Chapter 9. Your World, Or Mine?

Before we go deeper into exploring subatomic particles, let's step back again and take a closer look at physics as a discipline. We will shift into abstraction for a while, and then get back to concrete research and examples. Relax and bear with it.

Layers of Physics

There are several levels we can work from. At the "deepest" level there is no such thing as physics. In a sense Harry Palmer wiped out physics as we know it with a single sentence. Starting from his proposition that belief and experience are perfectly mapped, he took another step that opened up the field of applied consciousness. He said,

"I call my philosophy Creativism because it is not discovered truth, it is created truth. Most philosophies are derived from some fundamental experience or understanding of the universe -- not Creativism; it is created by awareness at source."

(**Living Deliberately**, Ch. 14, "Creativism and Reality", p. 99. A remark quoted from a 1988 lecture by Palmer.) You can download that book free from the www.AvatarEPC.com web site.

The first sentence of that statement dissolves not only all past philosophies (and *a priori* religions), it dissolves physics and all of the sciences as well -- not as belief systems, but as claimants to Ultimate Truth. Read Palmer's statement carefully. "Creativism" is not discovered truth. It is **CREATED** truth. And furthermore it is "meta-creativism". Palmer created out of source awareness a set of tools for exploring awareness. Not only Palmer, but also you, and I, and anyone can create anything we like. You have a choice. You can use Palmer's tools if you like. Or you can create your own tools. You can create your own universe. And of course it will have its own laws of physics, which will be whatever you decide, as long as they are reasonably consistent. Otherwise your universe may not hold together very well. In a later essay I will show you a very general way to design physical universes -- not necessarily the only way, but a way that works.

The subject of Creativism brings us back around to Einstein. He created his great system of general relativity on the basis of two fundamental creative assertions: the **equivalence principle,** and his great assumption that the core laws of the universe are **isotropic** for all observers. We have shown that the equivalence principle is really only a special case in the limit of the infinitesimal -- hardly the basis for a universal theory. Einstein may have been on the right track about equivalence, but I think the principle needs to be applied a bit differently. In chapter one's discussion of language, mind, and the physical world we saw some intimations of equivalence. Palmer's principle also suggests the role of equivalence with his notion that the mental world of beliefs and the physical world of experiences map with perfect equivalence (except for the inversion that must be taken into account). The "reciprocal principle" is a fundamental part of the mathematical structure of equivalence. For example, we discovered the relation:

* $m_p = \pi\, e\, b / c$. (under **Mech a** interpretation)

This equation expresses an equivalence relation. The part on the left represents a particle in terms of its mass. The part on the right therefore must also express the same particle in terms of its mass. However, there are some other components involved that cancel out all other physical units and also add a scalar proportion. We can rearrange the equation as follows:

* $m_p\, (c / \pi\, e\, b) = 1$.

In this rearrangement of the same equation, we find that even the mass cancels out and we are left with unity. This tells us that the interaction of these two masses results in a cancellation of the mass. The unity stands for the potential energy out of which two reciprocally related particles may appear. We may consider one component a particle and the other component its corresponding "antiparticle". An interesting aspect of this quality of "unity" in the equivalence relation is that it is completely general. Any number of massive particles (or other physical properties) can appear on the left side, and, as long as they are all balanced by their reciprocal masses and other properties, we still end up with the same number, 1. Unity has an amazing power in the equivalence relation. Even if we end up with a different number than 1 on the right side (say 2), we merely include the reciprocal of that number (1/2) on the left side as a constant scalar, and we are back to 1 on the right side.

We pointed out earlier that we use the multiplicative operation when properties interact directly. When properties coexist side by side without necessarily interacting, then we may use the additive operation. The way in which mathematical operations link up to physical events and observations is of great importance for clarifying the foundations of science. Lately scientists simply pick up whatever mathematical system that suits the topic they are studying and use it for modeling. We must be aware of the interface between one mathematical system and another and pay attention to whether we are unintentionally introducing mathematical operations or properties that do not cohere with the rest of the physical world, or we must show how they cohere.

So we can extend Einstein's "equivalence" to a much more general level and say that **in a universe (unified cosmos) governed by the equivalence relation, all physical properties are pair-created with their reciprocal properties.** The experiments of modern physics suggest pretty strongly that our universe is structured in this way. Each particle has a corresponding antiparticle. We will have to pay close attention to cases where this rule seems to be violated, and physicists certainly have been doing this. We also must allow that some beings may not believe that the equivalence relation should hold in their universe. Certainly mathematicians have found mathematical systems that do not deal with equivalence, or make it optional. For example in his resolution of the irrational crisis Eudoxus made use of the <, =, > options. Heisenberg's uncertainty principle is framed with the ≥ relation, making it truly uncertain.

Einstein's notion of isotropy (uniformity in all orientations) also becomes extremely suspect in the light of quantum mechanics and observer physics. If space is isotropic, then why does Einstein use a four-dimensional space-time system (with three dimensions of space) to describe his theory of general relativity? Once we become aware of the belief/experience paradox and Palmer's fundamental principle of Creativism -- that it is possible to CREATE truth, not just discover it -- the whole ballgame shifts, and we must revise Einstein's "special case" assumption about isotropic laws to make it more general.

There is really no reason why isotropism should hold. I don't think Einstein had anything more than his personal intuitive preference to back it up. And he **did** have wonderful intuition most of the time -- and a flair for prediction. However, in the light of Palmer's new and more general propositions, we begin to suspect that the core laws of a universe are only isotropic for that subset of observer-participants who truly BELIEVE they are isotropic. Furthermore, any given set of "isotropic" laws is only isotropic for the group that believes in them. Such a group and their shared set of core beliefs constitute a shared universe of experience. I say "core beliefs and laws", because a system may include meta-beliefs that permit participants to hold differing sub-beliefs while holding the same core beliefs. Also, when I say **truly** BELIEVE, that means a group's or an individual's experiences perfectly match their beliefs -- otherwise we only have pretense at belief. That means all experimental and experiential evidence should support the asserted beliefs. The very notion of isotropy implies that anisotropy also exists. Otherwise, how could we recognize isotropy? From the standpoint of Observer Physics we would say that isotropy is a viewpoint, and from that viewpoint isotropy appears to hold as an experience. Anisotropy is another viewpoint with another set of experiences.

Our experience may be that the universe contains a multiplicity of phenomena. Physics may contain a multiplicity of theories that attempt to set in order the facts of these experiences. Isotropy is one possibility and anisotropy is another. There may be many other possibilities. Quantum mechanics predicts that if something is possible, it happens. Palmer comments, (**Living Deliberately**, p. 39), *For any question beginning with "why", the answer is "because"; for any question beginning with "can", the answer is "yes".* From that viewpoint we must abandon the notion of theoretical physics as a final explanation for why things are and what is possible. On the other hand, there is still the question of "how"? If the answer to "can I do *x*?" is "yes", you still might want to know "how to do *x*", and perhaps also the most efficient way. Along with that, perhaps we still have "who", "what", "when", and "where" to consider. So even from this non-mental viewpoint there is still a good bit of physics to explore, or at least to decide upon.

Observer Physics predicts that **anything that can be imagined is possible and will become an experience if someone decides he really wants to experience it.** What any individual or group of individuals happens to experience is the reflection of the current beliefs that she/he/I/we/you/they hold. Individuals can always modify their beliefs and thereby modify their experiences. Thus physics devolves into descriptions of possible sets of beliefs held with varying intensity by various groups of individuals. In this sense theoretical physics starts to resemble anthropology, or biology, or theoretical mathematics, or who knows what. The "specialized" boundaries of physics begin to dissolve.

"Specialization tends to shut off the wide-band tuning searches and thus to preclude further discovery of the all-powerful generalized principles." So said Buckminster Fuller (**Synergetics**, xxvii). Yet some of the greatest general principles have been discovered through very specialized and focused research. Phase Conjugation is an example of such a discovery that we will explore in this book.

Perhaps the pure experience of whatever is happening in the moment of NOW is about as specialized and focused as you can get. Yet it may provide the simplest, and perhaps only, example of a truly isotropic law. Throughout all of space and time and the various possible conditions of experience in our universe or any other universe, one thing always holds -- that an experience IS just what it is. Ironically that may be all we can say about it. This undefined nature of pure experience is isotropic (the same from all orientations despite all sorts of possible diversity of details), but perhaps nothing else qualifies for isotropy, and there is nothing to say about something that is undefined, except perhaps -- "There it is...enjoy." It's whatever you want it to be, whatever you choose to believe, whatever is happening for you. Thus science and any true general theory of relativity, ends up concerning itself with a description of relative anisotropies. Sorry Einstein. Isotropy, by definition of the term and by its nature as an experience, is not relative. It is absolute and can not be discussed although it does exist among all possibilities.

To the extent that a set of beliefs overlaps, the universes defined by them overlap. A perfect overlap would end individuality and you would have multiple selves mapped to the same set of beliefs. They would merge and lose their individuality, which would lead to a paradox that resolves only in undefined awareness. You would have isotropy. End of story. A set of beliefs defines a viewpoint, an identity. It may be impossible to identify an individual without a set of beliefs that reflect a viewpoint. And the True Self behind an individual may be a transcendental witness not defined by any of the beliefs he or she or it beholds via a chosen viewpoint. In that sense the transcendental True Self of any individual is the same as that of any other individual. We can say that we are all connected at Source.

Two identities with totally disjoint sets of beliefs would have no experiences in common and so obviously would be unaware of each other as anything other than an abstract possibility -- if at all. This situation would be like a rational number (a human male?) trying to get acquainted with a non-periodic (except in the biological sense) irrational number (a human female?). You assign the labels. He might have a vague idea and could imagine such things existing. But he'd probably never meet one, even if they were neighbors. The ancients on our planet a few thousand years ago seem to have been totally disjoint from the notion of non-periodic irrational numbers and didn't even imagine them as something that could exist. The Greeks were flummoxed when they began to encounter them in their studies of geometry. (Homosexuality was a common and accepted social experience among the ancient Greeks and did not flummox them as it does some people today.) And somehow through it all humanity survives. Universes that overlap only a little would resemble ants and people sharing food at a picnic.

Einstein's Special Relativity is so simple that an average high school student can understand it by applying a little bit of attention. We can also see examples of it in our daily lives and in the nuclear issues we face. On the other hand, Einstein's General Relativity is so complex and abstruse that for a long time only a handful of people claimed to understand it. I have a Ph.D. from Harvard and still find Einstein's General Relativity puzzling in certain ways. Verification of special relativity is commonplace. Verification of general relativity is extremely subtle and difficult -- and still subject to some controversy. General relativity is all about gravity, and we on this planet all experience gravity as a major influence in our daily lives. Yet no one has directly detected the gravity **waves** predicted by the theory (except perhaps indirectly by observing the behaviors of certain pairs of binary stars). Why? Something fundamental must be wrong with a theory that is so hard to understand and verify in experience. (Or is it a belief that a good theory must be easy to understand?) Most people just accept general relativity on the basis of Einstein's reputation that he established with his marvelous theory of special relativity and his profound contributions to quantum mechanics (a subject he did not even want to accept), but those same people have no tangible experience of general relativity at all in their lives.

According to Observer Physics, if something seems complicated, then it is not clearly understood, so, according to Observer Physics, Einstein's theory as it is today is not complete. Einstein merely described the behavior of objects under the influence of something called gravity with no clear explanation of what gravity is or why it influences phenomena the way it does. Take a break, shift viewpoints, and then take another, closer look. When attention is fully directed on something, then it becomes simple and clear. Why is it that, after nearly a hundred years of the best minds working on it, the general relativity theory of gravity still has not been satisfactorily integrated with the rest of physics? We need a major viewpoint shift here.

Exercise: Do you have some issues in your life that puzzle you, frustrate you, or that you seem unable to resolve? Sit at a desk or table and put a small object on the table in front of you. For example, select a pen. Focus your attention on the pen. Can you see its shape and color clearly? Can you read any words printed on it? Now place a coin a few inches from the pen and focus your attention on the coin. Can you see the coin clearly? Can you read any writing or numbers stamped onto it? As you stare at the coin, can you still see the pen on the table? While focused on the coin, can you still read any letters on the pen? Does the pen now appear clear or fuzzy? Focus on the pen. Can you still read the symbols on the coin? Where your attention is focused, you see things clearly. When objects are a bit peripheral to your focus, they lose focus and get fuzzy. Toss the coin over your shoulder so that it rolls somewhere behind you. Look at the pen again. Can you see the coin? Do you know for sure where it is?

Clarity of perception and understanding depend on where the attention is focused. The sharpest visual perception (highest resolution) is in the foveal region of the retina. Any aspect of your reality that is unclear is unclear simply due to lack of focusing attention on that aspect of your reality. This is a very general principle of Observer Physics. The only excuse for ignorance is lack of attention. Awareness is willing to go wherever you direct it. Blaming others for personal ignorance in some issue is a symptom of lack of attention to what is going on. On the other hand, ignorance of details is inevitable, because attention only allows clear perception in a small defined area. That is the paradox of attention and the reason why attention management is so important for successful management of life's affairs.

Exercise: Do the **Expansion Exercise** (#26) in the **ReSurfacing** workbook. When you deliberately expand the boundaries of attention, the trade-off is that you lose the details of all that is included within that expanded territory. On the other hand, it is easy to do this and has powerful practical applications. What are some practical applications of expanded attention? Now do "Minding the Edges" (#11) until you can "clearly" experience the differences in the way you direct attention. There is foregrounding (attention focused within the edges that define something). There is backgrounding (attention focused elsewhere so that the "something" loses focus or is unperceived). There is "minding the edges" in which attention is expanded a bit outside the edges that define something, but the something is still floating within the expanded viewpoint.

Every chief executive has learned how to expand attention and see the big picture. She maps that field of attention experience to an ideal intention in her mind, and whenever anything in the big picture mismatches, she zooms in to focus on the details and clarify the situation. That, plus skill in managing large groups of people on projects, is what makes for a successful executive. People who can only focus on details are only good for detail work and must leave the large-scale management decisions to the executives. Cosmologists want to be good at the big picture. At the same time they must work with experimentalists who are good at the mechanical details in order to develop the experiments that can test the cosmological theories.

So there is relativity of observer belief systems. Undefined awareness "underlies" all belief systems. Beliefs can tunnel from one universe to another via imagination that is highly imbued with undefined awareness, since undefined awareness has no preferred set of beliefs and no preferred universe. Imagination is an individual's process of exploring and perhaps even preferring a new set of beliefs that do not reside in that individual's current reality. This quantum tunneling process only works well when channeling through source, the field of undefined awareness. Otherwise there may be distortions along the way from the influence of nearby belief systems. Palmer's Avatar tools are about as complete and general a system as I have seen for tunneling from one universe of beliefs to another. There probably are other approaches I haven't encountered. The main idea is to go to *tabula rasa* for a clean slate; otherwise, data from the previous reality may bleed over into the new reality.

You see from this how physics as we know it works. The physicists doing "physics" are simply exploring their current set(s) of core beliefs. Thus "hard physics" is all an elaborate **memory** exercise. The physicist gradually remembers the beliefs that generate his current experiences, including his creation of "mass consciousness" experiences of "reality". For that matter we might even say that "Creativism" is another form of "remembrance". It all depends on one's viewpoint.

Discovery of laws is not what I would call "real" physics. That is living in the "past", a very imaginary world of priorly created core beliefs. Fortunately, however, the process of exploring often opens awareness to the influx of new beliefs and experiences through the use of the imaginative function of consciousness. This gradually shifts the reality paradigm held by the community of physicists.

A "realer" type of physics, though also an imaginary one, is a "Palmer" Process of first deciding how you would like things to be, and then manifesting that as your reality. Such a Palmer Process is effortless if you really believe it is!!! Some would call that engineering. And of course, once you have tasted a bit of your new reality, you may decide you don't like it after all. Remember the story of King Midas. So you can decide again, change your beliefs, and eventually perhaps make the universe the way you prefer it to be.

Physics is a way of defining things. But the ultimate universe is undefined, so there is no physics involved (at that level) -- by definition!!! Undefined awareness is beyond physics. That is perhaps why physicists do not like to talk much about the universe beyond or before the Big Bang. The veil of the Big Bang is the event horizon leading to an undefined reality. Physicists can not do much with that -- although recently some intrepid few theoretical physicists are venturing to explore what a reality prior to the Big Bang might look and feel like.

Here are some examples of how physics can be done on different levels of observer operation in consciousness.

Level 0: Using an approach like Palmer's Creativism, we manifest whatever we like from Source. This is the world of Avatars. It seems like magic to people who prefer to live their lives in default habits of thought and experience. As Avatars (Experiencers), or Siddhas (Perfected Ones), we can decide what kind of world we would like to play in, create that world deliberately, jump in and play around in it, explore it and experience it thoroughly, then jump out and dissolve that world back into the realm of all possibilities. When not engaged in creating and experiencing a new reality, we can live fully in the moment, the NOW of undefined awareness. There are no fixed laws of physics. As Avatars we can create such laws as we prefer in the form of core beliefs, and then fully enjoy the experiences they generate. We only have to be responsible for whatever reality we opt into, because that is how we choose to be. Living with one foot in one universe and another foot in an alien universe is a possible choice, but leads to an experience of schizophrenia. When attention is divided, you get only partial focus in both realities or have to jump back and forth constantly. Or you have to generate alternate versions of yourself that run in parallel. It is totally up to you how you decide to live life.

Level I: We begin from a new or a given viewpoint and build a consistent system of principles (beliefs) that describes a reality that already exists. Along the way we may have to accommodate existing systems and/or face the turbulence generated by adjusting them. My definition of the constants as fundamental particles in these essays stems from the core beliefs of current physics and aims to describe the world more or less as we experience it. But the system involves some basic new shifts of viewpoint. For example, most people would find it strange to think of G, e, or c as "elementary particles". My analysis of quarks, leptons, and bosons differs somewhat from the standard theory.

Level II: We come down a step from **Level I** and work within an existing paradigm, perhaps modifying it in some ways. For example, in this book we define the currently recognized elementary particles in terms of the fundamental constants of physics plus some new proposed constants that we must justify: e.g., %. To some extent we integrate our new viewpoint and system with the current paradigm, the existing system, and lead it in new directions.

Level III: We come down another step and work on theories within the current paradigm that is accepted by the majority of the physics establishment, including the belief that the paradigm is not perfect and needs more work. An example might be performing experiments to detect gravitational waves and thereby confirm an aspect of general relativity, or the development of new research directions in quantum mechanics, or doing experiments to detect a Higgs particle and verify that it is and does what a given theory proclaims it should do.

Level IV: We come down another step and work on improving applications of theories that are already established and accepted as reliable descriptions of reality. An example would be the development and fabrication of new computer chips or improvements of the internal combustion engine based on new technologies that evolve.

The above is a general outline of the "layers" of physics that we may choose to play in. They range from "No Limit Existence" to applying what we already know for developing practical applications. Each level has its value, and practitioners of each level work together. And some scientists operate in more than one level. Of course, we also can write about or teach any of the above layers of knowledge or skills. Our conclusion is that **the new paradigm of Observer Physics will identify any form of science as an exploration of the relationship between beliefs (theories) and experiences (experiments). The purpose of science becomes to bring our experiences (experiments) into alignment with our beliefs (theories) or to bring our beliefs (theories) into alignment with our experiences (experiments). How we go about this process can vary considerably. From the level of undefined awareness there is no science to be done.**

The Subatomic World

Now let's go back to specifics and begin to delve into the subatomic zoo as it is currently understood to take a look at the leptons, quarks, and gauge bosons. Our proposal is that ultimately all particles are built from tiny black holes of energy. These are like little eddies that form in a stream of water.

The six leptons (electron, muon, and tau, plus their antiparticles and a much smaller chargeless neutrino sidekick for each) are the smallest eddies of energy that can find a stable configuration in which to spin. Notice that the analogy of eddies also carries the notion of spinning, but we will have to see how quantum spin differs from ordinary spinning. Our first question, though, is how do we find such stable configurations of energy? Answer: We look at the constants in the simplest ratios that generate resultant masses. We already saw an example with our derivation of the proton (m_p), and we found there are now elegant and precise ways to pinpoint the rest mass of the electron theoretically and experimentally: for example, the electron rest mass is described as follows: ($m_e = 2\, R_\infty\, h \,/\, c_0\, \alpha^2$).

In exploring these relationships we must keep in mind that the constants cover a huge range. Their values are expressed in three ways: ratio (2.99792458), scale (10^8), and dimension (m/s). The ratio is a value between 1 and 10. The scale is a power of ten. The dimension is expressed in terms of one or more standardized units. We will note special qualities of these three values of a constant as we go along. Here is the simplest form of mass, and the smallest particle that we can make from the simplest and smallest combination of our fundamental constants.

* $m_{ne} = (\hbar \,/\, c\ \%) = 1.11\ldots\times10^{-43}$ kg (about 6.231×10^{-8} **eV**/c^2)

We will propose that this very small mass is the **hypothetical** rest mass of the electron neutrino (m_{ne}). As yet we have no precisely defined rest mass for the neutrinos. Alternatively we could make it using R = 1 meter, our other constant of distance. These two values are about the same, given the scale we are talking about. You could also use h instead of h-bar ($\hbar$). This formula is basically the de Broglie wavelength solved for mass rather than wavelength. The assumption here is that % (3.16227766.... meters) forms the simplest bottom line for scaling of particles. Also, powers of % would require powers of R to keep the units balanced. This makes the expression more complex. The question is whether % is just an artifact of our local way of doing math in spite of the way it integrates so well with $\hbar$ and c and other quantum expressions. The electron neutrino is considered pretty stable, except for its tendency to oscillate with the muon and tau neutrinos when found together with them, as in the case of neutrinos emitted from the sun and stars. Because of its small mass and the tendency to oscillate, the neutrino mass is usually given as a sum of all three kinds of neutrino (about 0.320 ± 0.081 **eV**/c^2). Physicists believe that if neutrinos were beyond such an upper mass limit they would cause the universe to undergo gravitational collapse.

The electron antineutrino tends to pair with the electron. The neutrino, as well as its antineutrino reciprocal partner, has no electrical charge. A bit earlier we discussed the Compton wavelength radius for electrons:

* $\lambda_e = \hbar \,/\, m_e\, c = 3.85\times10^{-13}$ m.

"The Compton wavelength of a particle is equivalent to the wavelength of a photon whose energy is the same as the rest-mass energy of the particle. . . . The reduced Compton wavelength is a natural representation for mass on the quantum scale. Equations that pertain to inertial mass like Klein-Gordon and Schrödinger's, use the reduced Compton wavelength. The non-reduced Compton wavelength is a natural representation for mass that has been converted into energy. Equations that pertain to the conversion of mass into energy, or to the wavelengths of photons interacting with mass, use the non-reduced Compton wavelength. A particle of rest mass m has a rest energy of $E = mc^2$. The non-reduced Compton wavelength for this particle is the wavelength of a photon of the same energy. For photons of frequency f, energy is given by

* $E = hf = hc / \lambda = mc^2$

which yields the non-reduced or standard Compton wavelength formula if solved for λ." (**Wikipedia**, "Compton wavelength".) We could use this expression to define the rest mass of the electron since λ_e is a measurable constant:

* $m_e = h / \lambda_e c$. (The CODATA 2010 value for the Compton wavelength of the electron is $2.4263102389(16)\times10^{-12}$ m and gives a good value for the electron rest mass.)

In a sense, such a definition is circular, since we defined the radius in terms of the mass, but it is easier to measure the wavelength and deduce the mass from it. We can substitute % for λ_{ne} below since both are distances. That gives us a new value for the electron neutrino mass in the de Broglie relation ($\lambda_{db} = h / p$) as shown by the expression

* $m_{ne} = (\hbar / c\ \%) = 1.11\ldots\times10^{-43}$ kg.

The de Broglie wavelength λ_{db} "depends on the momentum [$p = mv$] of a particle and determines the cutoff between particle and wave behavior in quantum mechanics." (**Wikipedia**, "Compton wavelength") The neutrino lives in that cutoff realm. Here I arbitrarily chose % for the de Broglie wavelength, the reduced Planck constant, and the speed of light as the limit velocity for an electron neutrino. This number for the m_{ne} mass is very interesting, because 1.111 happens to be the ratio value of $\hbar$ squared, but here we only have $\hbar$ in the first degree! This means that (c %) is equal to 9.487 the reciprocal of the ratio of $\hbar$, i.e. $(9/10)^{1/2}$, or about .9487 with an order of magnitude shift. Since % is a D-shift operator, we see that this number has a fractal relationship with c via the D-shift operator %. So $\hbar$, c, and % play with the ratios between 9 and 10 and create a fractal system with a fundamental tone at (1.11×10^{-43} kg). We'll ignore the 10 power scale and units right now and just look at the ratios.

* $(1.054)^0\ (3\times3.162)^{-1} = 0.1054.$
* $(1.054)^1\ (3\times3.162)^{-1} = 0.1111$
* $(1.054)^1\ (3\times3.162)^0 = 1.054$
* $(1.054)^2\ (3\times3.162)^0 = 1.111$
* $(1.054)^2\ (3\times3.162)^1 = 10.54$

* $(1.054)^3 (3\times3.162)^1 = 11.11$, etc.

You get the picture. It is a fractal structure that repeats itself at every scale. The Planck scale happens to be the limiting value for energy in our physical universe. The physical universe is structured from the constants and geometry in a (quasi)fractal manner. I say "quasi" because at certain scales matter behaves very differently than at other scales.

I propose that ($\hbar$ / c %), which is the simplest form of the "electron neutrino" expression using our basic physical constants, represents the minimum mass quantum of the electron neutrino. It is strictly a relationship between a radius of rotational momentum and the speed of light mediated by the D-shift operator.

The operator % is determined by the fractal relationship between $\hbar$ and c.

There is no electric charge involved, and indeed the neutrino is chargeless. (Later we'll take a closer look at why and we will get a better idea of what charge is, since nobody seems to come up with a clear explanatory definition of it. We will at least try to answer "how" if not "why".) The speed of light c tells us how fast the energy is really "going", and $\hbar$ locates it as a certain radius of rotational momentum arising at a singularity, and % sets up a vortex so it wraps around itself and creates the possibility of scaling to bigger sizes. Here is a variant that adds some geometry:

* $\hbar$ Ao / c π % = $1.111...\times10^{-44}$ kg.

This differs by one order of magnitude. It is smaller, but more complex. If you drop out the π, then it goes to 3.44×10^{-44}, the midpoint. So the value may oscillate somewhere around there, possibly also within a multiple of 2 π.

On a larger scale we see a magnified version of this quantum relationship every time we observe a photon deflected by a free electron in the Compton effect. On a still larger scale, we see it when a proton deflects a photon. But if you imagined the deflecting particle getting more and more massive until the photon no longer deflects but goes into a gravitational orbit, then you would have a neutrino. You also have a mini black hole. The odd thing is that there is no nuclear particle. The neutrino self-interacts and is also quite diffuse in its free state. The neutrino occurs as the vibration of the photon starts to form a wave pattern that wraps around in a circle rather than simply oscillating. The space/time around an elementary particle is severely warped. This is just like the experiment of starlight bending as it passes by the sun or galactic gravity lenses. If you look at that starlight closer and closer to the sun's surface (which you cannot do because of the corona's large-scale disturbances and such problems -- but we can imagine an ideal solar-sized object), it would start to bend by the Compton effect magnified by the huge solar mass. Light that gets too close is simply sucked in and absorbed by the nearest electron black hole. It rarely gets to a proton unless we have an ionized gas where the electrons have zipped away because they are already full of absorbed photons. Ironically our sun is not a black hole, but each of its constituent particles is!!

So the neutrino is the minimum energy quasi-black hole configuration of a photon "eddy". It does not absorb photons the way an electron does, but it does disturb them slightly. The neutrino has no charge, so one would think this must be a gravitational effect. The neutrino is made of nothing but photons so energetic that the frequency wraps around as it travels. You get a wave with some particle qualities. The particle properties, however, are quite weak and diffuse, and will not hold a charge. They also tend to waver in their commitment to a fixed mass -- they oscillate among three flavors. They are also quite uncertain with regard to their position. You can not put a neutrino in a box and say exactly where it is. You can't even catch one except by a process such as reverse neutron decay. The electron is much more defined than a neutrino, and you can put an electron more or less into a certain area and manipulate it through its charge. Nevertheless, under the right conditions even electrons can tunnel right through barriers that would seem to have stopped them. The quantum world is strange until you learn how it works and adjust to the deeper logic.

As a rough mathematical sketch, let's use Newton's formula for gravity to determine the radius of a black hole (BH) event horizon (which is what our photon now defines.) An actual BH calculation is more complicated, but this is good enough for a start and actually happens to hit on the right answer pretty well. We set ($m_x v^2 / 2$) as the kinetic energy of the particle.

* $m_x v^2 / 2 = G m_x m_y / r$.

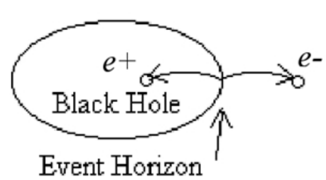
Here m_x is the mass of the "satellite" particle, v is the velocity, m_y is the core (deflecting) mass, G is the gravity constant, and is the r radial distance between the two bodies. The mass of the satellite particle cancels out.

* $v = (2 G m_y / r)^{1/2}$.

We can now calculate from our sketch the radius and mass that would keep the photon as a satellite trapped in orbit at the BH event horizon, by substituting c as the velocity v.

* $r = 2 G m_y / c^2$. (The Schwarzschild Radius of a black hole)

Admittedly we do not know very much about the inner mechanics of BHs or neutrinos. However, the above expression is what you see in texts and all over the Internet. I think this is probably not quite correct. In the previous chapter we discussed Hawking radiation of BH's. Hawking's theory is based on the notion that pair creation can take place at the event horizon of a BH.



Since the energy of a particle's rest mass is mc^2, then the energy required for pair creation must at least be $2mc^2$ (e.g., one for an electron e^- and one for a positron e^+). Hawking radiation involves one member of a pair falling in from the event horizon and the other member falling out. The process of stuff falling into a BH from outside must be the reverse of Hawking radiation. That suggests material falling into a BH from outside the event horizon may meet material that "falls" out to the event horizon from the singularity. So, in a sense, BHs are like strange bubbles, and stuff falling in over the event horizon pulls stuff **away** from the singularity at the center toward the event horizon -- which makes sense from a gravitational point of view and from a charge point of view if the members of the particle pair are oppositely charged -- which they usually are.

Furthermore, the relativistic equations of stuff falling into BHs suggest this. From an outside observer viewpoint the material falls slower and slower toward the event horizon approaching a limit that means it comes to "rest" on the event horizon, not at the singularity. Scientists then turn around and "renormalize" the equations that blow up when the speed gets to 0 and say that the matter continues on into the singularity. Depending on BH size the mass inside the event horizon will hold most of the new material. Hawking has shown that the radius just tends to get larger. That may be due to the material congregating into a larger and larger sphere with different space-time gradients on either side of the event horizon.

Recently Hawking dropped a "bombshell" on the community of BH enthusiasts when he stated what should have been obvious: BH event horizons are "fuzzy" and not precise mathematical surfaces of spheres. Quantum mechanics requires this.

What if the event horizon functions like a quantum mirror running pair production backwards as pair annihilation? The BH grows from a dense ball of material. As its material reaches the BH event horizon, it starts to annihilate its matter at the event horizon as new material falls in. This results in a great release of energy, about half of which falls in and about half of which falls "out" as X-rays and other radiation. Nevertheless, large new doses of matter still cause the BH to grow.

People imagine that a BH is a super dense ball of matter, so dense that light is unable to escape. In a sense this is true, as we saw with the radiation and explosive annihilation of very small BHs. It all depends on the scale. We can do a "paper napkin" rough calculation as an example. Astronomers tell us many or even most large galaxies (including ours) have BHs at their core. Suppose we have a galaxy whose core contains 1 billion (10^9) solar masses averaging about 2×10^{30} kg each. That gives us a core mass of around $M = 2\times10^{39}$ kg. The radius $r = GM/c^2$. That means:

* $r = (6.7\times10^{-11}\ \mathrm{m^3\ s^{-2}\ kg^{-1}})(2\times10^{39}\ \mathrm{kg})\ (1.11111\times10^{-17}\ \mathrm{s^2\ m^{-2}})$
* $r = 1.5\times10^{12}$ m.

The diameter of this core will be almost 3 billion km (3×10^{12} m). The radius of our sun is about 6.955×10^8 m, or a diameter of 1.391×10^9 m.

The volume of our sun is $1.4\times10^{27}\ \mathrm{m^3}$. The volume of our galactic core will be about

1.4×10^{37} m^3. In other words, about 10^{10} solar masses at solar volumes could fit into the space of the galactic core BH. But there are only 10^9 stars in the core. That means the stars, as is, could mush around in there with as much as several star diameters between them. And stars are not all that dense. Our sun's density is about 1.408×10^3 kg m^{-3}, while earth's is about 5.515×10^3 kg m^{-3}. It is a bit under 1/4th as dense. A larger galaxy with a larger core containing 100 billion stars could even have solar systems floating around comfortably in them with plenty of space in between stars. Our universe is probably a giant BH with solar systems and galaxies floating about with plenty of space (with an average density of perhaps 10 atoms of hydrogen per cubic meter). We can calculate the size of the universe just by knowing the average density of matter in space, but that is a question that will await a deeper understanding of cosmology for we have to deal with expansion, dark energy, dark matter, and other issues.

For now, I want to suggest that when we calculate the energy involved in a BH, and its corresponding radius, we must **double** the kinetic energy involved because of the pair production phenomenon.

* $2\, m_x v^2 / 2 = G\, m_x m_y / r$.
* $v^2 = (G\, m_y / r)$. (We substitute c for v and solve for r to "blacken" our hole.)
* $c^2 = (G\, m_y / r)$
* $r = (G\, m_y / c^2)$ (From our "Hawking-Schwarzschild" radius solve for m_y.)
* $m_y = r\, c^2 / G$.
* $m_y = \hbar / c\, \lambda_y$.
* $\hbar / c\, \lambda_y = r\, c^2 / G$.
* $\lambda_y = \hbar\, G / r\, c^3$.

Of course, $r = \lambda_y$.

* $\lambda_y^2 = \hbar\, G / c^3 = \hbar^2 / m_y^2\, c^2$. (Hence, $m_y^2 = \hbar\, c / G$.)
* $\lambda_y = 1.616\times10^{-35}$ m.

This gives us a very rough idea of the size of the neutrino: $\lambda_y = r =$ the neutrino's radius. This number is known as the Planck radius or Planck length. (See **Wikipedia**, ("Planck length".) Interestingly, the mass of the photon does not matter, as is the case with any body falling in a gravitational field. But we can calculate m_y, the deflecting mass, from this by substituting (λ_y) back into our earlier equation $m_y = \hbar / c\, \lambda_y$, using 1.616×10^{-35} m as our version of λ_y. Then we get something that in the literature is called the Planck mass.

* $m_y = 2.176\times10^{-8}$ kg.

"In physics, the **Planck mass**, denoted by m_P, is the unit of mass in the system of natural units known as Planck units. It is defined so that

* $m_P = \sqrt{\frac{\hbar c}{G}} \approx 1.2209\times10^{19}$ GeV/c^2 $= 2.17651(13)\times10^{-8}$ kg, (or 21.7651 μg), where c is the speed of light in a vacuum, G is the gravitational constant, and $\hbar$ is the reduced

Planck constant." (**Wikipedia**, "Planck Mass")

Recall that we calculated in the previous chapter the Union particle's theoretical mass:

* $U_n = 1.86 \times 10^{-9}$ kg.

The Union is akin to a boson as we'll see when we discuss those particles, because it is a quantum particle that can break through the Pauli Exclusion limit. As a class I refer to these Union Boson particles with a *B* in front instead of an *m*. So we will now call them union bosons B_u. Although they appear to have mass, they actually are vehicles for generating the appearance of mass. That becomes clearer when we discuss the photon *Bf* and other bosons, their natures, and functions.

However, the "official" Planck mass $(\hbar\ c\ /\ G)^{1/2} = 2.17651(13) \times 10^{-8}$ kg that we calculated is off from our B_u particle by a factor of about 11.7. This number happens to be the square root of the inverse of the fine-structure constant ($a^{-1} = 137$). Physicists for some reason leave out the constant *α* though it perfectly links the Black Hole Planck mass with the electro-gravitational equilibrium mass.

The constant *a* comes up any time you are involved with electromagnetic interactions and is hiding inside Coulomb's Law for a static electrical force: $F_e = e^2\ /\ 4\ \pi\ \varepsilon_o\ r^2$, and connects it to Newton's Law: $F_g = G\ m_1\ m_2\ /\ r^2$. Thus we have two equivalent expressions for the Planck Mass, one based on Newton and one based on Coulomb.

* $(\hbar\ c\ \alpha\ /\ G)^{1/2}$.
* $\alpha = e^2\ /\ 4\ \pi\ \varepsilon_o\ \hbar\ c$.

We substitute the constant expression for alpha (*α*) into the expression for Planck Mass,

* $(\hbar\ c\ e^2\ /\ 4\ \pi\ \varepsilon_o\ \hbar\ c\ G) = e^2\ 4\ \pi\ \varepsilon_o\ G$.

Thus, we end up with:

* $B_u^2 = e^2 / 4\ \pi\ \varepsilon_o\ G = \hbar\ c\ \alpha\ /\ G$.
* $B_u = (e^2 / 4\ \pi\ \varepsilon_o\ G)^{1/2} = (\hbar\ c\ \alpha\ /\ G)^{1/2}$
* $B_u = 1.86 \times 10^{-9}$ kg.

So the real Planck mass is the same as our union boson at the equilibrium point of the electric and gravity forces, which makes sense if it is the **Big Bang particle**. It is odd that this particle is large enough to be seen by the human eye.

Neutrino Magic

I represented the **hypothetical** neutrino (m_{ne}) with (ħ / c %), giving it a "rest mass" value of around 1.11×10^{-43} kg. The rest mass is not really a rest mass, because you can’t get a free neutrino to stop. The neutrino is a small group of photon waves that has a specific resonant frequency, but is too diffuse to function as a particle and really just behaves as a quantized impulse of energy. (The Planck length size of the neutrino "point-particle" rest mass radius is opposed to its "wavelength" spread that I estimated roughly at % (3.162 m). Some believe the neutrino is just an accounting trick to maintain conservation of energy. However, the role it plays in nuclear decay processes suggests it can be treated as a particle with a quantized mass and energy. Most free neutrinos travel in relativity mode at nearly light speed and thus also drag along a lot of kinetic mass-energy momentum in spite of their small size, so it is not very useful to speak of their "rest mass" since the "mass" is mostly high-speed momentum. Their kinetic mass-energy is invisible to us, because neutrinos lack charge and thus do not interact with ordinary matter except maybe very, very, very, rarely. Their size is too small and they have no charge. Recall what we said about resistance and mass. Neutrinos have almost no **resistance**, so it is difficult to detect any **mass** for them. If we can't interact with them -- resist them --, even their tiny "rest mass" is invisible.

We first imagine the neutrino as an interaction of two photons, photon B circulating around photon A, taking A as a motionless center. The angular momentum (l) of the particle packet consists of the interaction of the packet mass, packet internal photon linear velocity (c), and a radius of packet internal angular vibration (r).

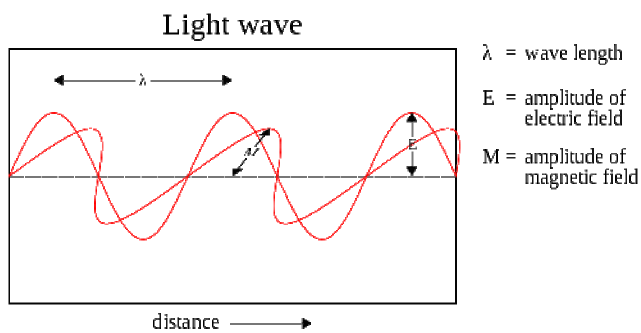
* $l = m_{ne}\, c\, r.$

The linear velocity is tangent to the circular orbit and is slightly less than c. The linear velocity is $c = 2\, \pi\, r \,/\, t$, always as if in a straight line, but curved by the constant influence of the radius length r, with t representing the clock pace in seconds. The angular momentum then is the mass times the linear velocity times the radius times the sine of the angle between the linear velocity and the radius, which angle for a particle moving in a circle around a center is always 90 degrees and thus unity. So the angular momentum is the linear momentum times the radius. The mass is then the angular momentum divided by the velocity and the radius. For a quantum particle we substitute Planck's constant for the angular momentum and wavelength for the radius, where the wavelength λ is $2\, \pi\, r$. Thus $m_{ne} = h \,/\, c\, \lambda = h\, t \,/\, 4\, \pi^2\, r^2 = \hbar\, t \,/\, 2\, \pi\, r^2$. Each photon that forms the packet of the neutrino travels at c relative to anything else. The energy of the neutrino packet is $E = m_{ne}\, c^2 = hc \,/\, \lambda$, where the "at rest" value of $\lambda = 2\, \pi\, r$. The energy then is $hc \,/\, 2\, \pi\, r = h \,/\, t$, or $2\, \pi\, \hbar \,/\, t$. I suspect that the average value of r is %, or about 3.162 m, which gives the free electron neutrino a macroscopic, but extremely diffuse energy footprint. The mass is ½ the reduced Planck constant times the period divided by the area swept by the radius during a single photon orbit.

As photon B circulates around photon A, we could just as easily say photon A goes around photon B, since we have no definite viewpoint other than an arbitrary choice as observer. The two could be going around a center point between them. Since motion is relative, we can choose any viewpoint that works. So let's continue with A at the center. When B circulates around A there is a virtual axis formed through A that is perpendicular to the plane of B's orbit. This axis is considered a vector, but is balanced ½ oriented up and ½ oriented down.

Although we are generally unable to observe the neutrino directly due to its lack of charge, we **assume** that its spin is similar to that of an electron. It would seem that one cycle would be 2 π, but it actually takes 4 π (or 720 degrees) to complete a cycle, whereas a photon spins relative to its antiphoton partner, and completes a cycle in only 2 π (or 360 degrees). The reason for this is that the photon-antiphoton pair has a transverse vibration between the electric and magnetic components such that one electric cycle equals one magnetic cycle.

In other words, each time the "electric" photon spins once around, the "magnetic" photon also spins once – which means that the primary spin axis pole flips over. This happens because the photon-antiphoton pair function as an integrated whole called a boson. Also photons (and other bosons) are Self-sufficient, Self-absorbed, and Self-observing. In other words, light is awareness and is thus self-aware. The photon and antiphoton always travel at speed *c* relative to each other or anything else. That means photons never actually move. All phenomena are made from photons, and photons relative to photons are always at rest. What we see as light speed derives from our fermion viewpoint. From the boson photon viewpoint there is no motion or change. When awareness identifies with photon light, undefined awareness is the result.



The neutrino, electron and other particles known as fermions have split from their antiparticle partners. They are not self-observing and must interact with an observer who has split them off from Self. The observer is nevertheless still connected to them, so, as they spin, there is at least a photon interacting with a photon, each of which is oscillating – and the observer viewpoint is also oscillating. So the fermion spin cycle is twice as long as a boson's. A fermion spin cycle of 360 degrees is only ½ of a complete boson cycle of 360 degrees, so it is said to have spin ½ and takes two fermion cycles to complete the equivalent of a 360-degree boson cycle.

Richard Feynman may have been the first physicist to suggest an analogy to the curious 720-degree spin cycle of a fermion. However, he never (at least not in public) explained clearly why it works that way.

Experiment: Hold your right hand above eye level with forearm vertical, elbow down, and palm horizontal with fingers pointed away from your head. Slowly rotate your palm counterclockwise as you look **up** at it, palm remaining level, until your fingers point toward your head. Continue to rotate your palm in the same direction, but lower your palm and raise your elbow until the forearm is again vertical, but with the elbow raised about even with your head. It is a bit awkward, but keep your palm horizontal with fingers pointed away from you. Now continue rotating your palm in the same direction until the fingers again face toward you. Then complete the second full rotation bringing the palm back up and the elbow back down until the fingers again point away from you, palm level, forearm vertical with elbow down and palm up. You have just rotated your palm 720 degrees through two full rotations. Practice this until you can do it even holding a glass of water without spilling the water.

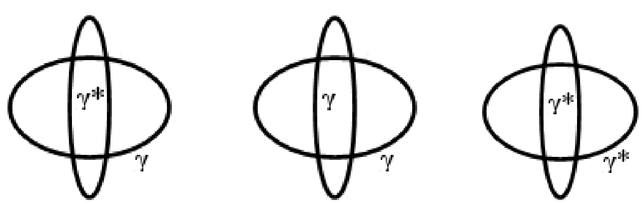
There are several important things to notice here. First, your forearm serves as the axis of rotation of the palm. Second, when you complete the first half of the first rotation, your forearm has rotated until it is about level with the palm, and when you complete the second half of the first rotation, your forearm rotates until the "poles" have flipped (that is, elbow goes from down to up, and wrist goes from up to down). The second rotation is just the reverse: elbow goes from up to level and then back to down position. The pole flips back to its original position. So you have rotated the forearm pole once during two rotations of the palm. Thirdly, your elbow is connected to your shoulder and body by its upper arm. This represents the connection of the observer with his object of observation. As you perform the rotations you are also flipping your observer viewpoint even though you feel like you have not moved. During the first rotation you look up at the rotating palm and see it move counterclockwise. During the second rotation you look down on the rotating palm and see it move clockwise. Yet the palm continues to rotate in the same direction. Go through the experiment slowly and pay attention to the clock motion of the palm during the first and second rotation as well as your observer viewpoint relative to the palm.

Not only does the palm rotate 720 degrees (or continuously as many degrees as you like), but also the forearm pole rotates, flipping elbow and wrist up and down as well as through level in between each reversal. As an observer you **see** your palm rotate one direction and then the other direction, but you **feel** it continue to rotate in the same direction. This is how fermions "spin". Arbitrarily we can say that the electric spin is horizontal and the magnetic spin is vertical (although the EM wave sketch shown above is rotated by 90 degrees and shows the electric field vertical and the magnetic field horizontal).

The particle, whether a boson photon pair or a fermion neutrino (or electron, etc.), can be absorbed into a larger particle or can move through open space. When it is absorbed, it becomes part of the overall energy of the particle and may influence its kinetic behavior as well. When it moves through free space, the "rotation" expands into a wave motion. A photon-antiphoton pair moves at speed c relative to any other particle, because its internal motion is perfectly balanced. (We will take a look at Special Relativity in the next chapter.) The energy is held in the frequency, and any kinetic motion relative to other particles is absorbed by the frequency, modifying it to match the addition or subtraction of energy, while leaving the speed unchanged. The wavelength also usually adjusts accordingly. The rest mass of the particle is determined by the simple rotational dynamics of the particle packet.

* $m_{ne} = h / c \lambda$ (rest mass)
* $m_{ne} c^2 = h / t = 2 \pi \hbar / t = \hbar c/r$ (rest energy)

We only need to know the basic "rest" value of r or $\lambda = 2 \pi r$, which is hard to find experimentally, but which I hazard at a guess to be %. We can visualize the packet as a photon orbiting at the rate of $c = 2\pi r/t$ around another photon at a distance r – rather like a binary star system. The radial distance r becomes stretched into the wavelength λ and that lengthens as the packet as a whole moves at a group velocity. Planck's constant and the speed of light keep the system stable. The mass varies as the wavelength, but the wavelength automatically falls into a fractal resonance with hc. So $\hbar c/ r$ becomes J at some power of 10, with a tendency to stabilize at 10^{-26} J. This is the smallest binary star system – two photons whirling around each other at light speed. To get a smaller net mass a larger wavelength (radius) is required, and hence a larger separation between the photons. At some point the photons lose touch as a binary system. So the only way for the wavelength to go is down to a smaller photon displacement. An ordinary photon is a photon-antiphoton pair generating a photon electric field and an antiphoton magnetic field. The electron neutrino consists of an impulse of a pair of photons that form a bubble disconnected from their antiphoton partners. The antineutrino is a pair of antiphotons that are disconnected from their photon partners. The neutrino does not radiate, and thus has no charge. However, if a neutrino and an antineutrino meet, they mutually annihilate, popping the two bubbles which revert to photon-antiphoton pairs, and go on their way as normal EM radiation. The photon does not annihilate, because it is its own antiparticle, and is the ground state of existence, so annihilation just reproduces the same pair. We will study these interactions in later chapters. Neutrino mixing seems to occur when several neutrinos cluster together into a clump of bubbles. We will know more about that when we have more data about the muon and tau neutrinos. The sketches below suggest the differences between a photon, a neutrino, and an antineutrino. The gamma stands for a photon in general and does not specify the frequency range. The star indicates an antiphoton. The (electron) neutrino and antineutrino tend to retain a fermion particle configuration with spin 1/2, whereas the photon pair tends to have spin 1 and remain as a boson.



Photon Pair Neutrino Antineutrino

The photon and antiphoton have no rest mass and no force component other than a very tiny momentum by themselves, which is why they are classed as bosons. Neutrinos and larger fermion particles have rest mass and may engage in interactions with force, although neutrinos are the lightest fermions and, being without charge, they have only very weak interactions with matter and tend to pass through it with little or no effects. You can see clearly that an encounter of a neutrino with an antineutrino results in their "annihilation" into two photon-antiphoton pairs, just like with other fermion pairs.

The ancients had a tradition about something they called the "akashic records." The Maharishi referred to this traditional notion as RBP (*Ritam Bhara Pragya*.), which means "wisdom that bears right knowledge." Experiences pass and worlds pass, but it is believed that the akashic records silently record everything that happens, preserving it for a very long, time, very close to forever -- and maybe in some way even forever.

Imagine a huge vacuum state with non-interacting neutrinos zipping about in it. Whenever matter decays, various fragments issue forth. They later interact with other particles and rearrange themselves. Their earlier history is forgotten in the mixing and matching. But the neutrinos that come out of the event carry a signature energy and directional momentum of the event in that tiny portion of energy that they carry off. They fly off into space carrying that information (Oh, a neutron decayed in Spokane!). They remember that information almost forever, until the Gnab Gib, or until a gigantic BH captures them. The universal neutrino gas doesn't record everything, but it's a start at a physical mechanism for storing very long-term records in the ever-changing universe. Unfortunately we large bodied people can't **read** those records with any physical device because of the very fact that the neutrinos interact only extremely weakly. You would have to be very much awake in neutral (undefined) attention awareness to sense them. The data field is non-local and spread throughout the cosmos. The neutrino gas in the vacuum is like the subatomic version of a noble gas. Helium gas is its macroscopic cousin by analogy as the lightest non-interacting gas.

Optional Exercise: Just for fun, imagine a vast hall full of neutrino gas!!! The neutrinos are all spread out like ghostly blobs, but have various vector values and energies. Imagine that you can "read" them. In so doing you must be fully undefined so that you do not disturb the data that they hold. As we explore leptons further, we will propose a way to "read" the cosmic neutrino gas.

The Electron

Now let's begin to discuss the electron. We will continue developing a model of its structure in the next two chapters. This very common lepton is quite stable unless it bumps into its antiparticle, in which case the pair annihilates into photon energy usually expressed as a pair of energetic photons. It has one quantum unit of negative charge and plays a major role in the structure of atoms and molecules, because it is a very common emitter and absorber of photons by means of which it adjusts its kinetic energy state.

I want to sketch out the steps by which I found one of the basic constant relations for the electron, because these steps bring up some interesting fundamental aspects of the electron. The proton's mass is a very straightforward ratio of the quantum charge to the speed of light. The electron is much subtler. I've spent several years playing with the electron and found out a lot of things about it, but still have much to learn. For example, recall the way we can read information about the electron from the **Rydberg number**. The Rydberg number is like a little book, as indeed are all the spectral lines that chemists and astronomers have learned to read. There may be much more to read there.

The rest mass of the electron has a funny ratio. It falls in between the neutrino and the proton, but seems closer to the proton. We will play around with our notation. Maybe we will discover something, and maybe we will just get a bit used to playing with our notation system and our strange way of thinking (relative to establishment physicists).

Step 1. An obvious starting point is to look at the ratio between our hypothetical ideal neutrino and the proton.

* $m_{ne} = \hbar / c$ % $= 1.111\times10^{-43}$ kg
* $m_{ne} / m_p = .666\times10^{-16}$.

If we square that, we get right about to the scale of the electron.

* $(m_{ne} / m_p)^2 = .4444\times10^{-32}$.

That's about 205 times smaller than an electron. The problem is that the masses all cancel out. But we have something that looks pretty natural. It is a simple ratio, it is time independent, and it almost has the correct scale.

Step 2. Next I looked at the **numerical ratio** component of G and m_p.

G hovers around (20 / 3), and m_p hovers around (5 / 3). So there may be a link between these two constants. The proton generates most of the gravitational mass in the universe, and G is the universal gravitational constant. The value of the electron's mass (9.109534×10^{-31} kg) is a weird number. It seems very close to 9.1111.... But that value does not seem to fit well with the other constant values, so m_e's ratio sticks out like a sore thumb in the whole system.

The main similarity I came up with as a starting point was the value (1.11111) which we saw above for the hypothetical neutrino, and which also comes up as the ratio for the square of $\hbar$. ($1.111...\times10^{-68}$ $J^2 \cdot s^2$.) Since we already had $\hbar^2$ involved, that sounded promising. Playing with that I found that 9.1111 divided by 1.111 is 8.2. Further exploration revealed that (9 × 9.11111) = 82 which differs from the previous number by an order of magnitude. Now I could plug in constants using the D-Shift Operator to generate an equation. At this point my attention was only on exploring the **idealized** ratios, and not the units or scale.

* m_e %$^2 / \hbar^2 = 8.2\times10^{38}$ s^2 / kg m^2.
* m_e $c^2 = 8.2\times10^{-14}$ kg m^2 / s^2.

Step 3. The units of the above expressions are **energy reciprocals**, so if we multiply the two, we get a pure number constant!!! We can then take the square root of the whole thing multiplied together and get the following:

* m_e c % $/ \hbar = 8.2\times10^{12}$.

This is the ratio of the idealized electron mass to our idealized electron neutrino mass.

* $m_e / m_{ne} = 8.2\times10^{12}$.

So now we have the following additional mass ratios:

* $B_u / m_{ne} = 1.67\times10^{33}$. (A fractal echo of the proton.)
* $m_{ne} / m_p = 6.66\times10^{-15}$ (A fractal echo of G.)

Step 4. We next need to find some mass for our "particle". Armed with these relations it is clear that the neutrino mass to electron mass ratio (m_{ne} / m_e) is in the neighborhood of the reciprocal of the permittivity constant ε_o. (i.e., 10^{12}.) So we cancel out the spatial units with a "standard cube" ($R^3 = 1$ m^3).

* $(4 \pi \varepsilon_o R^3) = 1.111\times10^{-10}$ kg.
* $(m_e / m_{ne})(4 \pi \varepsilon_o R^3) = 911.11$ kg.

Armed with these relations I then multiplied (m_e / m_{ne}) by ε_o %^{3} and got a mass of 2295.9 kg.

* $(m_e / m_{ne}) (\varepsilon_o) (\%)^3 = (m_e\, c\, \varepsilon_o\, \%^4) / (\hbar) = 2295.9$ kg.

Step 5. I then multiplied that by (Oo As Ao^2 / π^3 %^{4} Ss) = .06, the reciprocal of the proton ratio divided by 10. That's like dividing by a scaled "echo" version of the proton in a different dimension, but with no mass, because I wanted to keep the mass I already had generated.

* $(m_e\, c\, \varepsilon_o\, \%^4 / \hbar)$(Oo As Ao^2 / π^3 %^{4} Ss) = 137 kg.

The 137 is a magic number. It is the reciprocal of the fine-structure constant (fsc = a), a pure number usually represented with a Greek letter alpha. This number is meaningful, since the fsc governs the electron's emission and absorption of photons. So we just plug that in, using its derivation in terms of constants.

* $(m_e\, c\, \varepsilon_o\, \%^4 / \hbar)$(Oo As Ao^2 / π^3 %^{4} Ss) = (a^{-1}) kg.

* $(m_e\, c\, \varepsilon_o\, \%^4 / \hbar)$(Oo As Ao^2 / π^3 %^{4} Ss) = $(4\, \pi\, \varepsilon_o\, \hbar\, c / e^2)$ kg.

We collect and simplify.

* (m_e kg^{-1}) = $(\hbar^2 / e^2)$ (π^4 Ss / Oo Ao^3) = 9.11×10^{-31}. (a pure number)

The second factor in the expression, (π^4 Ss / Oo Ao^3), is pure geometry. The simple ratio on the left ($\hbar^2 / e^2$) is so close to the scale (not the dimension) of the electron considering 31 orders of magnitude that it can not be a coincidence. By itself it comes to 4.328687×10^{-31} m^4, a 4-D space. This value is just under ½ the mass of the electron. But, unfortunately, the mass has disappeared and we have a 4-D space. The factor we need turns out to be around 2.1 m^{-4}. We write that value as (π^4 Ss / Oo Ao^3) in our geometry notation. But we now have a pure number that looks like the electron's mass. So perhaps we need to take out one of the *e*'s and substitute something else equivalent that has no mass.

Step 6. By exploration we find that we get very close to the massless value of e^2 with the following expression:

* $(m_p\, G) = 1.1111\times10^{-37}\ m^3\ s^{-2} = (10/9) \times 10^{-37}\ m^3\ s^{-2}$.

There's our Planck D-shift number popping up in the ratio portion. We used pure idealized ratios here: (5/3)(20/3). So we can play the scaling game that we saw emerge from the neutrino relation by allowing this expression to interact with $\hbar$ or with $(c\ \%)^{-1}$.

Step 7. If we replace one of the *e*'s with this expression, we still have the problem that the time dimension doesn't balance. So we square the $\hbar^2$ instead. This balances the time dimension out.

* $(\hbar^4 / e^2\, m_p\, G) = .0433\times10^{-60}\ kg^2\ m^5$.

We are getting closer. This expression has the units $kg^2\ m^5$. So we are shooting for a PAIR of electrons. This makes sense from our observation that the property called "spin" makes electrons tend to come in pairs (called Cooper pairs), an up and a down. Their identical charge with light mass keeps them at a distance from each other, but they hover in paired orbits.

To make the distance dimension an even power, we divide by %. This gives us

* $(\hbar^4 / e^2\, m_p\, G\ \%) = (a)^{-1}\ (10^{-4})\times10^{-60}\ kg^2\ m^4$.

There's the fsc again. That sounds right. We're getting close. We use a factor of $\%^4$ to shift the scale to 10^{-62}. We note in passing that the reciprocal of the *G* ratio (i.e., 3/20) mediates between 9.11 and 1.37. Very interesting!! We now have the following:

* $(\hbar^4\, a / e^2\, m_p\, G\ \%) = 10^{-64}\ kg^2\ m^4$.
* $(\hbar^4\, a\ \%^3 / e^2\, m_p\, G) = 10^{-62}\ kg^2\ m^8$.

Step 8. We don't worry about a few distance units, since we know how to D-shift. We have the dimension of a pair of electrons and their scale. We need the ratio, which for two of them is 83. This is nice and close to our old friend, 8.2, or 82, or 8.28. This ratio comes up a lot with the electron, and leptons in general. The electron-to-neutrino idealized ratio is 8.2×10^{12}, for example. This suggests an idea. We looked at the hypothetical electron-to-neutrino ratio and proton-to-neutrino ratio (3/2), -- an echo of the *G* ratio reciprocal. Let's take a look at the proton-to-electron mass ratio. Nobody makes much sense out of that, since nobody knows why the proton and electron have the masses they have. It's just a commonly bandied about pure number ratio, right?

* $m_p / m_e = 1836$.

This is very close to twice the ratio of the electron shifted by two magnitudes. So we throw in a simple factor from geometry to handle that and also handle the extra spatial units.

* $(m_p / m_e)(\pi \text{ Ao} / \text{Oo} \%^5) = (1836)(.0049673) \text{ m}^{-4} = 9.12 \text{ m}^{-4}$.

Step 9. We put the whole thing together (squaring our ratio) and then collect and simplify the terms:

* $(m_p / m_e)^2 (\pi \text{ Ao} / \text{Oo} \%^5)^2 = 83 \text{ m}^{-8}$.

* $(\hbar^4 a \%^3 / e^2 m_p G)(m_p / m_e)^2 (\pi \text{ Ao} / \text{Oo} \%^5)^2 = (83 \text{ m}^{-8})(10^{-62} \text{ kg}^2 \text{ m}^8) = m_e^2$.

* $m_e^4 = (\hbar^4 / e^2)(m_p / G)(\text{Ao } a / \text{As } \%^5)$.

The left side comes to about 6889×10^{-124} kg^4. The right side comes to around 6939.85×10^{-124} kg^4. Pretty close for an idealized calculation over such huge scales.

You can also substitute in (e^2 Ao / As $\pi\ \varepsilon_o\ \hbar\ c$) for the fsc a if you like. That is nice because then our expression for the electron contains all the basic physical constants in a very simple and elegant relationship, if we allow that e and ε_o alternate through the vehicle of the fsc.

* $m_e^4 = \hbar^3 m_p \text{ Ao}^2 / G\ \varepsilon_o\ c\ \pi \text{ As}^2 \%^5$.
* $(m_e / m_p) = (\hbar^3 / m_e^3)(\text{Ao}^2 / \text{As}^2)(G\ \varepsilon_o\ c\ \pi\ \%^5)^{-1}$.

Here the right side comes to around 6934×10^{-124} kg^4. The discrepancy comes from rounding of numbers and the extreme scale differences. Interestingly, if we multiply the core physical constant cluster ($\hbar^3 m_p / G\ \varepsilon_o\ c$) by ($\text{Ao}^2 / \text{As}^2$) = 16^{-1}, we get 6889 as our ratio, matching 83^2. But the spatial dimension and order of magnitude are off.

The whole expression can be viewed as a fractal expanded version of the mass ratio

* $(m_e / m_p = 1 / 1836)$.

Using more exact values for m_e and the other constants still leaves a little discrepancy. But it's amazingly close, and the fundamental physical constants are all in there about as neatly as they can be packed (ε_o, c, and e^2 alternating via the fsc). My theory for the discrepancy at this point is that, given the various basic constants, there is a set of possible ways of deriving a particle like the proton or electron. The value that we observe should be the average of all those derivations taken together. To test this idea we have to figure out all the possible derivations and average them. I've done a few, and the idea seems in the right direction. But I haven't figured them all at this point. See the examples in chapter 8, page 22 showing how the CODATA suggested values for Planck's constant are averaged from a variety of different measurement experiments.

The mass components of G and ε_o cancel out, so our electron system (4 interacting electrons, not just two) comes from 3 $\hbar$'s and an m_p involved with light speed in a geometry relationship of a 4 (+1?) space. This is a viewpoint for viewing the electron. There are others.

To summarize some of the things we found in this little exercise:

** The proton-electron mass ratio is relevant to determining the electron mass. It fits our theory that the particles have fractal-type relationships that echo at various scales. Also, it shows that the relative masses of these particles are not random coincidence.

** We found the scale for the electron is based on the relationship $(\hbar^2 / e^2)$ and $(\hbar^4 / e^2)$ (m_p / G) or $(\hbar^3\ m_p / G\ \varepsilon_o\ c)$. This also indicates that **the electron is a manifestation of all the basic physical constants interacting at once.**

** We have some indication of how charge is structured in the particle. Although this needs further exploration, we can see that m_p's charge is determined by e, as in (e / c), and m_e's charge is determined by (m_p / e^2) which comes to (c / e). This gives some idea of why the charges are opposite, the proton having a net positive charge, and electron having a net negative charge, but with the SAME UNIT VALUE despite the great difference in their masses!!! Also, the neutrino's structure contains no e charge component, which agrees with the lack of charge observed. Charge is expressed through e, which is a "pseudo-force" of a unit of mass per second (per **Mech a**). We'll get a better handle on charge later. The key point is that charge is not really different from gravity, it just seems that way because it is operating through a different "window" of scale in the fractal cascade of space/time. They are the same thing at different scales. And we have shown there is a viewpoint where the two scales converge. Charge indicates a shifting of mass in time, so it can translate into motion through space under the proper conditions. A 0-orbital electron sitting snug with a proton cancels the proton's charge into a neutral neutron.

** We also got some suggestion in our expression of how the electrons tend to form in pairs even though they repel through having the same charge, a phenomenon noticed in the electron shell structure of atoms. The subject of quantum "spin" for the electron we have to explore more deeply later on. Right now we are focusing on mass.

** We found that the fine-structure constant a is involved in defining the electron mass. This should probably not be a surprise.

** Earlier we saw how we can "read" information about the electron from the Rydberg number. Here we see also how we can move into the electron's structure via the observable Compton effect, which is like a handy magnifying glass.

** We exercised the principle of describing the elementary particles in the simplest manner possible using the universal constants of physics and constants of geometry.

What about the other leptons?

The muon m_m is larger than the electron by a factor of about 206.767 -- close to the factor 210 we found with ($\hbar^2$ / e^2). The ratios 2.1 and 8.2 or 8.3 are keys to the leptons.

* $\mathbf{(m_{ne} / m_p)^2 (m_m / m_e) \approx (\hbar / e)^2 (\pi^4 \text{ Ss} / \text{Oo Ao}^3)}$.

The tau (m_t) is about 17 muon masses or 3500 electron masses. The ratio of 3500 to 210 is 16.7 or 50/3 -- the ratio of the proton appears again, echoed among the leptons:

* $\mathbf{(m_t / m_e) = (\pi^6 \%^8 \text{ Ss}^2 / \text{As}^2 \text{ Ao}^5)}$.

Furthermore, we can go back to our idealized electron neutrino, which carries the ratio (10 / 9). Since the $\hbar^2$ component of the electron also has the ratio of (10/9) we see that these two particles are scaled images of each other. The electron, however, has mixed in the e charge. The e charge ratio squared is slightly more than a quarter of a magnitude: 2.5664.

* (2.5664)(3.8965) = 10
* 3(3.8965) = 11.6895.

The ratio 3 is the signature of light speed, a component of both m_e and m_{ne}.
Compare the above with the following, where a = fine-structure constant:

* $(1.054)(11.1111) = (3)(1000) / (256) = 11.7 = (\pi \% \text{ Ss} / \text{Ao As})^3 = a^{-1/2}$

We recall that 1.054, or $(10 / 9)^{1/2}$, is the ratio of $\hbar$. Planck's constant. It resonates through the lepton family, and the proton's signature occurs in a miniature echo, as does the gravity ratio. (See my comments in Ch. 16 on Nottale's fractal space-time theory.)

We can suppose that the muon neutrino and the tau neutrino will turn out to resonate with the electron neutrino in a way analogous to the way the muon and tau resonate with the electron. If we get firmer observational knowledge of them, we'll be able to tell. As we go deeper into our study of the relation between leptons and baryons, we will discover some further secrets of the electron.

Now let's begin to consider the other baryons. We already discussed the idea that the neutron is a proton with its energy enhanced by extra mass and charge, sucking in an electron and an antineutrino's worth of energy. When a proton-neutron ensemble breaks apart, the neutron by itself doesn't have enough charge to hold the electron in a negative orbit, so the jiggling electron pops out, and with it some additional energy adjusted by an antineutrino vortex. (This is also due to Heisenberg uncertainty rules as we will see.)

How about the other members of the hadron house: lambdas, sigmas, xis, deltas, and omegas with various charges, masses, mean lifetimes, and decay modes, not to speak of various resonant quasi-particles. These have all been arranged in neat decuplets and octets, just as the mesons are arranged in nonets of kaons, pions, rhoes, etas, small omegas, and phis.

Standard theory interprets them all as made of quarks. That is fine and provides a nice way of classifying them. But we should realize that all the baryons are really various resonant states of the proton. In between the stable increments of whole proton masses there are harmonics where the energy momentarily "hovers" before decaying back to a stable proton wave form. Generally, the more massive the baryon is, the briefer its mean life is. The notable exception to that is what we call "atomic nuclei," which live stable lives at the quantum multiples of proton mass and can grow quite massive, though even they get unstable beyond a certain point. The neutron is also a notable exception, because it has an electron in its grip. So, compared to the other subatomic particles, it takes a lot longer -- relatively speaking at the tiny time scales involved -- for the electron to escape and cause the neutron to decay back to its normal proton status.

Generally, baryons have less than two proton masses, but just like water can be superheated before boiling, a few baryons with charmed or bottom quarks go over the two proton mark and then decay into two protons or a proton and an array of lighter particles. The highly energized baryons should generally cascade down through lighter baryons, possibly including a neutron, before decaying. For example, a positive sigma can decay into a positive pion plus a neutron, and the neutron will decay into a proton, electron and antineutrino. Or it can decay into a neutral pion and a proton. The pions decay into photons, muons, and neutrinos, while the muon also decays into an electron plus a muon neutrino and an electron antineutrino.

Generally mesons decay into mesons, leptons and photons, whereas baryons decay into protons plus mesons, leptons, and photons. This is a key observation for our model. Even though both baryons and mesons are made from quarks according to standard theory, mesons decay only into other mesons, leptons, and photons. This tells us that even though some of the energetic mesons get up as high as almost six proton masses, and possibly even higher with more powerful equipment to study them, they are really still just very energized leptons or bosons, not energized protons. On the other hand, energized protons, starting even with the neutron, can contain lepton vortexes.

The meson-lepton system has a different harmonic resonating sequence with a lower fundamental than the proton. In quark theory this is explained by the notion that mesons have only two quarks: a quark and an anti-quark. The two quarks whirl about, create a tiny bubble for a moment, and then annihilate. Some bosons have figured out how to do this dance and stick around -- for example, the B_u bosons (Unions) and the B_f bosons (photons). Photons are stable because they "decay" into themselves. Mesons are fat photons that decay back down to photons. This tells us that quarks are really just made from photons.

According to standard theory, a baryon is made from 3 normal (non-anti) quarks or three anti-quarks. Given the close **confinement** of the quarks and the strong force needed to hold them confined against the force of the same charge, I do not see how it is possible to divide up a baryon's mass into three so that the quarks are additive. The situation is far too dynamic and interactive for that. The energy fluxes inside a baryon must be amazing. The only purpose quarks serve (in my view) is to help manage accounting from the outside. Nobody has seen a naked unconfined quark, and I doubt if they ever will. They are just accounting tokens for keeping track of quantum numbers such as charge, spin, truth, beauty, charm, and strangeness. They represent a certain amount of energy that is held in a dynamic relation. Only in the case of the proton/neutron ensemble is this dynamic relation stable, given the low energy density of our current universe.

A fundamental principle is that if sets of items are interacting, we use multiplication. If they are not interacting, but just coexisting, then we can use addition. For example, if I have 2 fruits and 3 vegetables and I want various dinners with one out of each set (order of the courses making no difference), I can have 6 possible dinners: f_1-v_1, f_1-v_2, f_1-v_3, f_2-v_1, f_2-v_2, f_2-v_3. If I just want to know how many items there are, I add them and get 2 + 3 = 5. Quarks are definitely found only in interacting mode. So we always **multiply** them to study their interactions. Thus the notion that the three quarks making up the proton are all about the same size -- about ⅓ of a proton mass with the down quark being slightly heavier -- makes no sense to me. It is billiard ball thinking.

I believe that the mesons should be classed as fermions that behave with boson tendencies, because they are quark pairs and thus have net integer spin. Similarly the W and Z intermediate vector bosons are bosons with fermion tendencies because of the high energy they pack. They "look" like particles, but they are more like B_u and B_f than m_p or m_e. Usually W's are involved with lepton decay in the weak interactions and Z's with pair production or annihilation. But they can also mediate quark mixing in baryon decay. For example, a negative lambda can decay via a W boson into a proton and a negative pion. Sometimes even a tau lepton can generate some hadrons in its decay process. It is definitely "fat" enough to do so.

The lepton resonance (≈ 9.1111) is governed primarily by $\hbar^2 \rightarrow (10/9)$, and secondarily by $c \rightarrow 3$ and $e \rightarrow (1.602 \approx 8/5)$. The proton resonance (5/3) is governed by $G \rightarrow (20/3)$, $e \rightarrow (\approx 8/5)$, and $c \rightarrow 3$. As the ratios go up and down their respective scales, there are points where proton resonance peeks into the lepton scale, and points where the lepton scale peeks into the proton scale. The lepton scale is lower and weaker. Although the neutrinos and electrons are stable, the higher resonances are all unstable. The proton scale is very stable until you get to very heavy masses at the high end of the periodic table, although the proton itself seems to remain stable even as the heavier nuclei decay. At higher masses the very stable proton ladder hits more and more lepton decay tendencies and the nucleons become unstable, though on a much slower time scale than the "in between" proton energies and all the higher lepton resonances. Any charged lepton above an electron is unstable and decays back to the electron. The tau can give off a tau neutrino and then a jet of pions that then further decay as described briefly above.

Below is a short list of five ratios related to universal constants followed by their first few powers.

3	9.11111	1.602****	1.05409255338	1.66666666
9	83.0123456789****	2.566404	1.111111111***	2.7777777*,***
27***,#	756.334705074	4.111379208	1.17121394817	4.6296296296
81	6891.04953511	6.58642949121	1.234567890**	7.71604938263
243	62785.1179865	10.5514600449**	1.30134883127	12.8600823043
729^	572042.186099	16.9034389919****	1.37174211239^	21.433470507
2187	5211939.91779	27.079309265*,#	1.44594314582	35.7224508448
6561	47486563.6954	43.3810534425	1.52415790261	59.5374180744
19683	432655358.113	69.4964476148	1.60660349531***	99.2290301236
59049	3941971040.58	111.333309078****	1.69351878064***	165.381716872#
177147***,****	35915736147.5	178.355961142*,****	1.78511499475*,**	275.636194785

The numbers here are not exact to the observed values in nature. But the patterns are easier to follow this way. You can see that they all have windows where they match more or less closely. I marked some particularly interesting ones. The 9.11 and 1.66 both do not match very much. (By the way, just for fun, turn these two numbers upside down and look at them!! That is a coincidence of calligraphy.)

* 9.11111111111....
* 1.66666666666....

The *e* force matches most often. The $\hbar$ column even produces a scaled value of the fine-structure constant reciprocal (13.7) at the point marked ^. Light speed (3) also gets close to the fsc at 729. Of course with combinations of these, the values get even more complex.

Adding the proton mass ratios we get:

05/3 = 01.6666666
10/3 = 03.3333333
15/3 = 05.0000000
20/3 = 06.6666666 = G ratio
25/3 = 08.3333333
30/3 = 10 = ($\%^2$ / R^2).
35/3 = 11.666666 (close to 1.11111)
40/3 = 13.333333 (close to 4th and 5th items in 1.1111's list.)
45/3 = 15.000000
50/3 = 16.666666
55/3 = 18.333333
60/3 = 20.000000
....

See how the pattern repeats itself gradually incrementing the high digits.

When we increment the proton mass, we are building **nucleons**. Notice that the first item is hydrogen and the fourth item corresponds to helium. The helium proton wave is very close to the ratio of *G*, since (m_p / *G*) has a ratio of 1/4, ignoring scale and units. This suggests that helium is the ideal end product for fusion. This certainly seems to be the zone in which fusion scientists are working. The ratio 60/3 = 20.00000 corresponds to carbon, the atom that forms more compounds than any other atom besides hydrogen, the "ground state" of all atoms. The first resonance below that, 10.00000, corresponds to lithium, the lightest and most reactive metal. LiH and NaH are both interesting candidates as vehicles for delivering safe portable hydrogen fuel. But the building of atomic nuclei is a complex subject that needs separate treatment beyond the scope of these papers. Atomic nuclei include "neutrons" and other factors that skew the atomic weights away from simple proton multiples.

Let's increment an electron's ratio in idealized form.

09.111111111
18.22222222 (Close to 1/100 of the m_p / m_e ratio.)
27.33333333 (27 comes up a lot)
36.44444444
45.55555555
54.66666666
63.77777777
72.88888888
81.99999999 = 82 (This is our magic number 82)
91.11111111 (We start repeating the cycle.)
100.2222222
109.3333333
118.4444444 (etc.)

This series alternates directions and counts in numerical order. It is a dimensional shifting operator, along with (10/9) or 1.11111, which is a close cousin.

Now let's take a look at the electron's fundamental ratio, ($\hbar$ / *e*). I'll just use the first three significant digits so you can see the basic pattern. We get: .658, .432, .285, .187, .123, .0811, .0153, .0351, .0231, .0152, .01000, .00658, .00433 , .00285, .00187, ...

We see that on the tenth iteration (11th number) we get very close to .01. From there the cycle repeats itself with just a tiny phase shift. You can imagine that after a lot of cycles the phase shift itself will recycle. Notice also the value .123. This echoes the idealized ratio value of ($\hbar^4$): 1.234567.... It has shifted up to $(\hbar/e)^5$, moved up by one power. So ($\hbar$) and ($\hbar/e$) come together periodically.

Finally, let's look at one of the most commonly occurring combinations of fundamental constants in all of modern physics, ($\hbar$ c). These two constants form a wonderful pair since $\hbar$ represents the boundary of the smallest energy unit, and c is the limit of kinetic energy on a large scale. Although c is a velocity, it takes energy to accelerate something from rest to a given velocity. According to relativity it takes infinite energy to shift something with rest mass from 0 velocity to c. So these two units, $\hbar$ and c, are like the poles of the universe defining the range of the cosmos from small scale to large scale.

What happens when we multiply them? We get a value that is familiar to us by now from these discussions.

* $\hbar\, c = 3.16227766\times10^{-26}$ kg m^3 s^{-2}.

Taking the combination to increasing powers we see how it scales.

3.16227766
10
31.6227766
100
316.227766
1000
etc.

Although I perhaps have idealized the numbers, this is the pattern -- a simple oscillation at shifting scales. This is the D-shift operator, %. So $\hbar$ c is nothing but the D-shift operator at the very small scale of 10^{-26} and with units J·m. Thus $\hbar$ c is actually the D-shift operator in disguise. I have looked at many physics books, but have never seen any mention of this curious oscillation. It is the mathematical basis for the range of creation from smaller than the smallest to bigger than the biggest. Reducing this combo to natural units $1\times1 = 1$ wipes this fractal beauty out of the equations.

Unfortunately many physicists have blinded themselves to even being able to encounter this dynamic D-shifter by this "natural units" convention they have adopted. I wonder sometimes if the convention was set up deliberately to hide the special properties of $\hbar c$!!?? These two constants occur extremely frequently in both quantum mechanics and quantum relativity, often together. The use of natural units simplifies equations by eliminating the occurrences of $\hbar$ and c.

By choosing natural units modern physicists may have simplified equations, but they have washed out the D-shift operator. It is like they are living in Flatland. They see the world with only one eye and have lost depth perspective.

In "natural units" $\hbar\, c = 1$.

In traditional units substituting *pi*, the D-shift, and the area of a unit circle so we can view the energy ratio from geometry, we get a visual picture of the limits of the cosmos.

* $\hbar c = 3.1622776 \times 10^{-26}$ J·m = (%) [(Ao / π %^{2})^{26} J].
* $\hbar c$ = (Ao / π)^{26} (%$^{-51}$) J.
* $(\hbar c)^2 = 10^{-51}$ J^2·m^2.

The physical world in all its richness is built by concatenating energy into many dimensions, folding it and refolding it. And ($\hbar c$) is a tool for achieving this. Using natural units is convenient in certain situations, but collapses that whole energy scaffolding so the building can't stand up and be seen. The equations just sit there on the paper.

The Heisenberg relation allows one conjugate variable to dip down below the $\hbar$ limit as long as the other one stays properly outside that limit. This is indeed so, at least theoretically, and is exemplified on a macroscopic scale by Hawking radiation in the case of BH's.

* $\Delta(m_x v_x)\ \Delta(x) \geq \hbar,$

where m_x is some mass, v_x is a velocity, and x is a distance. The Δ means a range of variation. Or you can slice it other ways.

* $\Delta(N e)\ \Delta(x^2) \geq \hbar.$

N is a dimensionless factor, e is unit charge, x is a distance. Here our variables are the charge factor and area.

* $\Delta(NkT)\ \Delta(t) \geq \hbar.$

Here N is a dimensionless factor, k is Boltzmann's constant, T is a temperature, and t is time. Time and temperature are the variables. We'll come back to this one when we go into thermodynamics and time.

* $\Delta(E)\ \Delta(t) \geq \hbar.$

Here E is energy, and t is time.

* $\Delta(p)\ \Delta(q) \geq \hbar.$

The Δp and Δq are any two variable items with dimensions kg$^{1/2}$ m s$^{-1/2}$ or combined dimensions of J·m.

Let's go back for a moment to our hypothetical idealized model of the neutrino.

* $m_{ne} = \hbar / c$ %.

We can rearrange it as follows:

* $m_{ne}\, c\, \% = \hbar$.

This is a Heisenberg relation. We know that ($m_{ne}\, c$) (%) will be greater than or equal to $\hbar$ even though we do not know exactly what the neutrino mass is and only hypothesized the wavelength-radius. Only $\hbar$ and c are limiting values here if we let m_{ne} and x vary, x standing for %. There $\hbar$ is a lower limit, and c is an upper limit, although zero velocities don't really make sense either. They cause the equation to explode. Furthermore, there is no zero velocity in the physical world. Everything moves and changes. So apparently we can vary the distance and the mass as much as we like. But mass is also energy. It can not be infinite, or the universe would collapse. Nor can it be zero, because of vacuum state fluctuations. So there must be a minimum value for mass: the energy of the vacuum. There must be a maximum value for mass: one that would prohibit Big Bangs. We can calculate the vacuum state and measure it observationally. But that is only an average. Within that average the energy can vary, dipping way down, way down below the $\hbar$ threshold, perhaps as low as you like, but not to zero. The range of such energy perhaps will cause the distance variable to fluctuate over huge spaces as a superluminal phase wave. Use of this vacuum state energy, for example, with Casimir plates gives the possibility of manipulating "zero-point" energy. It may be possible to actually manufacture on the fly neutrino-antineutrino pairs or even electron-positron pairs with properly designed zero-point devices.

Attention Particles

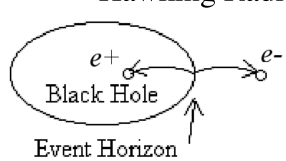
It is also possible to go down into that level with attention particles. Part of the mission of Observer Physics is to define precisely what an attention particle is. Attention involves energy, so there must be attention particles. Palmer has mentioned their existence (**ReSurfacing**, p. 43), but gives no details as to mass or velocity. Attention particles are thoughts, and in their simplest state (in my opinion) correspond to photons -- perhaps anti-photons. However, there is a quantum limit to how "tiny" you can get in terms of attention (thoughts). We know that wherever there is a stable bubble of mass possible, there must be a corresponding Compton radius that goes with it, given that we're establishing the radius with photons, the lightest "particles". Thus mass and distance are like correlated "particles." But now we "see" the limit. How can you set a Compton radius for a photon with a photon? The photon is stretched out, and not curled up, so it has no rest mass (only momentum) and therefore cannot bend space-time and deflect. So a photon will not interact with another photon except its antiphoton unless it has a wavelength that wraps around and then can entangle with another similarly wrapped photon. Photons can generally flow right through each other (or pass right next to each other). A space full of only photons as such and no other complex particle ensembles is Euclidean, and $\hbar$ doesn't even work there, -- much less general relativity. There is a threshold energy (frequency) level below which photons move straight, and above which they curl in on themselves. This is leading us into our deeper consideration of the bosons.

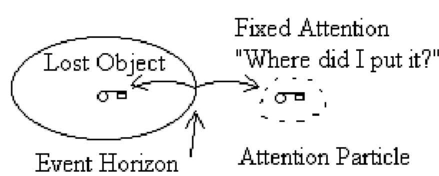
It is also possible to divide attention and thereby generate "entangled" attention particles (complicated thoughts), one of which could be inside an event horizon, and the other outside it. They would be correlated, but apparently out of contact with each other. That lack of contact is a vestige of one viewpoint that has been obscured by another viewpoint, -- a belief covered by another belief, like a piece of paper you carelessly placed over your keys on the table yesterday while you look frantically for them today. I'm sure you can think of times when you bumped into something you had set up but then totally forgot about, or you seemed to lose something. This is a case where you create a pair of correlated attention particles, then put one attention particle of the pair into a BH of awareness and then go off following the other correlated attention particle. No matter how far away you get, you are still correlated in consciousness to the forgotten or lost item. Sooner or later it will show up when you pop the quantum bubble -- i.e. shift viewpoint.

For an example from physics, when approaching an event horizon from outside, the physicist's equations seem to explode like Zeno's paradox of motion. So the physicist has to renormalize at the event horizon to continue following the evolution of a particle. This "renormalization" corresponds to what we call in ordinary speech "a shift of viewpoint." Using a Feynman diagram, you can view the event as starting at the bifurcation point on the event horizon and spreading simultaneously out away from it and into it toward the singularity. The event propagates from the horizon in two spatial directions but also oppositely in time. Then there's no viewpoint shift needed to incorporate both segments of the trajectory. So the physicist has a challenge choosing his viewpoints.

This sort of viewpoint shifting is also how the calculus works. Ordinary people shift viewpoints all the time. It is just good protocol to let yourself and your readers know when you do it. If not, you sometimes get into funny self-contradictory situations later on. Ah well, we often make hidden assumptions.

Hawking Radiation





Memory Automaton