Chapter 13. Snow White and the Seven Quantum Dwarfs

The starting point for this section is to review the theoretical model we are creating for the fundamental building blocks of nature in order to build our theory of how the universe is constructed. We will also consider how we define the basic units for measuring space, time, and mass. If physics is to be truly a universal science, then we must be able to measure accurately under the broadest possible range of conditions.

Our first principle is that all the building blocks of nature arise out of the basic universal constants of physics and their relation to the constants of Euclidean geometry. We use Euclidean geometry as our basis because the evidence shows that this viewpoint holds in the vacuum state to an extremely high degree of accuracy. The space/time curvature of the vacuum is essentially nil. The vacuum of free space is a state of equilibrium. There may be local quantum fluctuations in the vacuum, but the statistics of the phase space cancel them all out except in the situations when matter arises. Then the space/time takes on curvature properties depending on the density of the mass. This must be the bedrock of our theory.

Physical measurements of various phenomena bring to light certain universal invariances. The five fundamental constants appear to be the direct interaction of mass, space, and time (M, L, T) with the Euclidean geometry of the vacuum state. All other physical constants are compounds of the fundamental constants.

Universal Physical Constants
Let's review our invariant quantities.

The fundamental physical constants are c, $\hbar$, e, ε_o, and G. Many others are derived directly or indirectly from these five.

First let's give each one a definition, and then we will discuss them in detail and see how they generate the fundamental constituents of the physical universe.

* $c = 3\times10^8$ **m / s**.

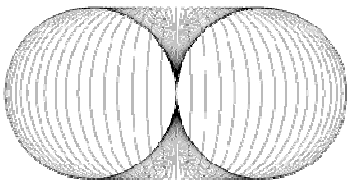
The velocity of light (and all EM radiation) is the quantum invariant relationship between space and time and the speed limit for mass. The speed of light was measured roughly by Fizeau (1851), Foucault (1862) and more accurately by Michelson and Morley (1880, 1885, 1886). The velocity of light has a finite value and appears to be the same regardless of the relative motion between bodies. The velocity remains constant, but adjusts the apparent frequency and/or wavelength to compensate for relative motions of objects. However, the units are a strict ratio of displacement in space per unit of time. Thus, in free space (in an equilibrium environment with no outside influences) the displacement or translation of photons occurs in a straight Euclidean line. If other influences are present, light takes the shortest path from emission to absorption. Recently the distance light travels in one second has been adopted (17th CGPM in 1983)

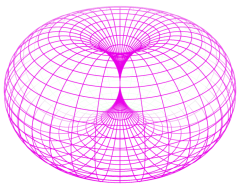
as the definition of the meter. This is an excellent idea, except that it is sad that they defined the velocity of light as 2.99792458×10^{8} m / s instead of just simply 3×10^{8} m / s. However, see my comments on quantum charge. Also, I probably would have opted to use light speed as the measure of time rather than space.

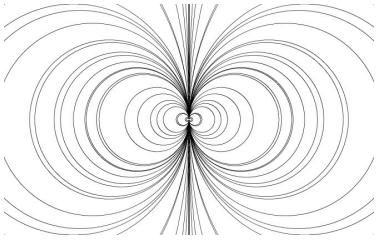
* **$\hbar = 1.054\times10^{-34}$ J·s.**

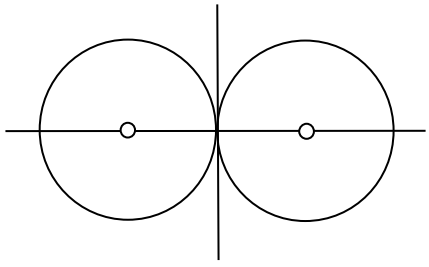
"H-bar" is the reduced Planck constant, the quantum invariant relationship between energy (J = joules) and time (s = seconds) that was discovered by Max Planck (1900) in his experiments with and analysis of black body radiation. Based on Planck's original unreduced form of the constant ($h = 2\pi\hbar$) we can also understand the relationship as a statement of the **conservation of angular momentum**. Energy and time are not directly observable. We can express the constant h more clearly in mechanical terms as a linear momentum ($p = mv$) times a circumference ($2\pi r$), both of which are observable. The reduced constant therefore expresses the product of the linear momentum times the radius that controls the resultant circular trajectory.

Angular momentum L is usually considered a vector quantity representing the product of the rotational inertia times the rotational velocity about an axis of rotation, all of which is very confusing terminology. However, it suggests that Planck's constant is a resultant "vector" that is a perpendicular axis to the radial vector and the momentum vector. We can interpret the motion indicated by that third vector as magnetic flux. However, Planck's constant clearly **defines** the three-dimensional space in which we find ourselves. This universal conservation principle thus preserves the perpetual integrity of 3D Euclidean space as the playground of physics. It also recalls the three "twists" by which the physical universe comes into being -- separation as resistance to unity, rotation as a resistance to the ineffectiveness of separation, and the axial polarity that generates complementarity (charge, matter and antimatter, magnetic flux, precession). We end up with a "horn torus" doughnut.









Interlaced Horn Tori

(http://www.horntorus.com/illustration/standard_dynamic_horn-torus.html#doodle)

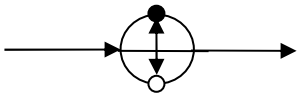
Another common formula for angular momentum is $L = I\ \omega$, where I is the inertial momentum $m\ r^2$ and ω is the rotational velocity, another perplexing analysis. We can also express it as $\boldsymbol{L} = \boldsymbol{p} \times \boldsymbol{r}$, where $\boldsymbol{p}$ is the momentum, $\boldsymbol{r}$ is the radial distance from the axis, and $\times$ is the cross product. This begins to look more reasonable. Planck found his constant when he was trying to figure out why the Rayleigh-Jeans formula for black body radiation failed as the energy increased. The classical approach was that the energy "obviously" could be in a continuum at any wavelength. Planck found that he needed a constant with the units of J·s or kg m^2/s in order to adjust the formula so that it fit the data over the full range of energies. The constant quantized the energies into discrete values. Soon physicists found Planck's constant involved in all sorts of microworld situations where it turned out quantization made sense.

The mechanical interpretation of Planck's constant is simply that we have a mass that is translating at some velocity (in a straight line). Then something intervenes to guide the translating mass from a straight line trajectory into a circular trajectory. This is the simplest form of a wave guide. It takes a straight line and bends it into a circle. It happens that the wave guide influence is applied at 90 degrees, and therefore is effortless, having no effect on the linear momentum other than to change its direction (as long as there is no friction that introduces drag). Blocking the momentum straight on or at some angle less than 90 degrees would result in resistance to the momentum and would change the speed of motion. Pulling back would also do so. The orthogonal relationship is the perfect wave guide principle that allows the momentum (theoretically) to continue unchanged, leading to the conservation of angular momentum, a great "secret" of the martial arts. Butting at a problem head on exposes you to the greatest possible damage. Resisting a problem only makes it persist. (Many of our military and political people seem unable to grasp this principle.) You must transcend the trajectory of the problem and deal with it from a higher dimension. Each new dimension is orthogonal to previous dimensions. Rotational is orthogonal to linear, and precessional is orthogonal to rotational. From the orthogonal viewpoint the whole range of a trajectory is visible, not just the oncoming problem. Also, at the shortest distance and with the least effort the problem can be deflected in a desired direction with no danger at all to the centrally located manager. This means also that if the radial distance of the circular trajectory path is shortened or lengthened, the rotational speed increases or decreases, because the mass is still traveling at the same speed, but in a shorter or longer circuit. Ice skaters use this principle to effortlessly modify their spinning speed by adjusting the extension of their arms. The third dimension in this system is the axis of rotation, but it is also a radius (or diameter) for the secondary rotation that we call precession and that generates the "magnetic" effect as well as some of the interesting dynamics of gyroscopes. (See the graphic showing interlaced horn tori. The limit of the tangent point of the two kissing circles is the vertical axis of rotation.)

Now suppose we have a photon moving at velocity c. Its momentum is then mc. We can assign it a radius of rotation, which then also becomes a wavelength in terms of its circumference. This gives us the relation $h = mc\ 2\pi r$ or $h = mc\ \lambda$. Or we can reduce it to $\hbar = mc\ r$, where r is the radius of the circular path. We have taken light, moving at

speed c, and wrapped it into a ring with a radius of r. Given that the angular momentum is constant, at certain values of r, c being also constant, then we may find various values of m. To find out what they might be, we have to look at other constant relations.

One of the common occurrences in the mathematics of quantum mechanics is the expression $\hbar c$. If we put that into our relationship between mass and radius, we get $\hbar c = mc^2 r$. This converts the momentum into the energy associated with a given mass: $E = mc^2$. Or we get $hc = 2mc^2 \pi r$. The $2mc^2$ is the minimum energy to create a particle pair, one above, and one below the zero point. The πr is half a cycle. This is the maximum push that separates each particle in the pair from the zero point. Thus each travels half of a loop and then they pop back into equilibrium. Oddly the equilibrium is present at each step of the virtual process.



It is all quite simple. However, we still do not know the mass of the particles in the pair, and, given the variable relation of m to r (h and c being constant, but not necessarily r), the mass theoretically could have any value -- but in the real world there are discrete watering holes for mass. If we multiply the speed of light times our unit of time, the second, we get a standard unit of distance, which, as we mentioned above, is approximately (and should be exactly if we did our metrology properly) 3×10^8 m. Reduced Planck's constant is approximately 1.054×10^{-34} kg m^2/s. We notice that the product of Planck's reduced constant and light speed is the Dimensional Shift operator times 10^{-26} joules.

* $\hbar c = (3\times10^8 \text{ m/s})\ (1.054\times10^{-34} \text{ kg m}^2\text{/s}) = 10^{1/2} \text{ m} \times10^{-26} \text{ kg m}^2\text{/s}^2 = (\%)\ (10^{-26} \text{ J})$.

* $\mathbf{e = 1.602\times10^{19} \text{ kg / s}}$.

The quantum invariant ratio between mass and time generated by electric charge is symbolized by e. The famous experiment to determine the quantum of electric charge was performed by Robert Millikan in 1909, and is known as the oil drop experiment. This was a very profound experiment and showed much more than just the quantum unit of charge. Millikan (with his assistant Harvey Fletcher) arranged two flat metal plates parallel to each other and set up an adjustable static charge between them. The upper plate had a little hole in it. Millikan then sprayed some oil droplets with an atomizer over the hole and used a telescope to watch the droplets that fell through the hole. The oil droplets were charged by friction as they went through the atomizer. As the droplets fell through the hole, Millikan then adjusted the electric potential between the plates until he was able to get a charged droplet to hover in midair between the plates. He had generated true levitation!! The gravitational force that "pulled" the droplet down was exactly balanced by the opposing charges between oil droplet and plate. The detailed calculations Millikan had to do were fairly complicated, because he had to figure the

density of the oil, the sizes and speeds of the droplets, and the influence of air molecules. But the basic equations are simple.

* $F = q\ \mathrm{E} = m_d\ g$.
* $\mathrm{E} = k\ Q\ /\ r^2$.

Here F is the net force involved, q is the charge on the droplet, E is the electric field, m_d is the mass of the droplet, and g is the gravitational force generated by the earth's mass. Millikan calculated the density of the oil and the radius of each inspected droplet, and derived the mass of the droplet. The tricky part was measuring the radius of the droplets. He had to get that by turning off the electric field and watching the drops fall. He then calculated the radius from the terminal velocity of the drop in the viscous air. By many careful measurements he arrived at the discovery that charge was quantized in units of 1.602×10^{-19} C. (His original measurements were slightly off, but later corrected.) Remarkably he was able to measure charges of a single extra electron on an oil droplet, a single quantum of charge!! (Actually he could NOT do that, because of interference by Brownian movement and other problems that occur when the droplets are very small, so he calculated many drops with a small number of multiple integer charges and extrapolated that there had to be drops with a single charge.)

From our exploration of the Planck-Mass B_u particles, we realize that Millikan actually demonstrated a macroscopic laboratory model of the B_u ensemble and observed it with his telescope. The oil droplet with a single charge had just the right mass so that it balanced between the gravitational force and the electrostatic force. This is an actual laboratory model of one of the B_u particle pair's key operational principles. The modern MagLev trains work on the same principle -- a balancing of a mass between the electrical and gravitational forces.

A single real microscopic B_u particle is unstable and decays. So it needs a partner to work with it and sustain it. In the Millikan experiment the droplet is oil that is much less dense than a B_u particle. Also the partner is not another droplet, but the charged plate that pushes the droplet upward against the pull of gravity. The oil droplet is obviously not a mini black hole (although the atoms making it up are). The oil droplet happens to be at just the right mass, about that of a baby flea, so that it demonstrates the Union effect where the two forces converge. In the case of a proton, the B_u particles are invisible even to the telescope or a microscope, because they have extremely high density, and thus much smaller size. So the mass equal to the oil droplet in a proton is compressed down to a radius as small as 1.616199×10^{-35} m, the Planck length. The radius of the whole B_u ensemble, of course, is much larger and comes out to the size of a proton.

Let's generate an expression for the charge quantum based on the Planck mass and Coulomb's equation.

* $(\hbar\ c\ a)\ (4\ \pi\ \varepsilon_o) = e^2 = 2.5664\times10^{-38}\ \mathrm{kg}^2\ /\ \mathrm{s}^2$.
* $e = 1.602\times10^{-19}\ \mathrm{kg/s}$.

A Planck energy-meter ($\hbar\ c$) expressed as (J·m) and the coupling constant a interacts with the "Eon" constant ensemble $k_C^{-1} = (4\ \pi\ \varepsilon_o) = 1.111\times10^{-10}$ kg / m^3. There's that Planck squared ratio of (10 / 9) again! There is no mass to be measured unless coupling takes place. Coupling requires a pair of charged particles that are exchanging photons. When the resultant particle formed by the Planck Mass couplet interacts with another particle, the coupling constant is squared. In each component of the Planck Mass couplet we have $a^{1/2}$. The two of these interacting B_u's give us a. This is the original level of electric charge "coupling". All other coupling is an echo of the B_u pair coupling, so it goes up as a^2 at each succeeding coupling. The two B_u particles are constantly exchanging energy and balancing each other. They suck in energy as black holes and radiate it out with Hawking radiation, finding equilibrium at the B_u pair configuration. The most stable of these energy configurations is the proton.

The usual unit for charge is the coulomb (C). However this is not a mechanical unit, and the mechanical interpretation of the coulomb depends on the way we interpret electrical phenomena. The mechanical unit that I use here (kg/s) is derived from **Mech a** in the list of interpretations of EM units that I gave earlier. Based on this interpretation we find that the proton rest mass can be expressed as $\pi\ e\ b\ /\ c$ or as $e\ \%\ /\ c$, where b may represent a constant magnetic unit of 1 meter.

The Compton wavelength of the proton is $\lambda = h\ /\ m_p\ c = 1.321\times10^{-15}$ m. The reduced version is $r_p = \hbar\ /\ m_p\ c = 2.1\times10^{-16}$ m, and is used in quantum mechanics when calculating mass, whereas the non-reduced version is used when mass is converted to energy.

* $E = hf = \frac{hc}{\lambda} = mc^2$, where E is energy and f is frequency.

If we substitute our expression for the proton mass into the reduced Compton formula, we get Planck's reduced constant in terms of % and the Compton "radius" of the proton wavelength.

* $\hbar = e\ \%\ r_p$. [The expression ($\hbar = \pi\ e\ b\ r_p$) is a bit closer.]

So, it appears that the proton can be understood as a relationship between charge and space such that it preserves the Planck constant of angular momentum. There are two dimensions of space involved. One gives the inherent constant momentum ($e\ \%$) of the proton in terms of charge and the D-shift operator. The other gives the radius (r_p) of the proton's characteristic vibrational wavelength. The Planck axis gives us the third dimension. The coulomb unit should be fundamental, but for practical reasons it was derived from the ampere (A), which is kg/s^2 in terms of **Mech a**. Progress is being made on perfecting a device called the Watt Balance as a tool for measuring mass in terms of the mass of electrons. The technology is a fancy version of the same principle that Millikan used to do his oil drop experiment. With this technology in place we will have both length and mass based on universal constants. We still need to derive the second from universal constants. Currently it is defined as a certain number of

vibrations of a cesium atom, but that is an arbitrary definition, and cesium is not necessarily available everywhere. My suggestion is to derive the meter from the proton and define the second with light speed or possibly the electron charge-to-mass ratio (e/m_e). I am not sure at this time how to design a device for measuring the meter experimentally from the proton mass, charge and light speed, but it must be doable. The proper formula for the unit radius R is $R = m_p\, c / \pi\, e$. There must be a better way of measuring a kilogram than using a complex device such as a Watt Balance.

* $\varepsilon_o = 8.854\times10^{-12}$ **kg / m^3**.

The symbol ε_o represents the quantum invariant relationship between mass and free space. It is often called the electric permittivity and nowadays also called the "electric constant", so as to avoid summoning memories of the aether that supposedly was banished by Einstein. This constant represents the quantum of mass density inherent to the vacuum state and has different values within states of physical matter. Coulomb in 1785 found the relationship for the electrical force [$F_e = k_C\, q_1\, q_2 / r^2$] that parallels that of Newton for gravity's force: [$F_g = G\, m_1\, m_2 / r^2$]. His constant ($k_C$) came to 9×10^9 N·m^2 / C^2. For convenience this was later usually written as ($1 / 4\, \pi\, \varepsilon_o$) with ($\varepsilon_o$) given the value 8.854×10^{-12} C^2 / N·m^2. There are alternate ways of defining the constants here, depending on point of view, but this is the standard we follow in this work, except that we use **Mech a** to interpret the EM coulomb unit C mechanically as kg/s. The constant property of ε_o in free space verifies that there is an aether that affects the speed of light and its relation to electrical and magnetic phenomena.

The expression $(4\, \pi\, \varepsilon_o)^{-1}$ was chosen to represent the proportionality constant in the force equation of Coulomb's law. First a unit is chosen for charge based on current and time. A is ampere, s is second, and C is coulomb.

* 1 A · s = 1 C.

Based on this the electric permittivity of a vacuum is measured and then the constant is set so that the total value is $(4\, \pi\, \varepsilon_o)$. The value of ε_o becomes 8.854×10^{-12} kg / m^3. The reason for breaking it into the three components is convenience for working with Gauss's law for electrostatics. When finding the electric flux through a spherical surface around a point charge, the integral turns out to be the surface of the sphere ($4\, \pi\, r^2$). This nicely cancels out the $4\, \pi\, r^2$ in the denominator, leaving the simple expression, (Q_A / ε_o). Gauss's law says that "the flux of the electric field **E** out of a closed surface is proportional to the electric charge Q_A enclosed in the surface (independent of how that charge is distributed); the integral form is:

* $\oint_A \mathbf{E} \cdot \mathrm{d}\mathbf{A} = \frac{Q_A}{\varepsilon_0}$, where ε_o is the permittivity of free space." (**Wikipedia**, "Flux")

* Flux = $(1 / 4\, \pi\, \varepsilon_o)\, (Q_A / r^2)\, (4\, \pi\, r^2) = (Q_A / \varepsilon_o)$.

The charge density ρ_q depends on the volume.

* $q = (4/3)\,\pi\, r^3\, \rho_q$.

If we put it in terms of a sphere with unit radius, we have:

* $\rho_e = e$ / Ss = $(1.602\times10^{-19}$ kg/s) $((4/3)\,\pi$ m$^3) = 3.8249\times10^{-20}$ kg / m^3 s.

This is a fundamental definition of minimum charge density -- a quantum unit of charge per minimum unit radius (spherical) volume of space.

The unit radius area of a sphere As governs the flux term, and the unit radius volume Ss governs the density. Density is the amount of charge per volume. The pseudo-mass generated by electric charge is, in its simplest configuration, an energy density emanating from a point. The point is the center of the energy vortex, the point charge.

* Flux = e As / As $\boldsymbol{\varepsilon_o} = e$ / $\boldsymbol{\varepsilon_o}$.
* Flux = Ss ρ_e / $\boldsymbol{\varepsilon_o}$.

The flux is in volume per second, Ss is a volume, ρ_e is a quantum charge per volume, and ($\boldsymbol{\varepsilon_o}$) is a pseudo-mass per volume. I call a mass generated by electrical energy a pseudo-mass, because physicists do not like to think of EM forces as mechanical forces governed by inertial mass.

Maxwell discovered the relationship of electric permittivity and magnetic permeability with light speed in free space and realized how all electromagnetic phenomena are essentially forms of light at various frequencies.

* $c_o^2\, \varepsilon_o\, \mu_o = 1$.

* $\boldsymbol{G = 6.672\times10^{-11}\ m^3 / s^2\ kg.}$

The fifth physical constant is the quantum invariant relationship between gravitational mass and space/time. Copernicus (1543) re-established the heliocentric view that had been known to some of the ancients but was lost sight of during the dark ages. Kepler (1601-1619) extracted the principles of orbits from Brahe's recorded observations of the solar system, and Newton put Kepler's principles into concise mathematical form some time between 1669 and 1679. The first reasonably accurate value of the universal gravitational constant that Newton hypothesized was measured by experiment over a century later by Cavendish and Michell, 1798. Because it is a weak "force" and becomes significant only at very large scales, it is difficult to measure it with a great degree of precision. (For various reasons it may only be a "fictitious" force like centrifugal force.) Because of this the Watt Balance will not be a truly universal device for measuring mass. It has to be recalibrated for the local gravity constant with adjustments for local variations.

We usually see the gravitational constant employed in calculations of celestial bodies as they move about in outer space. However, gravity should operate at any scale, and it should be no surprise to find it showing up in the Planck mass:

* $m_P = (\hbar c a / G)^{1/2}$.

The Planck mass also contains the important combination of constants, $\hbar c$, as well as the fine structure constant.

Constants of Geometry

We also have several fundamental constants of Euclidean geometry.

* **π = 3.14159265359...**

This is the constant ratio of a circle to its diameter. It is a pure number ratio without units, and in this work we often use 3.14159 as an approximate value.

* **$R = (m_p c) / (\pi e) \approx (m_p c) / (\% e) \approx$ 1 meter.**

This is the unit radius. It is the length gauge for the unit system that is adopted. It may be a natural unit or arbitrary. Based on the relations of the physical constants, we set the value of R at approximately 1 meter. The ratio of the light-speed momentum of a proton ($m_p c$) to *pi* times the quantum unit of charge (πe) is extremely close to one meter -- within less than 4 mm, which discrepancy may be due to tiny inaccuracies in the measurements of the various constants. In my opinion this formula should give us the standard meter. In 2000 D. A. White discovered this composite constant that naturally links physics and geometry at the universal level. It is also possible to take R to be b, a 1-meter magnetic constant.

* **Oo = $2 \pi R$.**

This is the circumference of a unit circle expressed as 2π meters.

* **Ao = πR^2.**

This is the area of a circle with unit radius (R). It has the value of *pi* and the dimensions of a flat circular Euclidean area in square meters.

* **As = $4 \pi R^2$.**

This is the area of the surface of a sphere of unit radius. It has the value of 4 *pi* and the dimensions of a spherical surface area in square meters.

* **Ss = (4/3) πR^3**.

This is the volume of a sphere of unit radius *R*. It has the value of 1⅓ *pi* and encloses a spherical volume in terms of cubic meters.

* $\mathbf{\% = (10\ Ao / \pi)^{1/2} = 3.16227766\ R.}$

This is the D-Shift Operator expressed in meters.
The ratio ($\boldsymbol{\pi}\ \%^2$ / Ao) = 10) is the pure number, 10.

The D-Shift Operator Constant, used together with the value of ($R \approx 1$ meter) and the constants involved with circles and spheres, integrates geometry with physics. The constant cluster $\hbar\ c$ forms the value $(\%)[(\boldsymbol{\pi}\ \%^2 / \text{Ao})^{-26}$ J] when the spatial interval (%) is expressed in meters and energy is expressed in Joules. The values of 3 and 1.054, as well as 10, are thus key components of the D-Shift Operator.

If we take the current accepted values for the constants (m_p), (c), (e), and ($\boldsymbol{\pi}$), we get the following "precise" value for (R).

* $m_p = 1.672621777\times10^{-27}$ kg.
* $m_n = 1.674927351\times10^{-27}$ kg.
* $c = 2.99792458$ m / s.
* $e = 1.602176565$ C (kg / s).
* $\boldsymbol{\pi} = 3.14159265359....$
* $\boldsymbol{\pi}\ e\ R / c = 1.678956889\times10^{-27}$ kg
* $R = m_p\ c / \boldsymbol{\pi}\ e = 0.996226757$ meters.
* $\boldsymbol{\%}\ e / c = 1.69\times10^{-27}$ kg

The expression $m_p\ c / \boldsymbol{\pi}\ e$ is so close to 1 meter (less than 4 millimeters off) that I recommend a thorough study of the standard units used for expressing the constants. With a tiny adjustment the whole system can be unified so that all of physics can be expressed in terms of the constants of geometry. The value of the proton computed with % is also very close, but not quite as persuasive -- as if another small factor is missing.

All particles and physical phenomena are based on these fundamental relationships.

Planck's reduced constant (ħ, "h-bar") represents an "energy-second". Physics unfolds as mass-energy transforming in the theater of space/time. It is a four-dimensional manifold of three pseudo-spatial dimensions plus a dimension of time. (The spatial dimensions are "pseudo-" because they are arbitrary human impositions on the isotropy of free space. The true spatial dimensions derive from the three orthogonal relationships of the photon trajectory with its electric and magnetic components.) There may be other dimensions, but we can still have a stable and coherent universe with just these physical dimensions in the context of observer awareness. These dimensions represent the resistances of the observer and become a cataloging system for generating, storing, recalling, and processing data. Resistance is an expression of the will. It manifests through the medium of the attention. The smallest unit of attention is a packet of photon-awareness energy, the "Planckton". In our units it is 1.054×10^{-34} J. A

Planckton by itself does nothing and is invisible. It is just a potentiality. But once it is pushed by the will through the time dimension, it becomes a Planck-second (J·s), a constant unit of angular momentum interacting with time via the motion involved with the momentum generated by the will's push. Thus it finds expression as a quantum of energy in time and can be harnessed to do "work", to make physical transformations occur.

The velocity of light *c* is the rate at which photons move through an equilibrium vacuum. It is measured by experiment (and recently standardized into a constant unit) as 2.99792458×10^8 m / s. In our calculations we will usually round it off to 3×10^8 m / s, which is close enough most of the time for our demonstration purposes. The photon's velocity expressed entirely in terms of constants of geometry per unit of time comes to:

* $c = (\text{As } \%^2 / \text{Ss}) (\%^2 \pi / \text{Ao})^7 \text{ s}^{-1} = (3\times10 \text{ m}) (10^7) \text{ s}^{-1} = 3\times10^8 \text{ m / s}$

Thus we can describe the motion of light as it has been measured in terms of *R*, the geometry of the unit radius interacting with time.

* $c\,t = (\text{As } \%^2 / \text{Ss}) (\%^2 \pi / \text{Ao})^7.$

The factor ($\%^2 \pi$ / Ao) is a way of expressing the pure number 10 in terms of circles and rectangles. The factor (As $\%^2$ / Ss) simply means 30 meters. The second is derived from the relationships of Planck's constant to space, the speed of light, and the geometry of circles and spheres. **The velocity of light should probably be the constant that defines time.** EM phenomena are everywhere and follow the rule of *c*, which itself is timeless, but acts as a universal clock by its constant speed in exchanging energy.

We can use this as a conversion factor for the standard second. Time always implies the presence of mass-energy. If there is no mass-energy, there is only light and no time. There are a number of equivalent ways to derive it. This is one example.

One of the simplest derivations of a constant time interval is the ratio of the proton rest mass to the quantum unit of charge.

* $(m_p / e) = 1.04396844486\times10^{-8}$ s.
* $(m_p / e) = (\pi R / c) = 1.04792251097....\times10^{-8}$ s.
* $(m_e / e) = 5.6856298544\times10^{-12}$ s.
* $(\pi \%^2 / \text{Ao}) = 10.$
* $\% = (10 \text{ Ao} / \pi)^{1/2} = 3.16227766 R.$

I have repeated myself sometimes in describing these constants in various ways, but the importance of these two values *R* and % in our integration of geometry and physics can not be overemphasized. They form a critical bridge of invariance that connects the two aspects of our reality, the physical World and the mathematical Mind. The two values π = C/D and $\underline{\%} = [(3^2 + 1^2)^{1/2}]$ are fundamental ratios. (I underline % when it stands for a pure number value. The former is the universal ratio between the Circumference and

the Diameter of a circle. The latter is the universal ratio between the diagonal and the Width of a rectangle 3 units Long and 1 unit Wide. Both are pure numbers. The ratio $\underline{\%} / \pi = 1.00658424208$ . . . (approximate ratio of two irrational numbers).

With $\underline{\%}$ we are looking at the equivalent of *pi* for circles in the world of rectangles. This is a secret battle that constantly goes on in physics where curves and rotations are mapped onto Cartesian grids. When R comes out to be 0.996226757 meters as calculated with π and the constants m_p, e, and c **using our standard meter**, it appears that some factor is missing or else our meter stick is slightly off. We can adjust our result to match the current measured result by inserting the ratio $\underline{\%}/\pi$ and various roots of that ratio as additional factors.

* $R\ (\underline{\%}/\pi) / (4\surd)(8\surd)(32\surd)(64\surd)(512\surd)(8192\surd) = 1.00000003947$ m.

Each power of 2 in parentheses represents a root of $(\underline{\%}/\pi)$. This is ad hoc fudging the data, because I do not have a clear physical reason for those factors -- unless they have to do with an actual physical interaction between momentum and curvature such as Planck's constant represents, but in the realm of pure geometry. The sequence looks like a damping series. Perhaps an astute mathematician can find a kind of mental friction between % and π that has a measurable physical effect.

Tired Light?

Photons express themselves in space, but have no sense of time relative to themselves. We use photons as wonderfully precise clocks, but relative to a photon's viewpoint, the clock stops. Photons also have no sense of perspective. There is no scale for a photon. When you observe an object from the viewpoint of "capturing" a single photon, you can not tell how "far away" the object is or how big or small it is. You need some statistics gathered from two or more viewpoints to get such notions. Photons live in the eternally instantaneous "here and now."

Experiment: Go out on a clear night and look at a far away star with one eye covered. You see the photons from the star here and now, even though you may imagine they came across many light-years of distance and perhaps even took millions of years to get here. Yet each photon is fresh and alive and just as it was when it "left" its source eons ago. It doesn't get shaggy, crotchety, or wrinkled. You can not judge its distance, although with some equipment you could estimate distance from its "red shift", if your assumptions are correct. There is evidence that due to overall expansion of the universe light from "distant" sources on average seems to shift toward the red end of the spectrum. However, no matter how it has shifted, it still travels at c, and if you relax and pretend you ARE the photon, you realize that the photon just manifested "here and now", and that "here and now" is completely non-local, beyond space and time. How else could it have "come" from such a distant "source" and be so fresh and present in the moment? The real source of the photon is you, the observer. You created the star, and then imagined that you pushed it far away, and then looked at it from a distance, and -- what do you know -- there it is, far away. It even red-shifted for you.

Point Sources of Charge

The EM resistance that we call charge occurs ONLY in the case of the electron and its anti-partner, the positron. These are the vortexes that form the foci of dynamic mass-energy wave packet ensembles. Charge only occurs where the vortex of mass-energy swirls tightly around a point. The neutrinos and quarks are the waveforms that flow around the vortexes. The muon and tau are "fat" electrons -- electrons with extra padding of energy whirling directly around the vortex. The charge per lepton is still the same quantum unit. The extra energy peels off and the fat leptons quickly drop back down into their simplest state as electron (or positron) vortexes in a time frame of around 10^{-6} s for muons and 10^{-13} s for taus. All charges observed "in" mesons or baryons are due to electron or positron vortexes that happen to be localized within the ensemble particle's average quantum energy radius. Electron and positron vortexes follow quantum wave function rules of geometry describing their relative positions with respect to the ensembles they anchor as foci.

From our quark analysis we saw that:

* m_p+ = (u d+ u).
* d+ = u* m_e++ m_{ne} m_{ne} m_e- m_{ne}*.

As we saw, the charge per electric flux is a ratio of mass to volume of space (kg/m^3), which is the electric permittivity. It is the quantum of minimum mass density of free space. The factor Ss tells us from geometry that the minimum volume of space is spherical. Thus, when mass density interacts with vacuum space, it naturally tends toward forming a sphere.

Charge Coupling and Conic Sections

The EM charge coupling constant *alpha* is a compound constant made from the relations of the various other constants, as discussed earlier. The coupling constant describes the way in which photons transfer energy to and from charged lepton vortexes such as electrons and positrons. The photon trajectory in a vacuum is a Euclidean straight line that oscillates transversely as it connects space/time points (energy vortexes). When we match up c with $\hbar$, the energy quantum in $\hbar$ interacts with the trajectory of c to bend it into the shape of a conic section. As a closed conic section it forms an ellipse:

* $(\hbar\ c) = 3.1622\times10^{-26}$ kg (m^3 / s^2).

The relationship (m^3 / s^2) in the constant compound ($\hbar\ c$) is the space/time signature of an ellipse. This same signature occurs in the gravitational constant *G*.

* $G = 6.672$ m^3 / s^2 kg.

When we divide ($\hbar\ c$) by G, the two ellipse trajectories cancel out, and we are left with two interacting masses. These are the proto-masses of the B_u Planck Mass particles.

* $a = k_C\ e^2 / \hbar\ c$

* $B_u^2 = (\hbar\, c\, a / G)^{1/2} = k_C\, e^2 / G.$

We will discuss further the role of conic sections in gravitational systems in the next chapter. From the above discussion it becomes clear that we can dispose of a couple of major myths that have bugged physics for a long time.

The first is the notion that gravity is mono-polar. Obviously gravity is not mono-polar. It takes two to tango. If you only have one particle, you can not detect any mass. Of course, you do not have a body with which to find out or you are it. Any force used to move it implies a second packet of mass-energy somewhere outside the first particle. Therefore, if there is only one particle, there is no gravity. We can say that the particle will tend to be spherical and the gravity "field" will degenerate to a single point and thus become undetectable. Whenever there are two particles, then we have a system that behaves according to the rules of conic sections. An ellipse has two foci. In a gravitational system the symmetry of the system is broken by a bias that charges the two foci. One becomes positively charged (both with gravitational mass and with electric charge), and the other becomes negatively charged with gravitational mass and electric charge. The other pole to gravity is kinetic momentum. If the masses remain unchanged and there is no other influence, a gravitational system can achieve equilibrium between momentum and gravity. Gravity is the tendency of all diversity to return to its original singularity.

All electrical systems are bipolar. The same is true of their children, the magnetic systems. They are also bipolar. There are no magnetic monopoles by definition and by the very structure of the beast. This is the second myth. Scientists can look if they like, but they will not find them, just like they will not find a naked quark. The only "naked quarks" are the neutrinos. When any of these "resistances" becomes mono-polar, they degenerate, the system collapses, and you can not detect either pole. In equilibrium all contrasts are balanced with CPT invariance.

A gravitational black hole is a macroscopic example of a gravity singularity. Light can not get out from inside, but gravity is not affected on the outside. The hole contains lots of mass, but little or no gravity on the inside. (This is an important point that we discuss in chapter 15.) You can detect gravity from the outside of a black hole only if you have mass or linear momentum (like photons). From inside the black hole, however massive it may be, oddly enough, you can not detect any force of gravity at its center. It is like standing at the center of the earth or floating in inertial orbit. The same is true of a static electric charge on a sphere. There is no charge inside the sphere. A statically charged hollow sphere is a macroscopic electrostatic singularity.

The only exception to these rules is that, because there is a real dynamic system there and not just the quiescent vacuum state, there will be quantum fluctuations due to Heisenberg uncertainty. An example of this is the Aharonov-Bohm effect with regard to the magnetic field trapped in a solenoid. With black holes we have the quantum fluctuation of Hawking radiation. Generally these fluctuations are minute fringe effects. But under special conditions they can have far reaching consequences.

The two poles of the gravitational system are located at the two foci of the ellipse that defines the particle trajectory. The inner, positive pole has positive mass and is the reservoir for the potential energy of the system. How much mass-energy there is in the Earth's physical structure determines how much potential energy is available in its environment. If you lift an apple up into the air, you raise the apple's potential energy relative to the Earth. You are doing this by drawing on the potential energy of the earth. If the earth were not present, moving the apple from position A to position B in open space would not increase its potential energy one bit. However, it does increase the apple's kinetic energy. Once you stop accelerating the apple, it will maintain the kinetic energy you gave it until acted on by some other force.

On the other hand, the "kinetic energy" of the apple is still relative to some observer's frame of reference. If there is no reference frame, then the apple has no motion. Without motion it has no kinetic energy. Once again we see that kinetic energy is bipolar and dualistic, just like gravity. We propose that kinetic energy is the other side of the coin, the other pole of mass. This is why the negative poles (i.e., electrons) of the proton can cut loose and appear to move around.

Not all conic sections are closed. They can also be open forms such as the parabola and the hyperbola. However, such open forms imply the existence of other open forms so that the total symmetry of the system is maintained. In other words, protons can exchange electrons with other protons. So, for example, in a molecule of water, a hydrogen atom can share its electron bonding with an electro-negative oxygen atom. The electron oscillates back and forth between the two atoms doing double duty. If a hydrogen atom is ionized into a plasma mode, its electron can fly off and zip around for a while and then land on another atom. When the hydrogen ion settles down again, it will pull in any electron that happens to be nearby. All electrons at the same energy level look alike, and the nucleon is not particular. Thus a proton is really a non-local particle when we include its second electron that lives outside the proton, and the proton's wave function extends indefinitely in space/time. But it is not infinite. Protons were created as quantum eddy fluctuations during the Big Bang inflation. All individual B_u quanta spontaneously decay. Only those that happened to have their event horizons touching or overlapping in the dense quantum soup of creation managed to survive. They found an equilibrium that has survived until now.

Are protons immortal? The answer is yes and no. Protons can have immense life spans equal to the life span of the universe. They ARE the universe. On the other hand, protons annihilate when they encounter antiprotons as anyone who works at a high-energy collider can tell you. But there are not a lot of antiprotons around. They all annihilated with protons as the universe cooled and expanded. All that is left are some protons that survived in random pockets of space. Like the left-handed neutrinos, and the right-handed sugars, the leftover proton ensembles had to be all of the same type, so there was a breaking of symmetry at the cosmic level when the protons were created -- just like the case of the neutrinos. However, when you take a proton ensemble apart, all the lepton components that form it exactly balance out. The apparent imbalance of

twice as many (u) quarks as (u*) quarks disappears when the quarks are separated, for then they immediately dissipate into pure energy photons or other quark clusters via Hawking radiation. The whole ensemble is an elaborate and wonderful mirage. The up quarks can oscillate to anti-up form so that the balance is always maintained.

When the universe collapses during the Gnab Gib, or big Crunch, at the point when matter returns to the density of quark soup, the protons will all melt down and decay back into the pure photon energy that they really are anyway. In the next universe cycle, they will reappear as usual with their particular statistical frequency in the freeze out from the quark soup.

Field Theories Do Not Generate Massive Bosons and Fermions

Our theory of quantum gravity is now beginning to take shape. But we still have to consider another set of fundamental particles, the massive vector bosons (W and Z).

The (W) and (Z) bosons mediate the so-called weak interaction in electro-weak theory. One of the difficulties faced by physicists has been how to account for the massiveness of the (W/Z) bosons. Quantum field theory is based on the assumption of zero mass for particles that exchange energy in a field. This works fine for the photon in QED, but leads to problems with the weak interaction, because the bosons that mediate the weak interaction turn out to have masses almost 100 times heavier than the proton.

Our approach is not through traditional field theory. QED is fine as a field theory for describing the electromagnetic interaction. But we can get the same results in other ways that do not limit us to particles without mass or require great contortions in order to get a semblance of mass from a zero-mass field. The field theories have no means to predict masses for any particles without using such contrived tricks. So we do not use the standard field theory approach. With our approach we get a nice quantum field with all the particles and masses just as we experience them experimentally.

From the viewpoint of the photon, there is no time or space. Penrose has developed this idea to some extent in his twistor theory. The "null lines" of photons in twistor space become points. Twistor space is developed from the viewpoint of projective geometry -- which we introduced briefly in an earlier section and highly recommended --, and forms a complex number field reflection of a space of lines into its dual, a space of points. This is a fine mental concept, but does not go anywhere in physics. It is just a transformation of one viewpoint to another. The value of Penrose's ideas is in recognizing the existence of this viewpoint and its validity as a mathematical idea. However, as with field theory, twistor theory has trouble with the generation of mass, which is what physics is all about.

The Observer Physics Way of Obtaining Mass from Nothing

We have no such trouble in our approach because we start with definitions of the **invariant relations** between mass-energy and space/time that are based on actual experimental data. We also show that these values are **inherent reflections of constant relations in geometry**. Thus **we have invariance built into our theory right**

from the start and do not have to start with generating a theoretical field with invariance. This principle is a key to assembling our unified theory of quantum physics. We must establish a systematic method for **defining the physical constants completely in terms of the constants of geometry. That unifies the mental field of geometry with the physical field of experimental phenomena.**

The Power of the Nothingth Power

When I studied algebra and number theory, I learned that we can take a number of any base and raise it to various powers by multiplying it times itself a given number of times. So, for example, we can study powers of 2 and represent that by 2^n, where n is some integer. We learned that negative powers represent the inverse of positive powers. The question then arises: What is the value of 2^n when $n = 0$? To see what it is, we just write out enough of the series of n values to see the logical answer.

* $2^{-4} = 1/16$; $2^{-3} = 1/8$; $2^{-2} = 1/4$; $2^{-1} = 1/2$; $\mathbf{2^0 = ?}$; $2^1 = 2$; $2^2 = 4$; $2^3 = 8$; $2^4 = 16$. . .

Going from left to right we multiply by 2; and going from right to left we divide by 2. We discover that 2^0 must equal 1. Not only that, but any number to the 0^{th} power = 1. So any value to the zeroth power is 1! This is a unified mathematical principle.

We mentioned earlier in this treatise that the way to express physical interactions is by multiplication. The way to express physical associations is by addition. **Our theory is that the universe arises from an interaction of various possibilities that result in unity -- an undefined bunch of stuff to the nothingth power.**

We therefore can conceive of an observer who arbitrarily defines a small set of fundamental physical properties that she would like to see displayed in her universe -- say mass, space, and time. There also have to be some axioms for the way the properties interact. For example, Euclidean space contains the primitive notions of point and neighborhood. Points can be extended into lines, planes and volumes or into centers, circles, and spheres. Other properties can be derived from the interactions of these properties. The three properties remain meaningless until the observer joins these properties into various combinations of mathematical relations, all of which can be given arbitrary definitions. The main principle in all of this, however, is that there must be a set of invariant combinations of the properties that hold true under all conditions. Furthermore, it must be possible to combine the invariant combinations so that they achieve the value of unity -- a state that represents the condition of perfect equilibrium. Then it does not matter what properties we define or how we combine them, so long as we can bring them into the state of unity.

Obviously each property or combination of properties finds unity when it interacts with itself. For example, $c/c = 1$ and $G/G = 1$. What makes the game interesting is when very different combinations of properties are found to be equivalent. That means they can interact to bring about unity. As I pursued this line of reasoning I decided to use scientific notation and only mechanical units.

I have developed a simple four-step program for achieving this marriage of geometry and physics into a unified theory. We will use the constants of physics and geometry that we have introduced earlier in this chapter to demonstrate how to generate a universe that is stable, eternal, and has a very close resemblance to our own currently experienced universe. I will first introduce a description of each step, then I will write out a demonstration of each step, and finally I will apply the sample formulas to demonstrate physical results and an understanding of principles underlying modern physics. Those who are interested may further explore the examples or forge into new territory and describe completely new universes that are stable, permanent, and coexist alongside our cosmos.

Step I. Use factors from the constants of geometry to shift each physical constant to an exact power of 10 while maintaining the units of the physical constant unchanged.

Step II. Identify all the fundamental physical constants that contain mass units, and organize them into all the combinations such that all the units cancel out. Disregard the ratios and scales.

Step III. Substitute the power-of-ten versions for each of the physical constants as derived in Step I into the combinations derived in Step II.

Step IV. Total up the powers of ten and set that equal to (π %^{2} / Ao) = 10 to the power of your total.

We now have an equation for each possible combination of physical constants that is expressed solely in terms of constants of geometry. Since we have a power-of-ten version for each physical constant, we can obviously write each combination as a power of ten. The D-Shift Operator is a constant of geometry and a constant of physics. The D-Shift Operator can match a power-of-ten result at any power, which is why this is such an important tool for mathematics, geometry, and physics. It forms the link between geometry and physics as well as the link between various scales.

Now let's do it.

Step I. Shift each constant to a power of ten.

* $e \rightarrow (\boldsymbol{e}\ \pi$ Oo / %) = 10^{-18} kg / s.
* $G \rightarrow (\boldsymbol{G}$ Oo %^{2} / Ss) = 10^{-9} m^3 / s^2 kg.
* $\varepsilon_o \rightarrow (\boldsymbol{\varepsilon_o}$ As^3 / Ss^2) = 10^{-9} kg / m^3.
* $\hbar \rightarrow (\boldsymbol{\hbar}$ As % / Ss) = 10^{-33} kg m^2 / s.
* $c \rightarrow (\boldsymbol{c}$ Ss / R As) = 10^{8} m / s.

Step II. Express each constant involving mass as a pure number ratio.

* $(\boldsymbol{G}\,\boldsymbol{\hbar} / c^3\,\%^2)$.
* $(\boldsymbol{G}\,\boldsymbol{\varepsilon_o}\,\%^2 / c^2)$.
* $(\boldsymbol{G}\,\boldsymbol{e} / c^3)$.
* $(\boldsymbol{\hbar} / e\,\%^2)$.
* $(\boldsymbol{\hbar} / \varepsilon_o\, c\,\%^4)$.
* $(\boldsymbol{e} / \varepsilon_o\, c\,\%^2)$.

Step III. Express each constant in Step II in terms of powers of ten.

* $(\boldsymbol{G}\,\boldsymbol{\hbar} / \mathbf{c}^3\,\%^2) \rightarrow (\boldsymbol{G}\ \mathrm{Oo}\ \%^2 / \mathrm{Ss})\ (\boldsymbol{\hbar}\ \mathrm{As}\ \% / \mathrm{Ss}) / (\boldsymbol{c}\ \mathrm{Ss} / R\ \mathrm{As})^3\ (\%^2)$
* $(\boldsymbol{G}\,\boldsymbol{\varepsilon_o}\,\%^2 / \mathrm{c}^2) \rightarrow (\boldsymbol{G}\ \mathrm{Oo}\ \%^2 / \mathrm{Ss})\ (\varepsilon_o\ \mathrm{As}^3 / \mathrm{Ss}^2)\ (\%^2) / (\boldsymbol{c}\ \mathrm{Ss} / R\ \mathrm{As})^2$
* $(\boldsymbol{G}\,\boldsymbol{e} / c^3) \rightarrow (\boldsymbol{G}\ \mathrm{Oo}\ \%^2 / \mathrm{Ss})\ (\boldsymbol{e}\ \pi\ \mathrm{Oo} / \%) / (\boldsymbol{c}\ \mathrm{Ss} / R\ \mathrm{As})^3$
* $(\boldsymbol{\hbar} / e\,\%^2) \rightarrow (\boldsymbol{\hbar}\ \mathrm{As}\ \% / \mathrm{Ss}) / (\boldsymbol{e}\ \pi\ \mathrm{Oo} / \%)\ (\%^2)$
* $(\boldsymbol{\hbar} / \varepsilon_o\ \mathrm{c}\ \%^4) \rightarrow (\boldsymbol{\hbar}\ \mathrm{As}\ \% / \mathrm{Ss}) / (\varepsilon_o\ \mathrm{As}^3 / \mathrm{Ss}^2)\ (\boldsymbol{c}\ \mathrm{Ss} / R\ \mathrm{As})\ (\%^4)$
* $(\boldsymbol{e} / \varepsilon_o\ \mathrm{c}\ \%^2) \rightarrow (\mathbf{e}\ \pi\ \mathrm{Oo} / \%) / (\varepsilon_o\ \mathrm{As}^3 / \mathrm{Ss}^2)\ (\boldsymbol{c}\ \mathrm{Ss} / R\ \mathrm{As})\ (\%^2)$

Step IV. Write the total powers of ten with the D-Shift Operator.

* $(\boldsymbol{G}\,\boldsymbol{\hbar} / c^3\,\%^2) \rightarrow (G\ \mathrm{Oo}\ \%^2 / \mathrm{Ss})\ (\boldsymbol{\hbar}\ \mathrm{As}\ \% / \mathrm{Ss}) / (c\ \mathrm{Ss} / R\ \mathrm{As})^3\ (\%^2) = (\pi\ \%^2 / \mathrm{Ao})^{-67}.$
  $10^{-9}\qquad 10^{-33}\qquad 10^{-24}\qquad 10^{-1}\qquad 10^{-67}$

* $(\boldsymbol{G}\,\varepsilon_o\,\%^2 / \mathrm{c}^2) \rightarrow (G\ \mathrm{Oo}\ \%^2 / \mathrm{Ss})(\varepsilon_o\ \mathrm{As}^3 / \mathrm{Ss}^2)\ (\%^2) / (c\ \mathrm{Ss} / R\ \mathrm{As})^2 = (\pi\ \%^2 / \mathrm{Ao})^{-33}.$
  $10^{-9}\qquad 10^{-9}\qquad 10\qquad 10^{-16}\qquad 10^{-33}$

* $(\boldsymbol{G}\,\boldsymbol{e} / c^3) \rightarrow (G\ \mathrm{Oo}\ \%^2 / \mathrm{Ss})\ (\mathrm{e}\ \pi\ \mathrm{Oo} / \%) / (c\ \mathrm{Ss} / R\ \mathrm{As})^3 = (\pi\ \%^2 / \mathrm{Ao})^{-51}.$
  $10^{-9}\qquad 10^{-18}\qquad 10^{-24}\qquad 10^{-51}$

* $(\boldsymbol{\hbar} / \boldsymbol{e}\,\%^2) \rightarrow (\boldsymbol{\hbar}\ \mathrm{As}\ \% / \mathrm{Ss}) / (e\ \pi\ \mathrm{Oo} / \%)\ (\%^2) = (\pi\ \%^2 / \mathrm{Ao})^{-16}.$
  $10^{-33}\qquad 10^{18}\qquad 10^{-1}\qquad 10^{-16}$

* $(\boldsymbol{\hbar} / \varepsilon_o\ \mathrm{c}\ \%^4) \rightarrow (\boldsymbol{\hbar}\ \mathrm{As}\ \% / \mathrm{Ss}) / (\varepsilon_o\ \mathrm{As}^3 / \mathrm{Ss}^2)\ (c\ \mathrm{Ss} / R\ \mathrm{As})\ (\%^4) = (\pi\ \%^2 / \mathrm{Ao})^{-34}.$
  $10^{-33}\qquad 10^{9}\qquad 10^{-8}\qquad 10^{-2}\qquad 10^{-34}$

* $(\boldsymbol{e} / \varepsilon_o\, c\,\%^2) \rightarrow (e\ \pi\ \mathrm{Oo} / \%) / (\varepsilon_o\ \mathrm{As}^3 / \mathrm{Ss}^2)\ (c\ \mathrm{Ss} / R\ \mathrm{As})\ (\%^2) = (\pi\ \%^2 / \mathrm{Ao})^{-18}.$
  $10^{-18}\qquad 10^{9}\qquad 10^{-8}\qquad 10^{-1}\qquad 10^{-18}$

The discussions, exercises, and formulas I presented earlier in this work hopefully have prepared you for the unusual notation. These equations show that we can take any combination of physical constants and express them in terms of constants of geometry, which tells us that our physical universe is no more than various configurations of space.

As you examine the above equations, you also discover that we have accomplished the goal of the field theorists. We have a set of equations from which we can derive all the forces and all the particles of physics that have mass as well as other dimensions and

properties. Nevertheless, they are all **without mass** and **without properties** in this field that consists of nothing more than various powers of the pure number ten. We have created a mathematical "grid" that has "depth" of scale and in which we can embed physical processes. When it is quiescent it is just an *n*-Dimensional field of 0's with an undefined quantum pure numerical value of unity (1) floating about as a possibility to land somewhere, anywhere.

* $(\pi\ \%^2 / \mathrm{Ao})^n = 10^n$

When it is in the quiescent vacuum state, the universe is flat. In mental space this is reflected as an *n*-dimensional field of 0's, or an indefinitely long line of 0's when viewed in 1 dimension. Each zero represents a quantum possibility to hold a value and a scale in a particular (as yet undefined) dimensional unit. But interestingly --

* $(\pi\ \%^2 / \mathrm{Ao})^0 = 1.$

The zero dimension of our field is a unity. The only way we get the field to be really all zeroes is to make its dimension really "small" but NOT zero. At zero the whole thing makes a quantum leap and jumps to the value 1 right in the middle of the zeroes.

* 0000000000000000000000000001.0000000000000000000000000000000

To get a small value we need a very large negative exponent.

* $(\pi\ \%^2 / \mathrm{Ao})^{-\infty}$.

When exponent $n \rightarrow$ minus infinity, the field becomes --

* ...0000000000000000000000000000.0000000000000000000000000000000...

But the reality is that in the physical world we do not play in infinity. Zero and infinity do not happen in the quantum world. Every possibility always has some probability, however small. An electron has a finite probability to exist not only somewhere in the universe for ever, but everywhere in the universe for ever. We play in the relative world. Therefore we define an arbitrary finite range as our playground. The numerical values we give to the range do not matter. We can think of probabilities between 0 and 1. But in our system we will think of all possible powers of 10, including zero, but not including infinity.

All that matters is the relationships. Once these are set, they hold for all viewpoints. The physical constants become the observed invariance of our physical world. Transformation operators purely derived from constants of geometry bring the quiescent particles to life and automatically endow them with their proper masses and interactive forces.

Here is what a 1-D numerical version of the quiescent vacuum state field with the

Planck-scale value of n = -35 (10^{-35}) looks like. To make it easier to read this "field" notation, we can use the convention of splitting the digits apart into triplets.

* 000 000 000 000 000 000 000.000 000 000 000 000 000 000 000 000 000 000 010....

This arbitrary method gives the "scale" that we choose to play with in our universe. Next we set the ratio of mass to space -- ε_o -- for our universe. Armed with this we can create particles. Consider the mass of a hypothetical proton. It exists "frozen" in the vacuum until activated as a physical possibility. The vacuum splits.

* $(10^{-35})\ (10^{17}) = (10^{-18}) = (\pi\ \%^2 / \text{Ao})^{-18}$

* $(\pi\ e\ \text{Oo} / \%)\ (R\ \text{As} / c\ \text{Ss})\ (\text{Ss}^2 / \varepsilon_o\ \text{As}^3)\ (\%^{-2}) = (\pi\ \%^2 / \text{Ao})^{-18}$
  $(10^{-18})\quad (10^{-8})\quad (10^{9})\quad (10^{-1}) = \quad (10^{-18})$.

* 0000000000000000.000 000 000 000 000 001 000 000

Now we have a potential mass window involving a charge at a certain scale in the vacuum mass gauge. But it still has no mass. It is just a blip of possibility of mass at that pure number scale window around 10^{-18}, which we notice just happens to be the scale of the B_u pair interacting. Next we rearrange the components to reveal the hidden proton mass.

* $(\pi\ e\ R / c\ )\ (1 / \varepsilon_o)\ (\text{Oo Ss} / \%^3\ \text{As}^2) = (\pi\ \%^2 / \text{Ao})^{-18}$.
* $m_p = (\varepsilon_o)\ (\%^3\ \text{As}^2 / \text{Oo Ss})\ (\pi\ \%^2 / \text{Ao})^{-18}$.
* 00000000000000000.000 000 000 000 000 000 000 000 00**1 67 kg**.

We extract the Planck scale we want for our universe from an indefinitely long string of zeros by choosing an arbitrary pure number value of 10^{-35}. We split that into two other pure numbers based on the ratio of charge to the Planck scale. Then we operate on one of them with the ratio of mass to space that we defined for our vacuum.

Whenever the ε_o constant encounters the simple relationship in geometry,

$$(\%^3\ \text{As}^2 / \text{Oo Ss})\ (\pi\ \%^2 / \text{Ao})^{-18},$$

a proton magically appears!!! The proton likes this (ε_o) window because of the simple relation between the physical ratio (e / c) and the *pi* gauge ($\pi\ R$).

* $m_p = (e / c)\ (\pi\ R)$.

Notice also that the expression $(\varepsilon_o)\ (\%^3\ \text{As}^2 / \text{Oo Ss})\ (\pi\ \%^2 / \text{Ao})^{-18}$ is a perfect reflection of the proton in the Dirac sea. It is the permittivity of an anti-proton in the geometry of the vacuum state!

Now our hypothetical particle has a specific value, and that value we measure in kilograms from the viewpoint we have selected. Oddly enough, the geometry relation

that the vacuum ratio encountered had nothing to do with mass. The cluster of relations from geometry is not only without mass, it is purely an abstract mental property of the geometry of circles and spheres with an arbitrary unit radius that somehow reflects into the physical world. Once the vacuum permits mass at the ε_o density, certain particles can appear. Based on our equilibrium equations, one of those possible particles is the proton. The collection of circles and spheres is probably what John Wheeler was imagining when he broached the concept of "quantum foam." It is simply the geometry of pure Euclidean space boiling into bubbles that can become the "holes" that allow particles with mass to appear. All we have to do is load that compliant space with the stress of potential -- which is the job of the Observer who decides to participate rather than simply observe. Remember! To a truly detached observer, the universe has no mass or energy, no forces or momentum. It is just a kaleidoscopic movie show for entertainment purposes only. If you want physical forces and inertia, you have to jump in and stress things up, -- you have to stir the pot all by yourself to feel things.

A Child's Tale and Some Examples

What happens here reminds me of the child's tale of Snow White and the Seven Dwarfs. Snow White is the sea of quantum foam at the Planck scale. The Seven Dwarfs are the seven constants of pure Euclidean geometry that provide a "house" for Snow White to live in. The Seven Dwarfs build the first three dimensions of space at the Planck scale. They are:

* 0D → π.
* 1D → *R*, %.
* 2D → Oo, Ao.
* 3D → As, Ss.
* 4D → T = Time

We can even hazard an identification of the Dwarfs. *Pi* at 0D sounds like Sleepy. He's OD'd and gone to sleep. He's really out of touch with the world, but the point is that the whole world is his dream of *pi* in the sky. Doc is the gauge metric at *R*. He sets the ruler for measuring the world. Dopey gets lost and confused wandering all over the scales with % D-Shifts. Bashful is like Oo. He's somewhat autistic and looks one-dimensional. But actually he extends himself into a second dimension by his autistic circularity. Happy is Ao. He has a smiley face, but is a bit flat. Grumpy is As, because he's all bluff on the surface with nothing inside. He's a real Ass. But he LOOKS three-dimensional. And Sneezy sneezes "Ss", spraying bubbles all over the place into three dimensions. At least he's for real, but he must have some allergies.

Sneezy gives us the Big Bang. Yep. That's how it happened. God sneezed. That tossed us into the 3 dimensional space of physics and introduced another dimension, time. Time gave rise to the story.

In the story there is a beautiful, narcissistic Queen who wants to be and remain the most beautiful and powerful of all. She is the Black Hole Queen. Ironically, inside her impregnable castle lives Snow White, her stepdaughter. Snow White happens to be

growing into a woman who will be more beautiful than the Queen. She is the lively quantum foam. She is a potential White Hole a perfect complement to the Black Hole Queen. Inside the castle of the primordial cosmic Black Hole lives a quantum foam White Hole, hidden and unknown. The invisible Transcendental Observer is the King. His original Queen, Pure Awareness seems to have died after she gave birth to Snow White, the Quantum Foam, and the King also has retired or gone away, leaving the rule of the land to his second wife, the Black Hole Queen. But Snow White reflects the transcendental beauty of her mother, the Queen of Pure Awareness. The Black Hole Queen is the King's second Queen, and the potential White Hole Queen is really the King's daughter and heir to the throne, but Snow White doesn't know this yet.

The jealous Queen stepmother orders a gamekeeper to get rid of Snow White, but he takes pity on Snow White and leaves her deep in the forest under the care of the Seven Dwarfs, miners who dig gems of perception (the physical constants) from deep in the depths of the Poincaré Peak of Possibilities. The Magical Phase Conjugation Mirror on the wall of the Queen's Castle bedroom never lies. One day as the Queen looks into the Phase Conjugation Mirror to see if she is the most beautiful of all, the Mirror reflects to her that Snow White still lives and has become the most beautiful woman in the Universe. The Queen realizes that she must do the job herself if she wants to be rid of Snow White, so she plans to kill Snow White with a poisoned Apple of Gravity. Her disguise for delivering the Apple is to transform herself into the hideous old crone, Time, and reflect her Beauty as it appears when ravaged by her warped imagination. The Apple is Newton's Apple, and the Apple of the Garden of Eden, and the golden apple in the Judgment of Paris. It is Gravity, the Black Hole's specialty. When Snow White eats the Apple, Gravity pulls her into a prone position, flat on the Ground State, stuck to the Event Horizon of the Black Queen's world like a picture drawn on a cup. She remains that way, in a sleeping trance, protected by the Seven Dwarfs. She has become the quiescent quantum foam.

One day Prince Eo arrives. He is the Perfect Conjugate Mate, wearing a magical dwarf jewel on his belt. When he kisses Snow White, his love for her potential to live in the physical world activates the magic jewel. Snow White wakes up again in the physical world, and they live together happily ever after until the Black Hole Queen makes a comeback -- but by that time they already have a new heir apparent. And so it goes. The physical world emerges again from the sleep imposed by the dream of gravity, and the celebration of creation as a Universe of All Possibilities begins.

There is a principle of duality at work here. For example, each particle with mass has an abstract relationship in geometry that calls forth its specific mass. The Snow White quantum foam is made up of nothing but combinations of the Seven Dwarfs – abstract lines, relationships, and bubbles. It is pure space in zero, one, two, and three dimensions. But the space has been compacted and wrapped into little balls all jumbled together into the physical dwarf jewels that are like diamonds and rubies, strong enough to last forever. The quantum gauge for doing this is the Planck Length. So Doc applies his Planck ruler and sets the gauge. He uses the set of jewels to do this. The Dwarfs mine these mental jewels from the mountain-of-all-possibilities and arrange them

into beautiful sets that can magically generate physical universes. For our universe Doc chooses the Chakra set -- Seven Gems of Perception, each one contributing to the magical crown that rules the universe: ($\hbar$ = Sneezy's Sinus), (G = Sleepy's Butt), (c = Happy's Heart), (e = Bashful's Pubis), (ε_o = Grumpy's Throat) and (R = Doc's Navel gauge), with (% = Dopey's Crown) for setting all the jewels.

The Planck-Length (squared) gauge:

* $(\hbar\, G / c^3) \approx (R)\ (\pi\ \%\ /\ \mathrm{Oo})^2\ (\mathrm{Ss}\ \pi\ \%\ /\ \mathrm{As\ Ao})\ (\pi\ \%^2\ /\ \mathrm{Ao})^{-7\ (\pi\ \%2\ /\ \mathrm{Ao})}$

connects the pure Euclidean space to our particular universe. The Planck length is 1.61619926×10^{-35} m. Our result in geometry comes to a ratio of:

* $(10^{1/2}\ (5/6))^{1/2}\ 10^{-35}$ m = $1.62333957737\times10^{-35}$ m.

If we multiply by the "proton" value of R = 0.996226757 m, we get 1.61721432267 m, which is accurate rounded to the third decimal -- not bad considering the poor resolution of the gravity constant G, whose ratio is 6.67384(80). The high range for G is 6.67464, which takes the Planck length ratio up to 1.61629612101. If we divide by the 16th root of the ratio %/π, that adjusts the geometry ratio to 1.61655081003. Divide again by the 32nd root of %/π, and you get 1.6162193167. In any case, we are close, but R occurs many times in the formula, especially in the formula for 10, so we take these calculations as a sketch, understanding that there may be some factors missing, and the universal constants for our universe have not yet been thoroughly worked out.

Some quantum theorists, such as Everett, propose a many-universe interpretation of quantum theory. Our approach also allows for multiple universes, but in a different way. Each universe is defined by the set of physical constants -- a set of Dwarf-jewels -- that applies to that particular universe. A set of fundamental constants needs to be finite, few in number, and mutually consistent. The constants are folded into the quantum foam according to the steps we outlined above.

The quantum foam itself consists of the Seven Dwarfs of compacted spatial dimensions tumbling about in all possible combinations. There are only Seven of them, so the number of ways the Seven can fit together into combinations is limited. Of course, there are higher power combinations, but they are much less probable. The constant gems are coated with foam like dirt particles in an emulsion. So they slip and slide about in the foam and do not interact. They also have no mass. They are transparent beliefs that are present, but can not be seen. However, whenever one or more of them happens to kiss the right combination of foam bubbles, magically its foam coating drops off and the constant, or particle, or force, or velocity, or frequency manifests in space/time. The property of gravity, as we shall see, is global and nonlocal. Thus, when one particle appears, it breaks the symmetry of the quantum foam for all possible universes, and the whole foam selects that particular universe option that kissed it rather like the way some baby animals bond to the first individual they interact with. Others are then incompatible. In that context they interfere self-destructively and their

probability drops effectively to zero for that universe.

For example, from QED we know that if photons emanate from a source (A) with an observer positioned at (B), the photon wave function actually goes in every direction. But only the photons following the straight path (least action path if interferences occur) from (A) to (B) interfere constructively and are detected by an observer at (B). All others cancel out. However, if we choose to stand as observer at point (C), then the photon wave function emanating from (A) as before, will now only collapse with constructive interference at point (C). Quantum foam interference works exactly the same way. Which "universe" we condense out of the quantum foam of all possibilities depends only on our position as an observer at the moment of creation.

Since we are used to living at a scale far removed from the Planck scale, we generally choose an arbitrary metric such as a meter as our radial unit. Thus all the constants are shifted to different numerical values and scales. But that does not disturb the fundamental relationships of our particular universe's jewel set.

Let's do some more examples. This time let's summon forth a force from the vacuum and see what happens. Suppose we want to look at the electrostatic force between a proton and an electron. We want to call forth Coulomb's Law. To simplify things, we will place the charges 1 R meter apart. We know what that will look like, so we apply formula IV.6 and square it to get e^2, our interacting pair of quantum charges:

* $F_e = q_1\, q_2 / 4\,\pi\,\varepsilon_o\, R^2 = e^2 / 4\,\pi\,\varepsilon_o\, R^2 = 2.3\times10^{-28}$ N.

* $(\mathbf{e}\,\pi\,\mathrm{Oo}\,/\,\%)^2\,(\mathrm{Ss}^2 / \varepsilon_o\,\mathrm{As}^3)^2\,(R\,\mathrm{As} / c\,\mathrm{Ss})^2\,(\%^{-4}) = (\pi\,\%^2 / \mathrm{Ao})^{-36}$.
$(10^{-36})\qquad(10^{18})\qquad(10^{-16})\qquad(10^{-2})\qquad(10^{-36})$

* $(\mathbf{e}\,\pi\,\mathrm{Oo}\,/\,\%)^2\,(\mathrm{Ss}^4 / \varepsilon_o^2\,\mathrm{As}^6)\,(R^2\,\mathrm{As}^2 / c^2\,\mathrm{Ss}^2\,\%^{-4}) = (\pi\,\%^2 / \mathrm{Ao})^{-36}$.

* $(\mathbf{e}^2 / 4\,\pi\,\varepsilon_o R^2) = (\varepsilon_o\, c^2\,\mathrm{As}^3\,\%^6 / \pi^2\,\mathrm{Oo}^2\,\mathrm{Ss}^2\,R^2)\,(\pi\,\%^2 / \mathrm{Ao})^{-36}$.

* $F_e = (\varepsilon_o\, c^2\,\mathrm{As}^3\,\%^6 / \pi^2\,\mathrm{Oo}^2\,\mathrm{Ss}^2\,R^2)\,(\pi\,\%^2 / \mathrm{Ao})^{-36} = 2.3\times10^{-28}$ N.

I used one of the As constants to get the $(4\,\pi\,R^2)$ for the force. The second ε_o on the right side of the equation provides the inertia for the equal and opposite force that appears magically whenever a force is exerted.

Returning to our child's story, we define the abstract notion of a "force" operator to be our Prince Eo who "kiss"-multiplies our "Snow White" quantum foam bubble cluster and generates a force. The prince and princess form a pair of matching forces. One force is an exercise of will by an observer that involves him in the equation. The other force is the response of Snow White that rises up from the state of least excitation to match the will of the prince.

* $F_e =$ $(\varepsilon_o\, c^2)$ $(\mathrm{As}^3\,\%^6 / \pi^2\,\mathrm{Oo}^2\,\mathrm{Ss}^2\,R^2)$ $(\pi\,\%^2 / \mathrm{Ao})^{-36}$.
(Prince Eo) (-------Snow White--------) (Snow White's Bed)

* $F_e = 2.3\times10^{-28}$ kg m / s^2.

* 000000000000.000 000 000 000 000 000 000 000 000 **2.3 kg m / s^2.**

Charming Prince Eo of the Kingdom of "Newton" is an archetype of force choosing his emblematic jewels from among the "gems". His brother Planck ($\hbar\ c$ / Ao) is also Charming. We activate the "force" dimension of our vacuum state by means of the pure geometry of space (Snow White) that has nothing to do with forces. A kiss from Prince Eo magically awakens the gentle foam of geometry to play in the wild world of the forces.

We start simply by operating on a power of ten: $(\pi\ \%^2\ /\ \text{Ao})^{-36}$ that is the bed of all possibilities on which Snow White lies.

In this expression for the bed of all possibilities there are only two circles interacting, no mass or time or force. One circle has an area exactly 10 times the other circle. We do a couple of simple transformations and end up with a precise physical force expressed by a law of physics -- **all within the vacuum**. Furthermore, this procedure is totally general. We can plug in any value for the radius or any multiple of quantum charges, and Coulomb's Law works. The dual mate of Coulomb's Law is this curious assembly of circles and spheres, a purely abstract set of mental relations -- a team of Bubble-Dwarfs with a jewel that permits a mass to appear in space. We do not need a Higgs particle to get mass when we already have the electric permittivity of the vacuum that gives us permission to let there be mass in our world -- so long as it is balanced with an anti-mass and every force is balanced with an anti-force. But whenever this geometry occurs, Coulomb's Law goes to work in the specific way we want. This is not just true for Coulomb's Law, but for any law of physics.

Now let's make an electron. A simple expression for the electron is

* $m_e = \hbar\ /\ c\ a\ a_o = 4\ \pi\ \varepsilon_o\ \hbar^2\ /\ a_o\ e^2.$

The most appropriate formula is IV.4, which we will square. We will also include a virtual factor $(\varepsilon_o\ a_o\ /\ \varepsilon_o\ a_o)$.

* $(\hbar\ \text{As}\ \%\ /\ \text{Ss})^2\ (\%\ /\ \text{e}\ \pi\ \text{Oo})^2\ (\%^{-2})^2\ (\varepsilon_o\ a_o\ /\ \varepsilon_o\ a_o) = (\pi\ \%^2\ /\ \text{Ao})^{-32}.$

We reorganize and simplify:

* $(\hbar^2\ 4\ \pi\ \varepsilon_o\ /\ e^2\ a_o) = (\varepsilon_o\ \text{Ss}^2\ \pi^2\ \text{Oo}^2\ /\ a_o\ \text{As}\ R\ \%^2)\ (10^{-32})$
* $m_e = (\varepsilon_o\ /\ a_o)\ (16\ \pi^5\ /\ 9)\ (10^{-32}) = 9.1\times10^{-31}\ \text{kg}.$
* $m_e = (8.854 \cdot 16 \cdot 31 \cdot 9.87\ /\ 5.29177 \cdot 9) = 910\times10^{-32-12+11}\ \text{kg} = 9.1\times10^{-31}\ \text{kg}.$

We notice several interesting aspects to this equation. The electron seems to be made primarily of the ratio $\hbar\ /\ e$ in which the mass components all cancel out. We basically have angular momentum $\hbar$ and charge e in a direct relation. To restore mass we introduce the virtual mass bubble $(\varepsilon_o\ /\ \varepsilon_o\ )$. We also find that the Bohr radius is also a virtual displacement $(a_o\ /\ a_o)$ and not a fundamental property of the electron.

Furthermore, our prince's ratio (ε_o / a_o) = 1.673 closely matches that of the proton, and it is the proton that determines the value of the Bohr radius. Snow White is alive in her dwarf bubbles ($Ss^2\, Oo^2\, \pi^2$/ As), and her bed is 10^{-32}.

Suppose now we put our electron into a cyclotron. There is a formula for the cyclotron frequency, given a fixed magnetic field B, where B functions as a pure number scaling constant that we can set at any value we want. The formula for the frequency is

* $qB / 2\pi\, m = e\, B / 2\pi\, m_e$, where m_e is the mass of the electron that we just found.

So we will start with formula IV.6 to generate the equation for our cyclotron frequency, first for any particle with a single charge. We will include a virtual bubble of ($2\, \pi / 2\, \pi$).

* (e π Oo / %) ($Ss^2 / \varepsilon_o\, As^3$) ($R$ As / c Ss)($1/\%^2$)($2\, \pi / 2\, \pi$) = 10^{-18}.
* (e B / 2 π ε_o $\%^3$) s^{-1} = ($c\, B$) ($As^2 / R\, 2\pi^2$ Oo Ss) (10^{-18}) s^{-1}
* $9.11\times10^{-11}\, s^{-1}$= $(3 \cdot 3 / \pi^2)\times10^{-18+\,8}\, s^{-1}$ = $9.11\times10^{-11}\, B\, s^{-1}$.

If we wish to specify that the particle with a quantum of charge has the mass of an electron, we combine our results for the electron and get, where f_{ce} is the cyclotron frequency of the electron, given a selected value of B:

* $f_{ce} = e\, B / 2\pi\, m_e = 2.8\times10^{10}\, B s^{-1}$
* $f_{ce} = e^3\, B\, a_o / 8\, \pi^2\, \varepsilon_o\ \ \hbar^2 = 4.11138 \cdot 5.29177 / 8\, \pi^2 \cdot 8.854 \cdot (1.054)^2 \times10^{12}\, B s^{-1}$
* $f_{ce} = 2.8\times10^{10}\, B s^{-1}$

What about our hypothetical neutrino? The formula for that is IV.5.

* ($\hbar$ As % / Ss) ($Ss^2 / \varepsilon_o\, As^3$) ($R$ As / c Ss) ($\%^{-4}$) = ($\pi\, \%^2$ / Ao)$^{-34}$
* m_{ve} = ($\hbar / c$ %) = (ε_o) (As $\%^2 / R$) (10^{-34}) = 1.11×10^{-43} kg.

Our hypothetical electron neutrino drops right out of the formula, as does its electron anti-neutrino partner. We find the prince, Snow White dressed in dwarf foam, and her silent Planck-scale bed. By the way, the pure ratio of (10/9) that shows up in the neutrino generates a pure dimensional value. Any number divided by 9 projects that number across the whole linear dimension to the right from the scale at which it begins, and $(10 / 9)^2$ does another 90 degree shift.

As our last example, let's find the union boson B_u pair. We recall:

* $B_u^2 = e^2 / 4\, \pi\, \varepsilon_o\, G$.

It appears appropriate to use two formulas: IV.6 and IV.3 because we need electromagnetic constants as well as the gravitational constant. Because the e components cancel between the two formulas (suggesting that the charges cancel in the relationship), we will also need a virtual factor (e^2/e^2), -- and it simplifies things to bring in ($4\, \pi / 4\, \pi$). One of the c-factors also cancels. Then we fill in the balancing bubbles.

* $(e^2/e^2)\ (\mathrm{Ss}^2 / \varepsilon_o\, \mathrm{As}^3)\ (1/\%^2)\ (\mathrm{Ss} / G\ \mathrm{Oo}\ \%^2)\ (c^2\ \mathrm{Ss}^2 / R^2\ \mathrm{As}^2)\ (4\ \pi / 4\ \pi) = 10^{51\text{-}18\ =\ 33}\ \mathrm{kg}^2$
* $(e^2 / 4\ \pi\ \varepsilon_o G) \quad = (e^2 / c^2)\ (\mathrm{As}^5\ \%^4\ \mathrm{Oo} / \mathrm{Ss}^5\ 4\ \pi)\ (10^{33})\ \mathrm{kg}^2$
* $B_u^2 = (2.5664 \cdot 27 \cdot 100 / 2) \times 10^{33\text{-}38\text{-}16}\ \mathrm{kg}^2 = 3.464 \times 10^{-18}\ \mathrm{kg}^2$
* $B_u = 1.86 \times 10^{-9}\ \mathrm{kg}.$

Interestingly, the complementary pair of antiparticles (e^2 / c^2) look very much like a pair of fat protons! Recall that (e / c) (πR) gives us a proton.

The vacuum undergoes a series of symmetry breaks. The whole quantum foam manifestation process works very much like the biochemical processes that occur in the plasma soup inside the cells of our body. A neutralized particle can float around in the alphabet soup and nothing happens. When it is activated, it gets a certain charge or shape, and starts to link up at "receptor sites" with various molecules and form structures. The unique property of the quantum foam field is that it starts from a flat empty vacuum and passes automatically into quantum foam and then into a solid physical reality -- all from the choice of viewpoint made by an observer. This is Observer Physics.

From the observed invariance of our physical world translated into our quiet field, we can derive all the observed masses of the objects in our physical space as well as their dynamic interactions. The numerical values assigned to the physical constants are dependent upon the particular units chosen to work with, and variables are left up to the observer-participant to provide, but the relations of the constants to each other remain invariant (although to some observers they may appear distorted at relativistic velocities). Thus the masses that we derive are also invariant and independent of the units chosen. Our concept of space is also derived from the experimental observation that a quiescent vacuum is indistinguishable from Euclidean space and a quiet mind. The fundamental $B_{\varepsilon o}$ particle, source of all other particles, is simply the marriage of energy and geometry.

* $B_{\varepsilon o} = B_u = (\varepsilon_o)\ (\pi\ \mathrm{Ss}\ \mathrm{As}^2 / \mathrm{Ao}^2) = (\varepsilon_o)\ (16\ \pi\ \mathrm{Ss}) = 1.86 \times 10^{-9}\ \mathrm{kg}.$

Prince Eo, the ratio of mass to pure space, finds his true Princess (16 π Ss). The (4 π eo) is a bubble of mass-energy as four particles intermixing (4 Ss). The constants G and $\hbar\ c$ tell us how space/time distorts under the influence of mass-energy. The Einstein relation tells how mass is related to energy, and the Heisenberg relation tells how momentum and energy are related to intervals of space-time through Planck's constant. The basic principles of Newton's laws, Einstein's relativity, and modern quantum mechanics hold -- with the few special modifications that I have pointed out.

Let's go back for a moment to our first demonstration of the unified theory when we simultaneously generated a proton -- and its anti-proton partner.

* $(\pi\ e\ R / c\ )\ (1 / \varepsilon_o)\ (\mathrm{Oo}\ \mathrm{Ss} / \%^3\ \mathrm{As}^2) = (\pi\ \%^2 / \mathrm{Ao})^{-18}.$
* $(\pi\ e\ R / c\ ) = (\varepsilon_o)\ (\%^3\ \mathrm{As}^2 / \mathrm{Oo}\ \mathrm{Ss})\ (\pi\ \%^2 / \mathrm{Ao})^{-18}$
* $m_p = (\varepsilon_o)\ (\%^3\ \mathrm{As}^2 / \mathrm{Oo}\ \mathrm{Ss})\ (\pi\ \%^2 / \mathrm{Ao})^{-18}.$

Let's rearrange the equation to see the pure unity that is always present.

*** $(\pi\, e\, R / c\,) / (\varepsilon_o)\ (\%^3\ As^2 / Oo\ Ss)\ (\pi\ \%^2 / Ao)^{-18} = 1.$**

Every calculation in this unified theory of mathematical physics can be interpreted as a restatement of unity, the Eternal One, with its dynamics of Wholeness on the Move.

Exercises: Play around with the formulas until you can generate various fundamental laws of physics in our universe with them. Then get bold and discover new and uncharted universes that have been lurking below your radar. You know the rules. Just crank them out. They are like new mathematical theories or string theories, -- except that they describe eternal realities to which you have mental and physical access once you bring their operational rules sufficiently to the conscious level of your awareness and define them.

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