change operators acting as wave functions. As Wheeler's geometrodynamics suggested, we construct the spacetime elements of the geodesic field equation by following the evolution of complex hypersphere manifolds[6] from individual to group logic.

The initial group logic renormalizes with degeneracy as points with diverse qualities fitting the Copenhagen interpretation. The points are the elements assembled to form literal geometric objects—the myriad of tangible ordinary things. Of course these points are ambiguous. We physicists like to forget that our science is the foundation upon which everything else gets constructed. We are the beginning, not the end.

Of course everything else is more ambiguous to us because it is a completely different line of thinking. Physics is just as unique relative to them. That doesn't mean either is wrong. Likewise, geometrodynamics and String Theory are unproven, broken/incomplete models. That doesn't mean everything about them is wrong. Go with what actually works without generically dismissing over a few shortcomings. Conversely, when your line of thought in fifty or more years has never produced anything practical, it is probably time to take a significant step back.

A geometry is a system for describing shape and relative arrangement. Plane geometry, as an example, can describe coordinate systems for surfaces, like circular, rectilinear, triangular, and hexagonal. A Euclidean space is a rectilinear geometry with Cartesian coordinates. It consists of two axes for a plane and three axes for a volume. All its axes are simple, flat, connected at a common origin without their own direction.

Generally speaking, when we use the word point in mathematical terms, we are describing a coordinate in Euclidean space with no intrinsic value. The coordinate is what identifies the point. Of course in physics the coordinate only describes a location, not what is at that location. The related functions intersecting that position describe what is there. That isn't to say what is there is a discrete thing of no dimension like the point. Quite the contrary, it has a non-zero value and the use of mathematical points applies specifically to the field definition of a discrete thing.

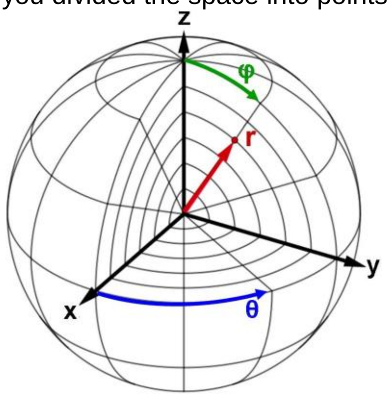
This discrete thing occupies a position in spacetime. It is a point with value. While mathematics allows for infinite divisibility, the universe is a bit more picky. You can think of the universe as you would a printer crafting letters and pictures with jets or other means of creating points. Its points aren't infinitely divisible. They have enough value to be observed and therefore functional. The same is true with the universe.

This pixilation phenomena has led to many pursuits like aether theory, Planck's units, the quest for ground state and quantization values, etc. Some are meaningful, many are not. Aether theory derived from monadic philosophy is a prime example of over-simplified thinking. It fails to recognize there are significant differences in the use of space between passive latent space, propagation, virtual perturbations, and discrete distributions. It essentially tried to make all spaces discrete distributions of the same thing.

Aether theory has some valid elements, you just have to be real careful not to go overboard. For example, the universe can be divided into points (pixilated) but that doesn't make those points relevant or discrete, just a map of possible positions. Yes the universe can be boiled down to just one thing: scalar value. Let's not forget that one thing's qualities begin with its absence followed by how it relates to that absence. And again, one cannot think of scalar value as discrete.

So let us stop thinking of the universe in these material terms and start thinking of it as a dynamic system of many states. Let us start by looking at it in mathematical terms as a point with no value. We can then add value in increments like layers of an onion as shown below to see coordinate possibilities. Such possibilities give us ideas for geometrizing the point itself, which is precisely what happens in a field. A uniform field perspective will use the same system no matter how you divided the space into points.

These coordinate possibilities are not true physical entities. They are just mapping conveniences not to be mistaken as actual things—φ in this diagram is not the mixing angle. Actual things do rhyme with these human systems, which leads to quite a bit of confusion. For those struggling with this, it is similar to the differences between ideal values and practical application of values. Ideal is how we like to think of things, but rarely are ideal functional in reality.



15.2 Point Coordination

One of our human problems is differentiating between local finitude and procedural infinites. Spaces are local, created, destroyed, and finite. Time as a flux function is procedural and therefore infinite. When we see time emerging, it isn't being created, it is being displaced by a quantity (e.g. m/s^2) applied relative to the surface of spatial creation.

Entropy generally measures the uncertainty of discrete distribution. As uncertainty of displacement, entropy ($S=k_B \ln \omega=E/K$) is an effect of distribution in Kelvin of energy ($E=mA/s^2$). In information theory, the outcomes are like coin tosses. The number of possible outcomes ($\leq \ln N$) sets the upper limit for entropy.[7]

The discrete distribution takes on an identity at $\omega=1$. From there, entropy proceeds down an imaginary axis because of this change in nature. Entropy is ergodic in the sense that all behavior over time and all samples are proportionally consistent with the phase state of the whole.[8] The ergodic hypothesis states energy in a space over time is proportional to volume, making all configurations of that space equally probable.[9]

If you have probability, you also have absolute certitude of no probability or definite outcomes. All the value in one hypersurface or hypervolume is singularity at S=0 with a complex unit and 1-sphere perspective. It is not a displacement, so no displacement is to be found. Displacement applies in 2-sphere mode, where the (Ricci) volume is ergodically defined and acted upon by a hypersurface. The degree of displacement is the dilation of entropy.

Degenerate density is absolute displacement. At ω=1, the spacetime is fully occupied and ergodic—static energy defined spacetime. Before applying the complex variable, ω=1 is certain—all configurations are equally probable. With the complex variable, information arranges the axes and is then observed in the projecting axis. The ω density then proceeds to diminish, increasing entropy relative to the initial identity.

No matter how you define these spaces, they are uniform relative to each other and the whole. The only differences would be limitations to their configurations leading to the Copenhagen interpretation. We call it a point geometry because it is an intensive arrangement of axes that can be arranged together extensively. Such an extensive distribution of discrete points tends to breaking up or diverge toward disorder as the surface of energy distribution (S) increases.

Entropy doesn't actually describe where things are but how densely packed and statistically arranged they are. It is not just a measure of discrete dilation, which affects the opportunity for information randomness. As Bell's theorem suggests, short of having absolute control of the variables as with mechanics, the best representative of a system's information in action is the system itself. The alternative is probability densities defining entropy.

This reminds us again that spaces belong to things and things displace and are separated by distribution in time. It is yet another reason the "expansion of space" is an inaccurate statement. Space isn't expanding, time is. And as it expands it converts into space coming into focus as part of the grand cycle of processes.

Simple Entropy

Complementarity states all valid perspectives apply in degrees relative to context. Bohr and Heisenberg did the unspeakable: they basically said everyone is right to some contextual degree. From the perspective of mechanisms responsible for diverse contextual qualities applying to one thing, this untidy mixing of working theories conveys to distribution. Every way a space can be configured establishes object-specific specifications.

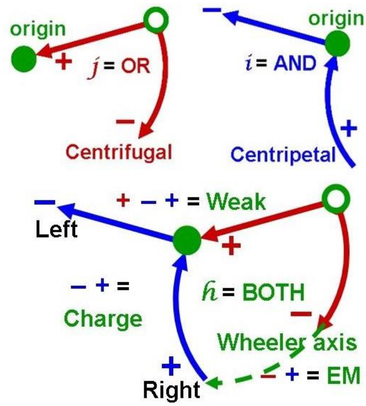
I refrain from using the word "classical" simply because it is hard to classify complex distributions as classical, but in a sense they are more classical than the real numbers. The differences are in the roles. For perturbations, the operators are complex giving directional shapes but with real diversity. The real diversity combines two axes separated by a mixing angle into one.

With confined distribution, the common axes rotate into complex diversity forms, handing the operator role over to time (real). Real number entropies scramble the variables consistent with a degree of disorder. They are the mess of octal geometrizing followed by simple mixtures of many points. Complex forms and 0 are classical as reasonably simple spatial axes or concepts. The flat temporal operator shaping and incrementing the axes makes them simple. Recall this table from the first chapter.

	Complex $=k$	Real $\neq 0$	Real $=0$
$0 \Rightarrow i$	Light	Volume	Blue
$\frac{1}{3} \Rightarrow j$	Electro	Surface	Red
$\frac{2}{3} \Rightarrow \hbar$	p^+ | pulsar Neutron p^- | pulsar	GFE	Phase

Diversity (S-Entropy)

Space Type



15.3 Glome Change Operator-Defined Entropy

Reasonably simple, is not too simple. To the left you see 0, $\frac{1}{3}$, and $\frac{2}{3}$ for the ratio of discrete spaces used to all spaces (volume, surface, and extensive). The traditional i-operator has no discrete spaces, only latent distribution in time consisting of absorption and emission axes. The emission axis can and is applied as value giving magnitude to discrete definitions.

The j-operator describes confinement into OR divergence from virtual particles with partial spaces. As a primordial axis it is a hypersurface singularity formed by sharing kinetic energy—nothing has actually been conveyed. By itself it has no discrete or extensive value. To have these values, a magnitude of temporal distribution (i) must be confined to its volume. Only then can an attributed value for the secondary centrifugal (extensive) axis emerge.

Chirals swap linear and angular axis roles. The active linear hypersurface contraction (+) or hypervolume expansion (–) becomes angular. The secondary axis is always the available axis, and the mixing angle is the degree from right angle intersection. Notice the intersect for i is also the origin, where j is separated. The common origin is where they conjoin into phase (BOTH).

For a glomed object like a lepton, the operator axes are mixed such as value in a j-axis and attributed value in an i-axis. That leaves two axes completely undefined without further context, but you cannot just add them without risking exclusion due to already having one gloming effect. Context must then be complex like rotating the aspect (spin quantum number) so the axes do not conflict and/or layering (principle quantum number).

In phase (BOTH) the axes of the parts become semi-Euclidean. I say semi because you have three axes defining a glomed volume with surface. These axes are directional, limited/confined (intensive), one is angular, and an angular fourth projects away (extensive). The relationships of these axes is vital as any gloming (mixing) creates geodesic and weak pressure effects. It also transforms the centrifugal axis into the angular Wheeler axis projecting electromagnetic feedback.

The $\acute{\imath}$-axis becomes electric charge in gloming context. Relative to the weak pressure, a valued $+\acute{\imath}$-axis is right handed pulling into focus, where $-\acute{\imath}$ is left handed diverging from focus. This valued $\acute{\imath}$-axis is either a linear or angular hypervolume. Alone it does not define a whole space.

The available $\acute{\imath}$-axis then couples with the kinetic valued $\acute{\jmath}$-hypersurface to form a surface. This is a complete surface—one of the three expected spaces. The $\acute{\imath}$-hypervolume becomes a real volume when it is coupled with the available $\acute{\jmath}$-axis which forms the angular Wheeler axis.

The Wheeler axis is the available distribution, an extensive property meaning it is a sum of its parts with emission potential. The charge axis isn't a space as much as an intensive unit property that is directional (+ or –) or neutral. The Wheeler space applies extra value by adjusting volume (neutrals), surface (for $\acute{\jmath}$), or projection of potential (+|– charges and handedness).

Nuclides have both projecting protons and expanding neutrons. It is easier to preserve identity projecting extra value than holding it in close to focus into new identities. The combined effects make excessive numbers of neutrons relative to protons more vulnerable to weak decay. The Wheeler axis is an active boson axis.

Complexes of these boson axes make new identity formation easier by providing focus and interference to create information for emission or discrete identity. When we think about the structuring of spaces like this, it isn't too hard to begin imagining how we can reconstruct the heuristics (adaptive algorithms) of the array of physical chemistry properties, decay and other nuclear changes.

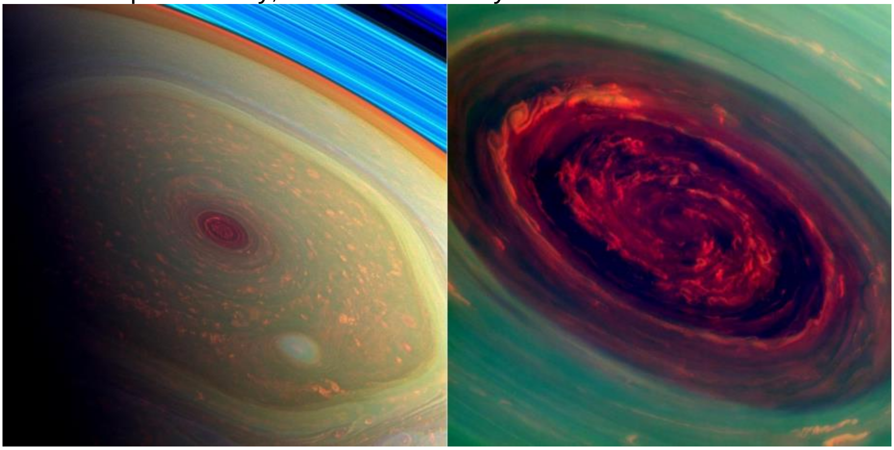
Celestial

As with previous editions, putting Quantum Relativity to print simply completed one thought cycle. The very same day, I started picking away at the latent case. Each door we open presents a whole new adventure and optics to view everything else from. It was from the latent case perspective that I found the major patterns of transformation and finally realized the significance of the Copenhagen interpretation.

This change in perspective dramatically affected how I look at celestials. Celestials are the eight generation of matter, consisting typically of so much pressure that atoms ionize (the electrons separate from the nuclides) and group behaviors quantize. By quantizing, the identity pulls into a uniform shape (e.g. becomes spherical) and takes on the full range of unit characteristics to include contextual configurations consistent with QM. Contexts span all the generations of matter preceding, and consistent relative to scale. Celestial WIMPs are one context.

Celestial WIMPs are virtual weakly interacting massive particles. They exist in the very special context of degenerate celestial mechanics. WIMPs are traditionally sought in particle accelerators. You actually need to look in superfluids and plasmas for any hint of celestial effects, but don't hold your breath. Forcing a small quantity of matter to behave abnormally is not the same as self-inducement.

Unfortunately, configurations of higher generations like celestials can only be observed, not reproduced. This skirts dangerously around the drain of speculation rather than empirical science. So long as we never violate the laws of empirical science and keep our hypothesizing within arm's reach of reproducibility, we should be okay.



15.4: Saturn's North Pole

We see evidence of WIMPs in magnetic fields and by their hexagonal shadows at the poles of some worlds. Earth's polar hexagons are rough due to resistance of solids. Saturn's (below) are the most prominent but smoothed by gas motion.[10] Neptune's are hard to see due to smoothing and coloring. Gauging size of the oblation or proving a WIMP shadow can be hard, but magnetic field lines are a big tell.

Clearly an object with such a magnitude of interactive potential is a tad beyond human ability to emulate. And there it is. Reality check. We can only emulate to a point. A singularity can occur at any magnitude. That does not mean the singularity acts the same, can be maintained, or grow from any magnitude. It is an incredibly common hypersurface feature. Where, how, and the scale perturbations occur are significant to understanding how the definition applies.

"Weakly interacting" invokes the definitions of "weak bosons." Weak bosons are intermediary—a transitional state of matter. They are a special case where value indeterminately applies to both surface and volume. The context then determines how mixing will differentiate into another form typically by divergence.

Here we are more specifically dealing with quark transitions to include the array of weak, boson, and lepton field features. These fields have somewhat conflicting features that complement each other. Among virtual particles, complement is achieved by filling and optimizing the use of space. Here complement is achieved by creating just enough space for function. The result is density layering in favor of the full range of conventional plasma and elemental states.

Not all celestials fit this image of field dynamics complete with discrete material points in layers. Quantum fluctuations (perturbations) can trigger uniform fields as individual identities on any scale. One such fluctuation has long been of interest to astronomers. WIMP divergence appears to follow one of two paths: equalizing into inert Ricci volume or catastrophic like a super nova.

Michell and Laplace's "dark star" from the 18th century became Wheeler's "gravitationally collapsed objects" he mistakenly called black holes in 1969. They were describing putting ordinary matter under so much pressure that it becomes one indistinguishable field. While many over-thought this, it is actually as common as forming isotopes.

A nuclide is precisely an indistinguishable combination of hadrons optimizing their use of space, displacement, and gravitational effect through strong interaction. These strong interactions are enabled by first creating so much pressure that a plasma forms. The projecting Wheeler axis now becomes a significant player as the plasma magnetizes and projects expanding value away which allows pressure to homogenize.

The efficacy of a magnetic field is largely dependent on the geometry of the parts. The better suited the geometry to directing the value around the group, the easier it is divert expanding energy away and force strong interactions near the same magnitude. Gravity is often blamed, but the changes in gravity are a consequence, not the cause.

In this case we are talking about diverging the WIMP into separate volume and surface identities. This is easily predicted by the balance of ferromagnetic elements in stellar composition. At some point the pressure one direction forces angular volume convergence while the expanding value diverges as the surface blasting away the opposite direction. The magnetic field is the causal mechanism for completing the WIMP's transition into nebula and neutron star (pulsar if the remnant is charged).

This gives us a good clue about how geometrization begins to break down and simplify in the higher generations. At the level of celestial objects, the role of strong interaction still applies, but only incidentally as a consequence of dynamic kinetic energies like Virial theorem (motion) and magnetic fields (charge). The next step puts the celestial in context of spacetime warp resulting in orbital and solar systems.

Degenerate Breakdown

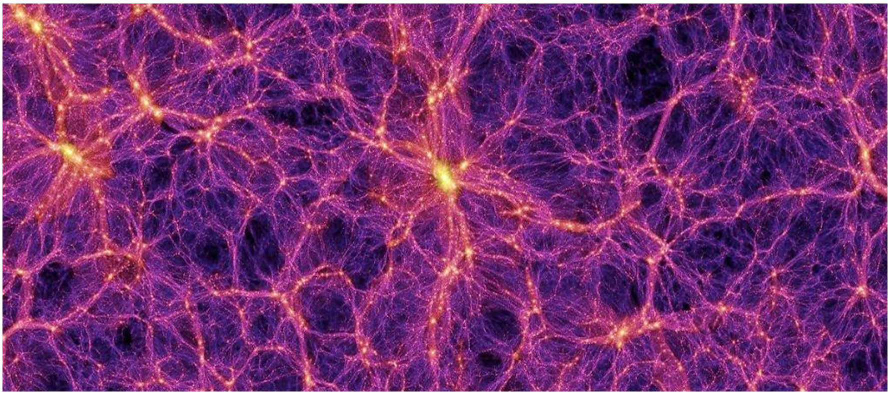
Degenerate breakdown sounds like an anti-social mental anguish punch line. Not far from the mark if you think about the headaches centuries of scientists have endured attempting to make sense of it all, or the contrary nature of how things on higher levels are antithetical to those on lower levels.

6. Baryons	Point Geometry	Strong
7. Atoms & Molecules	Geometries	Octal
8. Celestials	Geometry Renormalized	Quark Weak
9. Solar System	Loop Groupings	EM
10. Galaxies, Nebulae, & Clusters	Transitions (pressure-volume)	Weak Boson
11. Filaments & Walls	Fermionic (volumes)	1 & 2 Sphere (line & surface)
12. CMB Universe	Phase Space	Hypersurface

15.5 Deconstructing Generations

By following the generations of matter constructing spaces into geometries, we can easily see the chiral deconstruction of those same concepts. Remember chiral means imperfectly mirrored. In construction, the **temporal perturbation** of a Weyl fermion volume is the causal **1-sphere**, and the common interactive perspective is the 2-sphere. The object is the **spatial volume**.

Deconstructed, however, the object is the 1-sphere filament (angular arc lines). Filaments cross making a fabric-like pattern, a 2-sphere surface called a wall that clusters into a volume as shown below.[11] These are discrete objects whose moving displacement perturbs a flux of **volume in time**—easily misconstrued as expanding space. It is a role-reversal from virtual particles perturbed by energy coming into focus. Instead, the group dynamics diverges focus perturbing the flow



15.6 Filament Wall forming a Supercluster

When we look out even to our own solar system, we see a wide variety of celestials. Very few celestials are as simple as neutron stars or pulsars—that can be argued as 6th generation despite 8th generation scale. Likewise, as angular momentum (Virial) perturbations, black holes are one generation less than their perturbing factor. As galactic features, perturbed by the angular momentum of solar systems, supermassive black holes are 9th generation.

Almost everything else we look at is unique. The bigger our telescopes and ability to observe celestials, the more variety we will see. There is virtually no end to the variation as they renormalize geometrization. The point of the celestial is like every other perturbation: bringing into focus diversity that renormalizes into a simpler form. Renormalizing is the process of limiting an infinite into a finite frame or group.[12]

Renormalizing isn't as easy as simply adding the masses of individuals in a group to find the common mass. Gravity cannot renormalize,[13] at least not this way. You have to include the kinetic energy and the mixing to form a common effect. Zwickey did one without doing the other, incorrectly conflating latent potential resisting distribution with discrete mass resisting acceleration. The gravitational effect of the whole must be handled using Einstein's geodesic equation to account for the displacement effect of the total phenomenon.

When we put gravity this way and acknowledge it is the weakest interaction, we also realize it is nowhere near as significant as portrayed. The warp of spacetime, however, provides an entirely different argument angle because it basically states that despite local shortcomings, the background of the universe itself is a gravity-like pressure system. That system is without specified directions. It is a latent potential acting on discrete displacements.

Gravity is significant locally. The next ranking vectors are thermal and electromagnetism. When we are considering solar system dynamics, the shape of the dynamic is initially set by electromagnetic field interactions, then given volume relative to the thermal energy and pressure by local gravity. These take advantage of the gravitational warp of phase space.

A common mistake with solar systems is to look at them in terms of their parts interacting one-on-one instead of as a whole. We think of the Sun as emitting vast quantities of energy without thinking of the solar system as a whole representing a relatively conserved field of the Sun. Most of the energy in the solar system never leaves the solar system. It converts and recycles here. Some manages to emit, but even most of that is conserved within the identity of the galaxy.

These feedback systems are hypercomplex—electromagnetic fields applying the looping shapes to the warp of phase space. As a looped system, all the parts have angular momentum contributing kinetic energy to group identity and perturbing hypersurfaces—natures ideal generators. This totality increases the local warp factor by dilating phase space—aka gravity density commonly referred to as dark matter.

These systems simplify the remaining ambiguities of their parts to participate in a much grander galactic scheme. I put galaxies, nebulae, and clusters together in the tenth generation because they all participate directly in the same process. This is the black hole process that generates nearly all the lesser generations of matter by pressure-volume interactions and transformations—local to z=1 or about 10.9 Gly (about ten times the size of the BOSS Great Wall[14]). That may sound really big, but when you consider the scale jumps from atoms to celestials and then solar systems, it is exactly what you would expect.

A cluster consists of galaxies that can merge, diverge, and transform into and out of black hole process status. The black hole process is the one we tend to focus on due to its profound effects like shaping galaxies, quasars, and asymmetric baryogenesis. We forget that black hole singularities are perturbations that must be maintained throughout their cycles. When one is not maintained, it simply evaporates upon discharge in quasar phase.

It helps to have several midwives nearby to help conserve by shepherding and localize the effects. Clusters readily blend into filaments and walls, that are themselves flowing. This flow is essential to shepherding and localizing the clusters etc. These flows are distributions in time. From the discrete perspective of matter, that flow of time in space is a line subject to angular volume effects.

That is opposite to the latent perspective. In the latent perspective, light transforms from space-like to time-like, “expanding” itself in time as conversion from space. This is why it looks like the universe is expanding from a conventional redshift perspective, while cosmological principle shows the spatial distribution is consistent. The combination of latent and discrete effects is what we see as the universe, its energy anomaly exhibited in the spherical wavefronts of CMB.

Endnotes

[1] Weisstein, E.W. (2018) Degenerate. From MathWorld--A Wolfram Web Resource. mathworld.wolfram.com/Degenerate.html.

[2] Tenniel, J. in Carroll, L. (Nov. 26, 1865). Alice's Adventures in Wonderland. UK: Macmillan.

[3] Jalan, M. (Nov. 2018). What Is Avogadro's Law (Avogadro's Hypothesis Or Avogadro's Principle)? scienceabc.com/pure-sciences/avogadros-law-definition-formula-equation-example.html.

[4] Cain, F. (Dec. 24, 2015). Earth's Mass. universetoday.com/47217/earths-mass/.

[5] Nave, R. (2017). Weight. University of Georgia. hyperphysics.phy-astr.gsu.edu/hbase/mass.html.

[6] Anderson, E. (Sep. 30, 2004) Geometrodynamics: Spacetime or Space? Dissertation. Queen Mary, University of London. https://arxiv.org/pdf/gr-qc/0409123.pdf.

Misner, C.W.; Thorne, K.S.; & Zurek, W.H. (Apr. 2009). John Wheeler, relativity, and quantum information. Physics Today. https://www.its.caltech.edu/~kip/PubScans/VI-50.pdf.

[7] Wang, T. (Feb. 25, 2011). Information & Entropy. csun.edu/~twang/595DM/Slides/Information%20&%20Entropy.pdf.

[8] (ret. June 11, 2019). Merriam-Webster Dictionary: "Ergodic." https://www.merriam-webster.com/dictionary/ergodic.

[9] Boltzmann, L. (1898, trans. 1964). Lectures on Gas Theory. University of California Press.

[10] Stricker, M. (Jan. 14, 2017). The Storm System at Saturn's North Pole. www.sun.org/images/the-storm-system-at-saturn-s-north-pole.

[11] Image: Springel, V. (Mar. 12, 2016). BOSS Great Wall. Max Planck Institute For Astrophysics. https://en.wikipedia.org/wiki/BOSS_Great_Wall#/media/File:BOSS_Great_Wall.jpg.

[12] Baez, J. (Dec. 9, 2009). Renormalization Made Easy. math.ucr.edu/home/baez/renormalization.html

[13] Klauder, J.R. (Feb. 1975) "On the meaning of a non-renormalizable theory of gravitation." General Relativity and Gravitation. Vol. 6, Issue 1, pp 13–19. Springer.

[14] (Aug. 16, 2016). The BOSS Great Wall Is One Billion Light Years Wide. https://curiosity.com/topics/the-boss-great-wall-is-one-billion-light-years-wide-curiosity/.

16. Dimensional Analysis

> I believe that the next phase in the development of theoretical physics will bring us a theory of light that can be considered a fusion of the oscillation and emission theories.
>
> —Einstein (1909)[1]

Material and propagation processes fuse into a complementary system of transformations from finite space-like geometries to continuous time-like distributions. It isn't new science, but it is an evolution in Thermodynamics. The theory and processes were already modeled and applied in practical engineering. We're simply modeling them together.

The main obvious innovation was using evolving change logic to show how spaces are constructed and interact. The real innovations were in the background of dimensional analysis. Dimensional analysis is not just the variables and their machinations, but also their human contexts, methods, interpretative perspectives, etc. Like every abstract field, we in physics like to forget and even deny the human elements. After all, those are untidy like the Copenhagen interpretation, and we like things clean and simple.

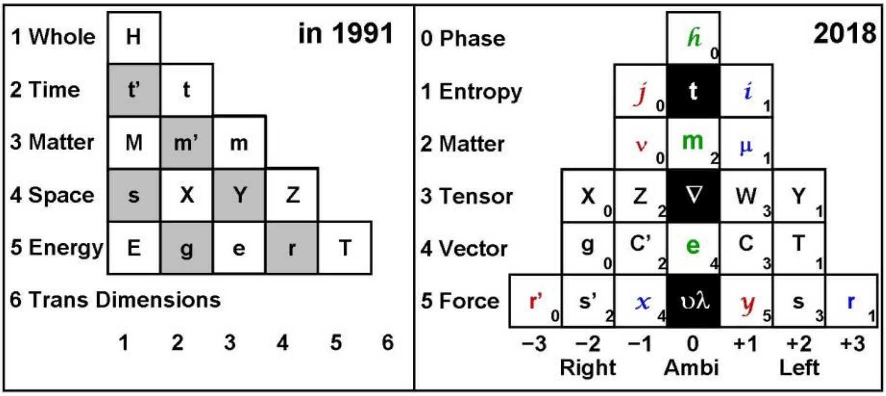
The object-oriented architectural model we started with treats physics as an operating system upon which other sciences run as applications. This is the unit reference frame, the holistic phase environment. Within that the latent (propagation), discrete (oscillation), and distributive (fields) perspectives are handled as complementary spacetime processes. Now we need a contextually adaptive interface.

The Matrix

I was drawn out of applied physics by the elegance of mathematics. You can reasonably argue that I tried to exchange one obsessive mental illness for another. The Matrix emerged from "intuitively" deconstructing the proportional variables of Relativity. To physics, pure mathematical intuition consists of hidden variables. It became a toy to play with, print, apply coffee stains ruthlessly to, round file and forget.

My graduate adviser attended one of classes. Seeing the pattern I was working with, she suggested I look into learning theory, especially the mathematical analyses. It posed a great distraction for a couple years as I unearthed the entire realm of epistemology confirming the patterns without realizing it was the same pattern I had looked at with the physics.

This ability to compartmentalize is an important quality for any doctor or researcher. It enables you to engage fully in a pursuit without incidentally cross-contaminating. But then the day comes when you accidentally set the two pictures next to each other and kick yourself for overlooking the obvious: mind is an imperfect reflection of reality. While epistemology is clearly in the soft sciences, there are certain consistencies like this pattern that cannot be ignored.



16.1: Evolution of Variables Matrix

Suddenly, the Matrix wasn't just a speculative curiosity. Due to the consistencies, especially with systems of formal logic, epistemology started to fill in and correct the hidden variable blanks and anomalies. The Matrix began its first round of evolution to include breaking apart complex variables syllogistically, breaking the Cartesian 3-D habit to see four axes intersect the vertices of a cube at right angles, and the contextual and sequentially compounding nature of the variables. This was literally a quantum evolution in the Matrix.

I could write a literal book on the history and explorations of the Matrix through its evolutions. It would be as much a testament of mental illness as Pascal's triangle and would take all the fun out of playing with it for yourself to get a feel for it. Despite three decades of tearing it apart, re-assembling, experimenting, etc., I haven't scratched its surface or complete potential. Like picking up a dictionary on mathematics, it has a tendency to inspire a myriad of questions. If it is good for nothing else….

$$c^2 = WXYZ \quad \div \quad ij \rightarrow t^2$$

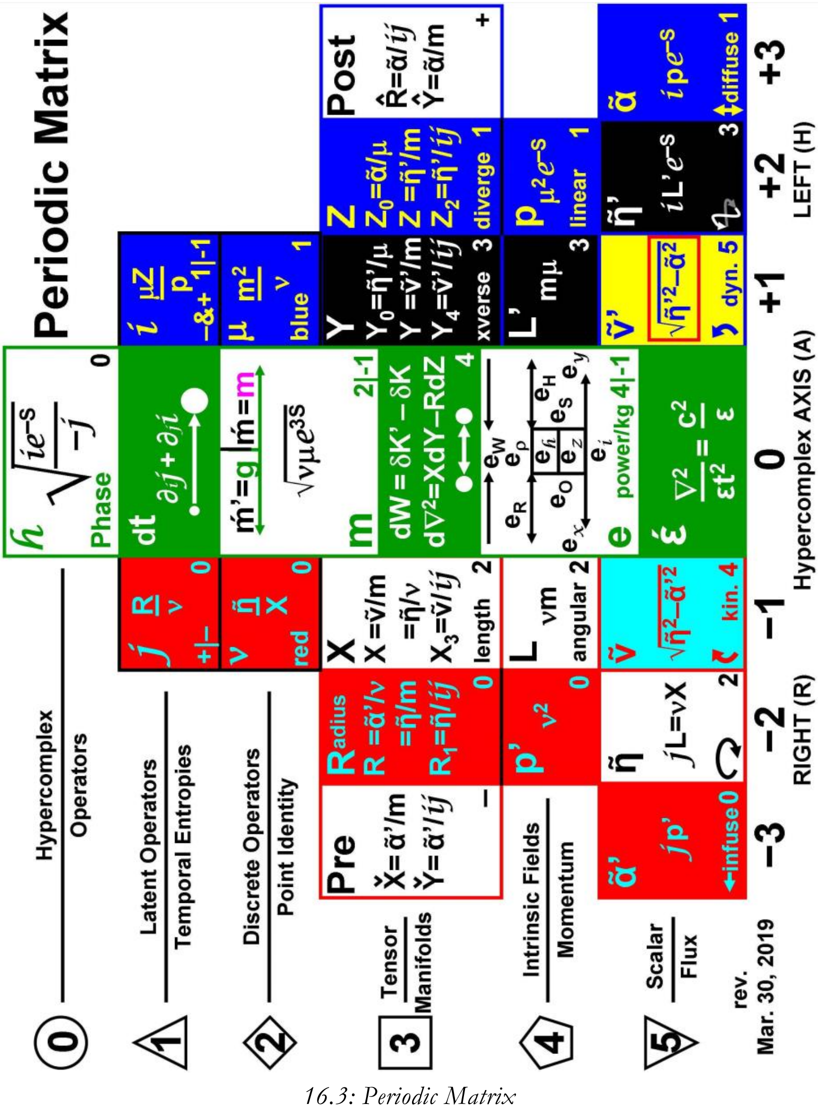
$$\begin{pmatrix} 4*3 = 12 \\ 2-2+1-1 = 0 \\ 0+1+2+3 = 6 \end{pmatrix} \div \begin{pmatrix} 2*1 = 2 \\ 1-1 = 0 \\ 0+1 = 1 \end{pmatrix} = \begin{pmatrix} 12-2 = 10 \\ 0-0 = 0 \\ 6-1 = 5 \end{pmatrix}$$

$$m \quad c^2 = \quad E \quad = e\sqrt{gC'CT}$$

$$\begin{pmatrix} 2 \\ 0 \\ 2 \end{pmatrix} \begin{pmatrix} 10 \\ 0 \\ 5 \end{pmatrix} = \begin{pmatrix} 12 \\ 0 \\ 7 \end{pmatrix} = \begin{pmatrix} 4+(4*4)/2 = 12 \\ 0+(2-2+1-1)/2 = 0 \\ 4+(0+1+2+3)/2 = 7 \end{pmatrix}$$

16.2: E=mc² Matrice Form

Don't get me wrong. The Matrix is here because it predicts, evolves, and at a minimum organizes the key variables. Organization is a logic unto itself that we are only beginning to understand. The big picture is simple. $E=mc^2$ is a proportional relationship between the Lagrangian total energy (row 4) and the mass (row 2) unit of a spacetime (row 3 per row 1). The operation is an exponential relationship $u^4=u^{2+3-1}$ applying also to column and sequence shown in matrix form above. From here you roughly get what the units for each row are.



16.3: Periodic Matrix

Then you break each category up into its parts. That sounds easy except our idea of the parts and the actual parts don't necessarily agree. In part this is because the parts we are looking at are renormalized to the nth degree. You can do that with the Matrix, but you have to start at the beginning and see how those variables evolve. It took three decades for me to I finally normalize most of the variables. Keep asking questions and digging. Eventually, if nothing else, the units and processes lead the way.

While I don't emphasize the association with polyhedrons, I retain the relic of the Matrix' origins linking polyhedron vertices with the axes of each category. That relic is seen to the left with the row numbers and remains in case it ever becomes relevant.

All the numbers here have a 0-point. The operations can go negative or beyond the observed range. The details of negative or excessive row values have not yet been explored, but appear to unwind what this weaves together. In the central column are the hypercomplex composites of opposite effects in each row.

Originally, the division of mirrored effects occurred as alternating relationships creating a checkerboard effect. This evolved with sequence into the division of columns to right (into focus) and left (diverging from focus). Sequence had the additional effect of splitting into greater detail, especially the breakdown of manifolds into specific field aspects relating to Lie functions.

This is one of several nuances known to occur in the Matrix. The first to be recognized and harder to comprehend: $2\hbar^2=2ij=i^2+j^2\rightarrow\delta i+\delta j=dt$. This is the corrected and updated version based on finally comprehending the variables. It contains a quadratic $0=i^2-2ij+j^2$ form of differential equation leading to the conclusion that the flux of time (dt) is the scale of change increments (δ) in i and j relative to each other ($\delta i+\delta j=\partial_j i+\partial_i j$).

The language nuances here led me to re-examine the first law of Thermodynamics and make some minor adjustments to account for circular (conserved) versus hyperbolic (changing) forms. For this reason, I used equivalent dU≡U' to indicate dU as changing but U' is the derived but fixed in that moment scale.

That brought me back to re-evaluating how four spatial dimensions distill into one Laplacian. $d\nabla^2=RXYZ$ deconstructs into the transformative process of space $d\nabla^2=XdY-RdZ$. While consistent with the energy transformations in TdS–PdV, they are distinct. The Laplacian only accounts for the spaces, not the temporal scaling or mass variable required to be an energy function.

The Matrix points awkwardly, largely due to our own limitations. You can't tell if a construct is going to take the expected $R^2+X^2+Y^2+Z^2$ path without digging deeper and understanding what the variables actually represent. The manifold variables are decisively not mapping variables like Euclidean xyz. As such, the expected path may bear fruit in some way, but don't count on it. The Matrix is no less humbling than the rest of reality. With regular review and detailed coverage, it could evolve and be far more useful than just an organizational tool.

Tensor Manifolds

A tensor is transformational scalar, vector, or group;[2] a geometric object of n^{th}-rank (directions) generalizing scalar (n=0), vector (n=1), and matrix (array/atlas; n=2) transformations.[3] A manifold is a topologically Euclidean space—meaning it can differentiate as flat like Earth being round versus our perspective of a flat surface.[4] A tensor manifold here is a fundamental subspace construct describing a differentiable and interactively shaping field space. More importantly, it is an adaptive unknown change variable, making the concept even more ambiguous.

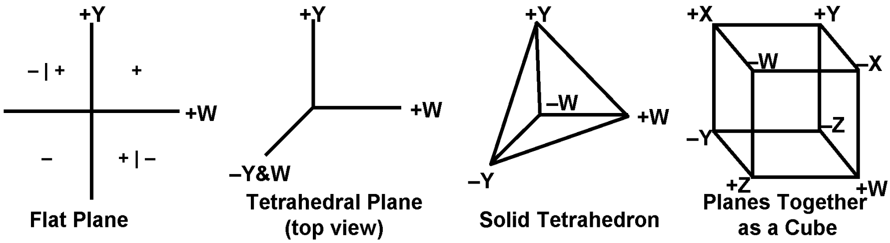
Social sciences to include the study of mind and learning (e.g. epistemology) are slippery as Einstein described.[5] The evolving dimensions of mind imperfectly mirror their physical analogs. You ignore your human dimensions of mind at the risk of getting lost and not actually developing understanding. Habits of repeating knowledge is not the same thing. Modern physics is overflowing with knowledge, and starving for practical understanding. In some areas it has lost its way completely from established science, even embracing hypothesis and speculation as evidence to establish perspectives. It's too easy to get lost, especially when you are a genius constantly being told how brilliant you are.

The first major evolution in the Matrix happened by accident of setting two diagrams down next to each other. It wasn't a complete accident. A few years earlier, my graduate adviser, who attended a weekend seminar I gave on cosmology, pulled the trigger. She suggested I should look into Kolb's experiential learning model, and if I did, let her know what I thought of it from a scientific perspective. With some minor adjustments, it could be. But to make the case, I needed to dig deeper.

For me deeper is finding the bottom. In this case it meant digging up literature dating to the dawn of civilization on every corner of the globe. I ended up mapping two distinct but clearly complementary groups consistent with learning and development/motivation. The first with four logical stages and the second with five. The concepts were reasonably consistent across history and cultures. Naturally, I saw these as logic and added logical syllogism (thesis, antithesis, synthesis), then paired opposition (yin-yang) and holistic unity. Fifteen complementary concepts forming a woven pyramidal pattern.

As a scientist, I am used to compartmentalizing. This served me well on many levels, like leaving the rest of the world at the door of my classroom. From a research perspective, it helps to be able to create blind studies. I did such a good job compartmentalizing, I had completely separated my hard and soft science thinking.

As I finished writing the LǐJiě Ching (Classic of Knowledge), I put together an introduction laying out the pattern. My three year cycle of focus on this matter was finally coming to a close and the next door of focus was being pried open. To close the door, I had summarized the entire subject in a series of metaphors—81 poems to convey the concepts on multiple levels. As the one door closed, another opened and the poet of logic stepped out with its own diagram.



16.4: Haar Linear Axis Relationships to Cube (4-D)

Haar orientations are vital to Lie theory and manifolds, as they form a locally compact group as opposed to subtractive – and additive +.[6] Here, a conventional rectangular plane converts first to Haar. This means positive and negative of the same axis are at right angles relative to each other. These complex axes then simplify and convey to cubic application by intersecting the vertices instead of the faces. This allows four spatial dimensions to intersect at right angles.

I have several points to make here. From a learning perspective, understanding emerges from **diverse** applications of the **entire process**. No shortcuts. You can't just read about it. You have to go out and actually do it. And many other things seemingly unrelated… to the extent that you can conceptualize. The poetry was a conceptual catalyst in that I was creating concrete stories and metaphors to represent the elements of the process in a precise sequence. They may not be the same, but the universe rhymes. Don't ignore or turn down the opportunity to explore those rhymes.

The second point is another human angle. Learning and development is what I call **normal psychology**. I call it normal because it applies to everyone without exception. The so-called exceptions are simply predispositions. It is how mind develops, perceives, evolves, and ultimately understands. The level of understanding is the level by which mind more accurately reflects and can adapt to reality. There isn't anything mystical or esoteric or easy about it.

The science of mind is a subset of quantum physics from how neural energy interacts with myelin, to chemical stimuli adapting how the interference is processed, to the contextual formation of consciousness in a QM sea of probable thought opportunities. The focus in epistemology tends to be on the spaces within which mind operates. These are the manifold spaces constructing mind: experience, reflect, abstract, conceptualize. It is not the only path to mind or understanding physics, but it is the most accessible.

The most important thing to learn is how you learn.

Up to this epiphany, my thinking about dimensions was, as Einstein would have put it, "tidy." The moment the human dimensions and all the metaphors stepped in, I suddenly realized the Matrix consists of PDE variables. PDEs (partial differential equations) are unknown change functions.[7] The variables adapt to context. For example, we can pretend the processes of normal psychology don't apply to us citing our unique qualities and experiences. In the end, we only confirm the underlying concepts are indomitable.

Copenhagen is the rule, a working theory, not just an interpretation.

For both the ordinary physics and the science of mind, it is in the manifolds where we find evolution starting with formation (confinement) and then building magnitudes that transform dimensional roles. If you thought Copenhagen was ambiguous and untidy, this is like saying bread becomes steak while labeling both the food variable.

In effect, bread can become steak as the cow eats the grains of bread to grow. Both are food to us, and therefore would be treated as the same manifold variable. But in keeping with the term manifold and the evolutionary nature of dimensional transformations, they both have the same variable. Generally speaking, I have only worked with immediate neighboring transformations. A-priori (inferior) input has negative sequence numbers, and output has sequence numbers greater than the number of members in the row.

The problem with tracking beyond the neighboring effects is the nature of identity. First, output causal of another identity is a superior number on one hand and an inferior number on the other. Then there is the Copenhagen effect on confinement—namely that all lesser configurations also have contextual probability densities.

In a way, the universe acts in many ways like a really ambiguous database where the records bleed into each other, interact, diverge into new tables, tables merge into new records, etc. I use this as an example because as the nature of identity changes, its handling adapts accordingly. That makes labeling and defining the dimensions on the Matrix a serious challenge.

Fields

The spacetime perspective of manifolds in change provides a nice clean sequence. Take another perspective where the row has an odd number of members like momentum or matter, and suddenly you notice there is a skip in the left-handed sequencing. The skip means there is a quantum number issue in the simple solutions. Everything but the sequence number adds up.

That quantum number issue hypothetically resolves in context with Planck's constant: $e^S=h^{-2/3}$. It appears to be a matter of scaling interfering with conversion. For example, $hm=\sqrt{\nu\mu}$, recognizing the ambiguity of the form $\nu\mu$ suggests equivalent conserved unit transformations $\nu d\mu\equiv\nu^2+\mu^2$. If you filled a barrel with proportional amounts you would find $\nu=1$ and $\mu=e$ consistent with e^0 and e^1. The mass is 5% of the total 1+e, specifically converging (ν) out of diverging μ.

Planck's function uses the symbol ν for frequency: $m=h\nu/c^2=h/\lambda^2\nu$. We have to be careful not to confuse these variables with each other, even though the latent and discrete clearly share a rhyme scheme. The transformation of ν converging μ into m is an energy change proportional to the use of space (λ). Put in frequency terms, it is the density of temporal displacement.

I said hypothetically because of all the confusion around dark matter (convergence) and dark energy (divergence). The confusion is not justified, but it exists. When you put all the pieces of the puzzle together like this, the hypothesis is a reasonable certainty. The cement simply needs to harden. It also isn’t incredibly important because we can simply go around it using more accessible and less ambiguous variables.

Momentum is a vector, meaning it consists of a directional magnitude. There is a misleading notion that certain fields like gravity have infinite range due to local systems being hyperbolic. Conservation in the simplest sense holds that energy is never created or destroyed, it transforms. You cannot have infinite range without violating conservation.

Each of the right handed fields like gravity is mirrored by a left handed analog. Step back far enough from local systems and eventually the open system fields combine into conserved proportions. Such a hypercomplex is a closed system, the field transformations being circular define a collective unit cycle.

These cyclic hypercomplexes are generically categorized as electromagnetism. These are dynamic systems of conserved energy. Consider the electroweak spacetime manifold (w_{kh} in s^2/m^2). The spin forces ($\tilde{\eta}'$ and $\tilde{\eta}$) convert linear ($\tilde{\alpha}$) to angular ($\tilde{\nu}$) forces. They also pave a convenient path to Laplacian distribution.

Electroweak: $$w_{kh} = i(r_k\partial_h - r_h\partial_k)$$

$$\frac{\tilde{\alpha}'\tilde{\eta}' + \tilde{\alpha}\tilde{\eta}}{ij=2\hbar^2\to t^2} \Rightarrow \frac{\partial_p\sqrt{\tilde{\alpha}'^2+\tilde{\alpha}^2}}{ij\rho} \Rightarrow \frac{\partial_p(\tilde{\alpha}'+i'\tilde{\alpha})}{\Delta}$$

$$\Rightarrow \frac{-i\partial_p(\tilde{\alpha}'+i'\tilde{\alpha})}{i'\Delta} \Rightarrow \frac{i\partial_p(i'\tilde{\alpha}'-\tilde{\alpha})}{\Delta} = e_w$$

16.5: Electroweak Field Equations

Earlier we saw $r_k= g_S^{-1}=\nabla$ (where $\nabla^2 = \Delta$) links to Gauss: $g_t/g_S= 4\pi G\rho_m$ (dilation=g_t=/s^2 and mass density=ρ_m). Where ρ = ($\tilde{\eta}'\tilde{\eta}=c^2$) = Δ_t is a temporal Laplacian distribution operator, and $ij\ \Delta_t = \Delta$. We derive to extract the spin variables as distribution. On the Matrix, weak is e_W. As gravity and thermal at the same magnitude interacting, it comes first in the EM hierarchy—consistent also with weak bosons.

EM is always last in hierarchy sequence because it is a projection of axes. Projection sustains an identity through energy changes without violating spacetime limitations. When the energy density of EM on a lower level is the magnitude of a higher level, a conflict occurs—as with the creation of ferromagnetic elements causing supernova.

Magnetism is induced by rotating linear charge axes into angular projection. Where the other variables localize, magnetism puts value at a distance freeing local resources. Its elements account for multiple post-orbital EM definitions. The Matrix provides two possible Laplacian distributions for each linear and angular EM evaluation. These often apply together or in sequence.

$$\Delta_{ht} = z^2 = \tilde{v}d\tilde{v}' = \tilde{v}'^2 + \tilde{v}^2$$

and

$$\Delta_{xt} = r^2 = \tilde{\alpha}'d\tilde{\alpha} = \tilde{\alpha}'^2 + \tilde{\alpha}^2$$

These and other Matrix-generated forms remain under-explored, but appear to provide insights into topics like linear thermal expansion. Operator-values z and r are also forces and, $rz = \rho = \Delta_t$. In their active roles, as operators they create directional charge fields: z (angular and polarized) and r (linear). Magnetic spacetime distribution is:

$$\text{Vector B to free energy } A\nabla = \qquad B = \frac{\partial_p z}{\nabla}$$

$$\frac{\tilde{v}\tilde{\eta}' + \tilde{v}'\tilde{\eta}}{ij = 2h^2 \rightarrow t^2} \Rightarrow \frac{\partial_p z}{ij(\rho = \nabla_t^2)} \Rightarrow \frac{\partial_p z}{\nabla^2} = A$$

16.6: Magnetic B Vector and Free Energy Fields

A=B/∇ is the Helmholtz "free energy" (A≡U–TS) in decomposition of magnetic vector potential. The magnetic vector field (B) is a sub-temporal force direction. Diverging B∇ → 0 gives the force no space to function in, neutralizing field direction per Gauss' Law[8] as with electroweak $w_{kh} \rightarrow c^{-2}$.

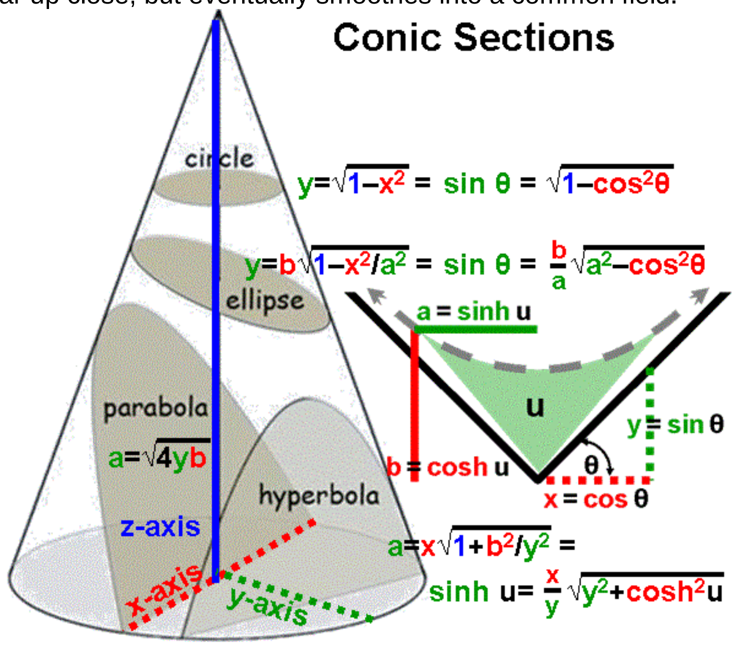
The phase operator (h) provides the characteristic torus shape. There is no difference swapping ∂_x for ∂_p. There shouldn't be because we are simply swapping which variables are providing value versus function, and these forces are inter-dependent. Of course extreme conditions will completely disagree with indiscriminate swapping by fixing the context.

Like other EM fields, we can expect this has a range of evolving applications differing across a spectrum. Magnetism is an evolution of angular momentum shifting object orientation from around (circular) to adjacent (toroidal) and then evolves to arcs beyond.

The spin elements of electroweak (linear) and magnetic (angular) interactions simplify them. Spin elements convert between forms, which is helpful locally for conservation, while leaving the door open for anomaly. They experience osculation—an orbital mechanics term for perturbations caused by a composite of detail differences (e.g. information) in the interactive field including n-body interference issues.

Orbital Mechanics

In electromagnetic interactions, values are shared. The local observer may feel like the values are being conveyed, but the conveyance is enclosed/contained by the system of interaction. You are subject to the force of surface gravity, and though it affects you in degrees relative to surface anomaly, it does not convey. It is shared. Put into a group dynamic, that sharing takes on an anomalous configuration, meaning it is irregular up close, but eventually smoothes into a common field.



16.7: Conic Section Recti-Polar Definitions

Orbital "planes" confuse just about everything. They contain linear and angular exchanges, giving them a range of reference and change shape potentials that quickly enfold into operators. The math simplifies into conic sections and circular functions that show some of how our complex forms get applied.

$$\frac{\tilde{\alpha}'\tilde{\nabla}'+\alpha\tilde{\nabla}}{ij} \Rightarrow \frac{\partial_z r}{\nabla^2} = e_o$$

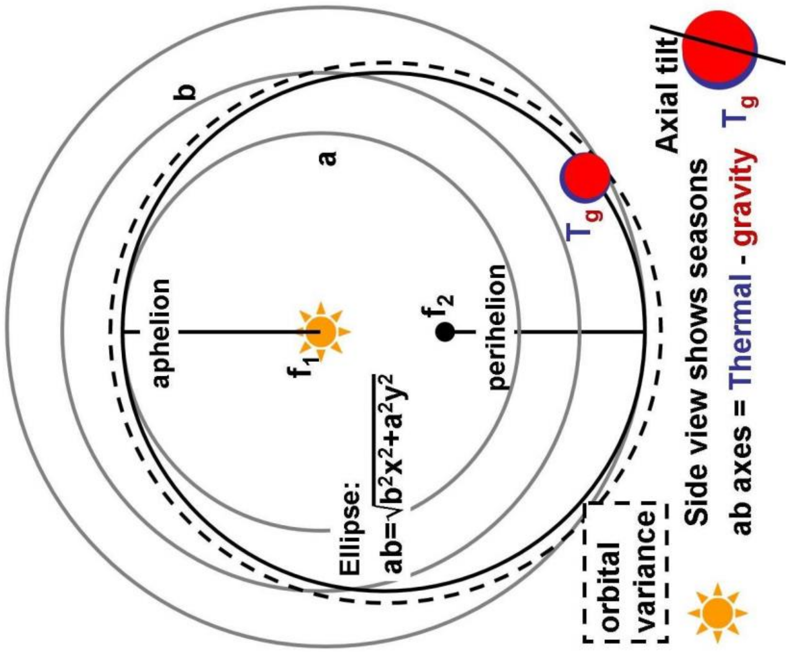
Also true: $\partial_r z/\nabla^2$, or more ambiguous as noted earlier. Newton's position ($\rho = r e_r$) uses linear $r^2 = x^2 + y^2 \equiv \tilde{\alpha}'^2 + \tilde{\alpha}^2$. The change information gives angle $\tan\theta = x/y$. The ij-change is $e_r = (\cos\theta, \sin\theta)$[9] leading to velocity $v = r' e_r + r e_r'$, etc. The ambiguities are linguistic attempts to simplify on one hand and give better meaning on the other.

Angular momentum (z) is traditionally given unit value and ignored. Treated as derivative of linear, angular change applies: e_z= (–sin θ, cos θ). We know it isn't so simple. Changes in any one value will make an orbit stretch, contract, or oscillate.

An orbit can tend toward linear or angular affected by imbalances. Exaggeration of one angular element can lead to a sinusoidal feature and exaggerating aspect oscillation into a twisting rotation. On primitive levels, the variables reduce to one linear, one angular. As degeneration evolves in the generations, the variables diverge (like twists in spiral arms) and eventually invert (e.g. filaments).

As an interaction, each body presents its own orbital plane perspective. Generally, orbits increase order, such that the Kepler orbit interaction conveys the potential for orbital twist to polar oscillations and the orbital azimuth. Adding bodies to a problem increases disorder.

Increase in disorder increases the wave pattern of the plane. This is notably evident in lunar month anomalies,[10] Mercury,[11] and asteroids. This perturbation is called orbital **osculation**. Osculation details provide exact orbital description but are computationally laborious, as opposed to mean orbit generalities.[12]



16.8: Basic Elliptical Orbit

Flat representations of orbit, like the one above, don't do the full range of features any justice. Oscillation and other complexities aren't as easy to imagine as tilt in the plane and elasticity. It also doesn't illustrate this is the byproduct of two fields interacting into a common system.

Unfortunately, orbital mechanics is not our area of research. We will go no further into it. Our point is the ambiguity of forms for modeling further study. One electromagnetic function can be interpreted in a broad array of ways based on developmental hierarchies, value distributions, etc. One has to be careful with these generalizations to account for context, let observations have the last word on interpretations, and first word in theory.

Wheeler Interaction

Let us end the book with the outstretching of the fourth axis appearing most notably in a degenerate density: the Wheeler space he called "quantum foam." What we see with clusters and filaments of galaxies is actually foam-like. In his geometrodynamics perspective, Wheeler was thinking of intrinsic spaces the same way. He extended this to singularity when he conflated Michell's dark star with a pulsar to coin the term "black hole." He wisely contracted the mistake later,[13] but few listened.

Singularity is ultimate order degenerating to fully occupy only one axis of a $\acute{j}$-entropy spacetime. This reduction of the complex space has no information. A quantum singularity is the ideal—the perfect distribution. Alone, it will ultimately annihilate itself leaving a contraction in spacetime known as a kaleidoscope effect.[14]

Proportional balance prevents annihilation, forcing the hyperbolic into a closed circular system. Balance is in the degree to which unfolding value (divergence) is enfolded (decomposition) locally. This optimizes at $\nu=1:\mu=e$, the ratio of dark matter (1–e/(1+e)=26.894≈27%) to dark energy (~68%) plus conventional matter (+~5%).[15] Wheeler called the degenerate order-disorder mixture quantum foam.[16]

Nucleons and neutron stars are degenerate and singularity-like in different ways. While they fully define axes, they also have information—an intrinsic level of disorder that makes them self-sustaining proportions. Where a singularity is defined and sustained by its environment, these fields are relativistic, defined intrinsically and responding contextually to environmental conditions.

The Wheeler space is the available axis that interacts with the rest of the universe. It is the space where value cycles that can't fit in the fully occupied local space. It is essentially an information axis, offering the information of identity for all its contextual configurations relative to probability density.

It is easy to think of this as an axis away from, cycling around, or through the poles forming a toroid. It is harder to conceive of this axis applying to every point in the fully occupied field. This is an axis applied to every point in the field, no matter how you divide or scale the field and points making it up.

In a degenerate density, the other axes are fully occupied. Their energy is static, locking what could be emitted into spatial configuration by depriving it of an available absorption line to follow. The full-occupation is a discrete point with magnitude. There is no available space for anything to move around in. All potentials and excess values, to include adapting the intrinsic value for dilation, are thus projected along this information axis.

As an absorption axis, the Wheeler space has a limit proportional to the occupied axes and its change feature defining its configurations. It has no intrinsic value that can be emitted. Value that can be emitted is absorbed and emitted relative to this axis. This is true no matter the scale upon which the axis occurs, such as with absorption lines of photon emissions from conventional atoms to stellar emissions.

Whether you are looking at an emission from an individual or collection of individuals, all the density of configurations (k=information) show in the electromagnetic distribution of radiant (R) and absorption (A) lines. The foam definition is itself a spacetime function subject to exchanging roles of permittivity (ε=how energy acts on a space) and permeability (έ=the rate energy acts on a space) relative to change.

Change Sequence (Foam) $$k^2 = \frac{\partial^2 R}{\partial R^2} + \frac{\partial^2 A}{\partial A^2}$$

Foam Distribution $$\partial_i \varepsilon + \partial_j \acute{\varepsilon} = \nabla_{k'}{}^2 \rightarrow c_{k'}{}^2$$

16.9: Strong Type VII—Foam Redefinition

The Wheeler interaction is the process of re-sequencing the axis into equilibrium consistent with the laws of Thermodynamics. Simply put, it is changing the information (k') of individuals in a group to conform to the group identity. We see this in Fourier analysis and here with Schrödinger's wave normalization function (see pg. 171) into a change distribution form of Laplacian. The distribution is the phase tangent (derived instant rate of change) of value functions in a complex spacetime (c_k).

As the mention of Fourier analysis suggests, this fourth axis isn't unique to degenerate density or even to matter. Whether we are arguing the latent or discrete cases individually, we ultimately are always dealing with four manifolds defining a distribution. The distribution is information, and information is what differentiates one identity from another.

Necessarily, that information is only conserved through the lifetime of an identity, but is also subject to changes that will evolve or transform the identity. It is never permanent. In a way, the Wheeler interaction is the dynamic universe. Without information change, nothing is created, destroyed, or happens.

Time is flux resistance to change. Information is independent of time so long as it isn't in the process of change. The moment change applies, time emerges to resist the flow of that change. It naturally follows the path of least resistance of order to disorder sequencing toward information equilibrium. In this case, equilibrium doesn't mean being identical but rather being complementary, like air filling a space. When the complementary role is filled, a new identity forms that now violates the space of the original identity and forces the process to continue.

Endnotes

[1] Einstein, A. (1909). On the Development of Our Views Concerning the Nature and Constitution of Radiation. Physikalische Zeitschrift, 10, 817-825. informationphilosopher.com/solutions/scientists/einstein/1909.html.
[2] Kolecki, J.C. (2002). An Introduction to Tensors for Students of Physics and Engineering. Cleveland, OH: Glenn Research Center. grc.nasa.gov/www/k-12/Numbers/Math/documents/Tensors_TM2002211716.pdf.
[3] Rowland, T. & Weisstein, E.W. (2018). Tensor. From MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/Tensor.html.
[4] Rowland, T. (2018). Manifold. MathWorld--A Wolfram Web Resource, created by E.W. Weisstein. http://mathworld.wolfram.com/Manifold.html.
[5] Einstein, A. (19). "Remarks on Bertrand Russell's Theory of Knowledge." Ideas and Opinions. NY: Crown Publishers, Inc. Pg. 19.
[6] Abbaspour, H. & Moskowitz, M.A. (2007). Basic Lie Theory. World Scientific.
[7] Grigoryan, V. (2010). Partial Differential Equations. UC Santa Barbara. web.math. ucsb.edu/~grigoryan/124A.pdf.
[8] Horsley, R. (Mar. 26, 2014). "9.5 Helmholtz's Theorem" in Hamiltonian Dynamics. University of Edinburgh. www2.ph.ed.ac.uk/~rhorsley/SI09-10_t+f/lec19.pdf.
[9] Fitzpatrick, R. (Apr. 26, 2011). Newtonian Dynamics. Austin: University of Texas. p. 57 et seq. farside.ph.utexas.edu/teaching/336k/Newton.pdf.
Miller, W. (2006). 0.1 Newton's equation with gravitational force. https://www.ima.umn.edu/~miller/1572Newtongrav.pdf.
[10] Espenak, F. (Jan. 12, 2012). Eclipses and the Moon's Orbit. eclipse.gsfc .nasa.gov/SEhelp/moonorbit.html.
[11] Balogh, A. & Giampieri, G. (Mar. 20, 2002). Mercury: the planet and its orbit.
www.astro.wisc.edu/~ewilcots/courses/astro340s04/readings/mercury.pdf.
[12] Guinn, J.R. (Dec. 28, 1995). OSMEAN-Osculating/Mean Classical Orbit Elements Conversion. ntrs.nasa.gov/search.jsp?R=19940003221.
[13] Wheeler, J.A. & Ford, K.W. (2010). Geons, black holes, and quantum foam : a life in physics. New York: W.W. Norton & Company.
[14] (Jul. 21, 2016). Space… the final frontier. ESA/Hubble Information Centre. https://phys.org/news/2016-07-space-frontier.html.
[15] Nagaraja, M.P. (Ret. Feb. 28, 2018). Dark Energy, Dark Matter. science.nasa .gov/astrophysics/focus-areas/what-is-dark-energy.
[16] Wheeler, J.A. & Ford, K.W. (2010). Geons, black holes, and quantum foam : a life in physics. New York: W.W. Norton & Company.