Chapter 12. Three Quarks for Muster Mark

The next step in our exploration is to probe deeper into the B_u boson pair to learn more about its structure and interactions so that we can lay the groundwork for a precise mathematical description of the leptons, hadrons, and nucleons as they are manifested by the Union Bosons. This will lead us gradually toward an outline of cosmology, a theory of quantum gravity, and a consideration of the laws of thermodynamics.

Since the discovery of the red shift phenomenon, astrophysicists and cosmologists have increasingly accepted the notion that the universe is expanding and has evolved over time from a primordial state known as the Big Bang (BB). According to this theory the universe began as a small particle that suddenly underwent an adiabatic expansion, the details of which form the history of our universe. Where the cosmic particle came from and why it Big Banged usually is thought to be beyond physics.

One of the first questions that comes up when contemplating the BB is, how big was the original particle that produced the Big Bang? The generally accepted answer is based on the notion of the quantum gravity limit, the point where physics breaks down. To calculate this limit we consider the point where thermal energy of the particle or particles is such that the de Broglie wavelength (λ_{db}) goes below the Schwarzschild radius (R_s). The Schwarzschild radius is the smallest radius that a black hole may have. We should qualify this by pointing out that this radius refers to a Schwarzschild black hole. Such a type one black hole has only mass (M_{bh}), with no spin (J) or charge (Q). Type two black holes (Kerr) have the added property of spin ($M_{bh} + J$). Type three black holes (Reissner-Nordstrom) have mass and charge ($M_{bh} + Q$). And type four black holes (Kerr-Newman) have all three "hairs", mass, spin, and charge ($M_{bh} + J + Q$). If the original particle had spin and charge, as it may have had, then this rough calculation may have to be modified a bit. But this is a start, and it is hard to imagine a particle with no external context "spinning" or having a charge with nothing for the charge to affect.

According to our theory of how charge is generated, we propose that, at least for mini black holes, there must be spin involved in order for charge to manifest. A spinless black hole would have no charge. However, for massive black holes, as for massive atoms, the charges can all cancel out and leave a neutral mass that is still spinning -- e.g., rotating neutron stars. So one may have spin without charge, but not charge without spin. Therefore I doubt any Reissner-Nordstrom black holes will be found in nature. A neutron star, while not yet a fully qualified black hole, functions as a single macroscopic neutron that has no net electrical charge. A black hole definitely may function as a single macroscopic fundamental particle, although super massive black holes (such as our universe may be) may look almost "normal" inside. A massive black hole could be a single massive quantum particle, even though it is so massive that its quantum increments appear practically continuous. As we become familiar with quantum processes, we are more and more able to construct macroscopic quantum mechanical systems in laboratory experiments and applied technology. In any case, the above arguments make a pretty good case for the Big Bang, if there is/was one, beginning from a Schwarzschild-type black hole.

Cosmologists think of the original Big Bang particle as a compact black hole that somehow became unstable and blew apart. It must have experienced severe Hawking radiation -- something characteristic of very small black holes. To find its size limit, they set the de Broglie wavelength (λ_{db}) and the Schwarzschild radius (R_s) to be equal, just exactly like we did with the gravitational force and the electrical force to find our B_u particle.

* $R_s = 2\,G\,M_{bh} / c^2$.
* $\lambda_{db} = 2\,\pi\,\hbar / p$.

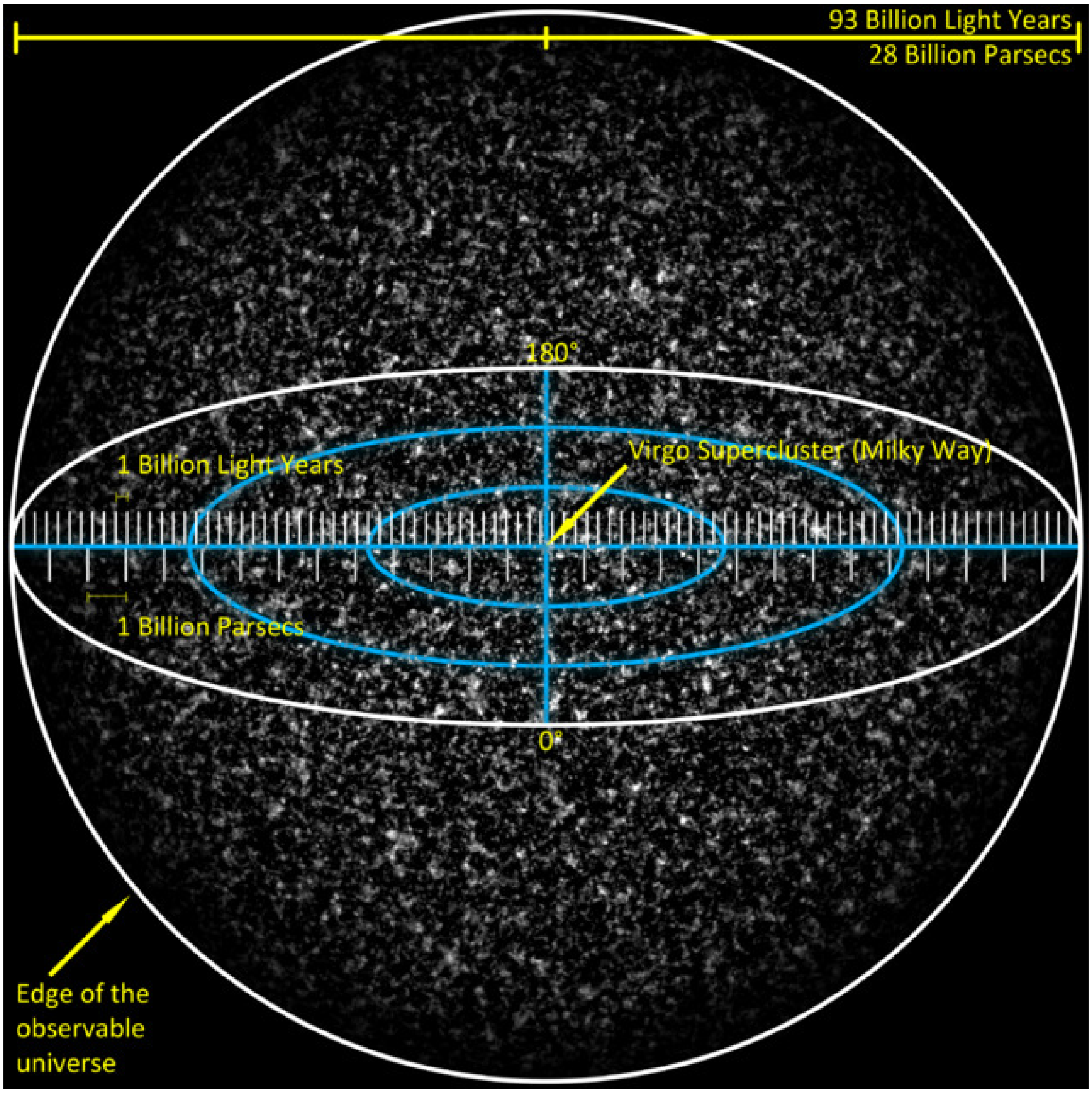
Here p represents the light-speed momentum of the particle, which we are here taking to be our black hole (M_{bh}).

* $2\,G\,M_{bh} / c^2 = 2\,\pi\,\hbar / M_{bh}\,c$.
* $M_{bh}^2 = \pi\,\hbar\,c / G$.
* $M_{bh} = (\pi\,\hbar\,c / G)^{1/2} \approx 3.9\times10^{-8}$ kg.
  This differs by $\pi^{1/2}$ from m_P, and by $(\pi/a)^{1/2}$ from B_u.
* $m_P = \sqrt{\frac{\hbar c}{G}} \approx 1.2209\times10^{19}$ GeV/c^2 $= 2.17651(13)\times10^{-8}$ kg, (or 21.7651 µg).
* $B_u = (\hbar\,c\,a / G)^{1/2} = 1.86\times10^{-9}$ kg

Given the scale at which we are working, a mass ratio of just a tad over 20 suggests that we are looking at the same particle, especially since the difference is only due to dimensionless constants.

Also we note that the Planck Mass-Union scale is not too far removed from our scale. We are talking about the weight of a skinny flea compared to a small dust mote when we compare the two masses to our ordinary world.

"Artist's logarithmic scale conception of the *observable universe* with the Solar System at the center, inner and outer planets, Kuiper belt, Oort cloud, Alpha Centauri, Perseus Arm, Milky Way galaxy, Andromeda galaxy, nearby galaxies, Cosmic Web, Cosmic microwave radiation and the Big Bang's invisible plasma on the edge." (**Wikipedia**, "Observable Universe")

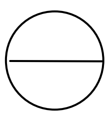


"Visualization of the 93 billion light year – or 28 billion parsec – three-dimensional observable universe. The scale is such that the fine grains represent collections of large numbers of superclusters. The Virgo Supercluster – home of Milky Way – is marked at the center, but is too small to be seen in the image. " (**Wikipedia**, "Observable Universe")

Cosmologists try to cram the entire visible universe and perhaps much more into this flea-sized particle and talk about 10^{53} kg of mass just for the visible matter of the known universe. This does not take into account dark matter and dark energy that are thought to be far greater, nor does it consider that the universe may extend far beyond what is visible, because the finite speed of light means we can only see back to the time of the Great Flash when photons decoupled from matter sometime around 380,000 years after the BB. Beyond that everything goes dark.

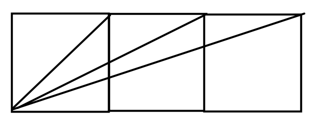
The little calculation we just did suggests that all this cosmology may be based on a major hidden assumption that matter somehow crams in the way they imagine. Modern quantum theory suggests that the vacuum state of free space is densely packed with mass-energy in a virtual condition. All the possible vibrations and phases cancel out from our observer viewpoint except for what we actually see -- which depends on where we locate ourselves in space-time as an observer viewpoint. It may well be that the cosmos is all neatly folded together in this "flea-sized" particle, and what we see depends on how we look at it. We know that a black hole of that size inherently is unstable and tends to explode. Even smaller ones would be more unstable. It just so happens that our universe is defined by constants that generate a stable Planck mass at $(\hbar\ c\ a\ /\ G)^{1/2}$, because this is where gravity and the EM force find equilibrium, and because this is where the protons and neutrons can manifest in a stable manner to form the atomic structures that make matter possible.

We also notice that the Planck D-Shift Operator ($\hbar\ c$) appears in the expression as well. This suggests that the D-Shift Operator (%) at the Planck scale is the "ground state" quantum of distance in our world. What does this mean? This operator sets the small and large scale metrics of the universe and allows the structure of the cosmos to unfold in an orderly fractal manner. The base-ten foundation is not arbitrary or just because we have ten fingers. It derives from the geometry of squares and powers. Circles and spheres are based on π, but squares and dimensions are based on %.



Circumference / Diameter = π

√2 × √5 = √10 = %



It also means that the Heisenberg uncertainty principle disallows a continuum of distance (or time) in terms of our physical reality. For example, if we allow for a variable interval of time (Δt) to shrink and become truly instantaneous, then we get an undefined amount of energy.

* $(\Delta E)\ (\Delta t) = \hbar$.
* $(\Delta p)\ (\Delta x) = \hbar$.

"Using the relativistic relation between momentum and energy $\mathbf{p} = \gamma m_0 \mathbf{v}$, when Δp exceeds mc then the uncertainty in energy is greater than mc^2, which is enough energy to create another particle of the same type. It follows that there is a fundamental limitation on Δx:

* $\Delta x \geq \frac{1}{2}\left(\frac{\hbar}{mc}\right)$. The uncertainty in position must be greater than half of the reduced Compton wavelength $\hbar/mc$." (**Wikipedia**, "Compton Wavelength")

The total conversion of proton rest mass to energy in a proton-antiproton collision is 2 m_p = 1876 MeV. That means you can get additional TeVs from the momentum buildup of your collider, but that's it. End of story. Beyond that the relativistic requirements of energy input are so high that you can't squeeze any more momentum using physical processes available to us at our density. At higher densities such as prevailed during the time just after the BB initiated, the situation is different, because the high energy density curves space-time very sharply. Such conditions may also hold inside of certain black holes.

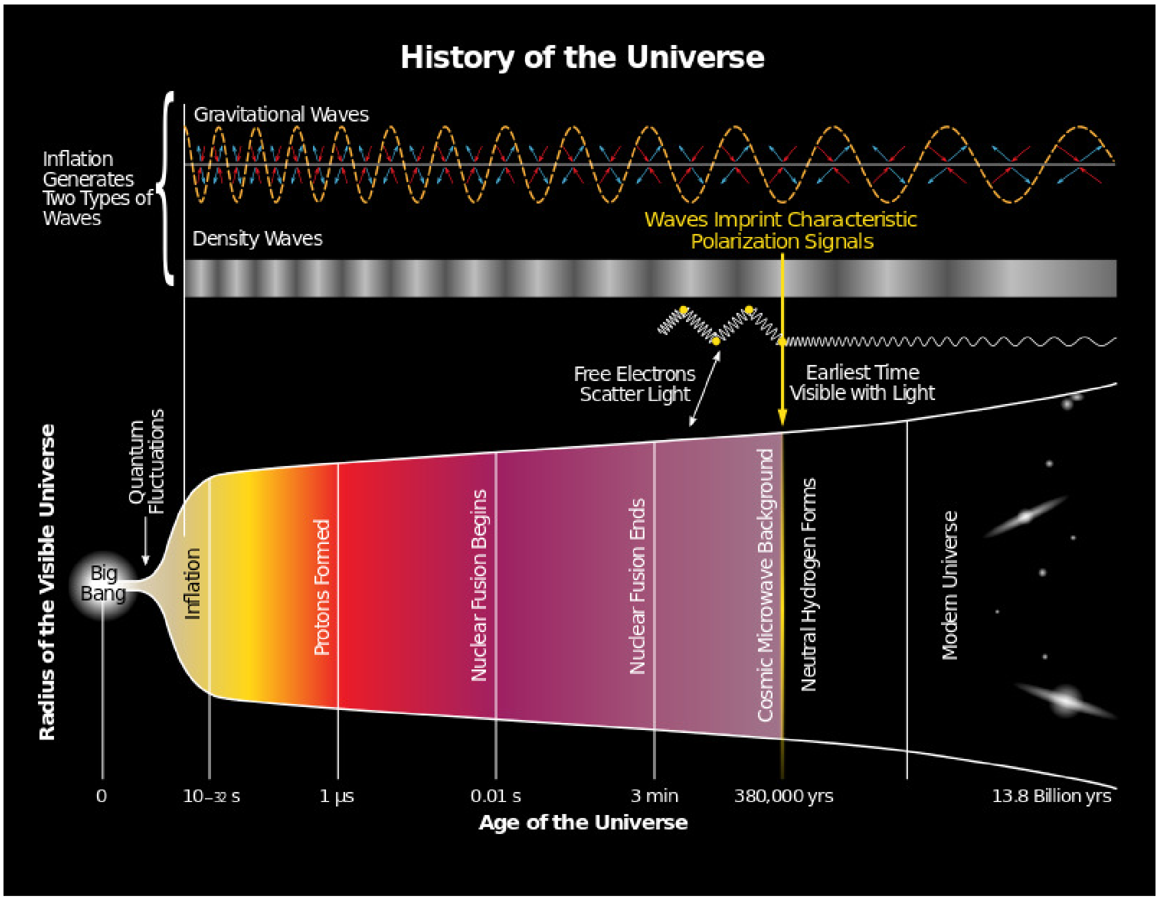
In a collider the relative velocity of the protons can reach 99.99997% of the speed of light. The Large Hadron Collider (LHC) has thus far (by 2013) gotten up to 4 TeV and plans to reach 6.5 per beam by 2015, pushing into 13 and perhaps up to 14 TeV territory. The collider business is pushing against the upper speed limit for this approach. The bang for your buck diminishes rapidly once you are in the TeV range. They are already using super-conducting magnets and electron cooling plus stochastic cooling for the antiprotons. The engineering challenges are formidable. The limit can't be too far from this neighborhood, -- say 20 TeV or so. It takes too much energy to boost the speed up any further using these brute force methods -- but maybe there will be breakthroughs. Perhaps the solution is to start working with neutron stars and black holes, or something like that. There you can get much richer densities to work with. But we will need major advances in our space program to be able to run such experiments. Even then there is nothing that even comes near ridiculous numbers such as 5.1×10^{96} kg/m^3, which is supposed to be the density one Planck second **after** the BB. It just doesn't work that way.

At any rate, the people at CERN in March of 2013 claimed that they observed a boson in the 125 GeV region. It couples with W and Z bosons, but also seems to have 0 spin and no charge, which makes it a scalar particle that can not be observed directly, but only by its decay regime. Thus far they say they have observed γγ, ττ, WW, and ZZ decay modes and will look for bottom quark decays. They think it may be the long-sought Higgs boson that explains how the bosons and fermions that have mass could have such a thing when the field theories do not produce anything with mass. All of this remains to be seen in experiments that are due to continue in 2015 and beyond. We shall see.

Zero Net Mass

More likely the net mass-energy of the universe is zero. The so-called "inflation" is an "exponential expansion of space in the early universe. The inflationary epoch lasted from 10^{-36} seconds after the Big Bang to sometime between 10^{-33} and 10^{-32} seconds. The inflationary hypothesis was developed in the 1980s by physicists Alan Guth and Andrei Linde. Inflation explains the origin of the large-scale structure of the cosmos. Quantum fluctuations in the microscopic inflationary region, magnified to cosmic size, become the seeds for the growth of structure in the universe (see galaxy formation, evolution, and structure formation). Many physicists also believe that inflation explains why the Universe appears to be the same in all directions (isotropic), why the cosmic microwave background radiation is distributed evenly, why the universe is flat, and why no magnetic monopoles have been observed. While the detailed particle physics mechanism responsible for inflation is not known, the basic picture makes a number of predictions that have been confirmed by observation. The hypothetical field thought to be responsible for inflation is called the inflaton." (**Wikipedia**, "Inflation (Cosmology)")

The Observer Physics viewpoint is that the hypothetical "inflaton" mentioned here is simply the observer's own resistance to unity. Unity is boring. It lacks diversity, companionship, love, fun, and adventure. The Planck second is about 10^{-43} seconds on our clock. In simple English an interval of 10^{-43} seconds sounds like living in the moment of NOW. To experience the physical world an observer has to push out from unity during that tiny interval proposed by Professors Guth and Linde. This is the Hawking explosion that ejects physical matter from the Union Boson at thousands of times the speed of light. This ejection unfolds the $Ur\text{-}B_u$ into about 10^{80} or more fundamental particles to form a quark-lepton soup. This starts to get interesting and attention goes to the details of what's cooking in the soup. Once that happens, the focus on breaking out of unity is lost and what remains is the momentum it has initiated.



The cosmologists who promote inflation have a problem that matter is not supposed to be able to exceed the speed of light, yet they need the inflation to account for the overall flat, homogeneous isotropy that is observed -- as well as the lack of magnetic monopoles predicted by currently popular grand unification theories. One gets the impression that cosmologists make ad hoc inventions out of thin air to explain anomalous evidence that does not fit their theories. Well, why not? I propose an Observer Physics theory based on the attention of an observer. Any individual can test the validity of the principle that dividing attention reduces the focal power of awareness, and thus reduces the effort one may apply in any particular direction. The dislike of loneliness and boredom with monotony are principles of consciousness easily observed in human society. Lack of desire to assume responsibility is another prevalent characteristic of consciousness. Also easily demonstrated is that the universe we experience is ours, and how we experience it depends on our chosen viewpoints. It is also easy to demonstrate experimentally that a change in viewpoint changes what is experienced. These principles and a realization that Einstein's relativity theory is greatly abused and misunderstood can easily resolve many of the fundamental problems in cosmology.

A fundamental principle of relativity is that the observer is always at rest relative to his viewpoint of "self". We can take that as a definition of a viewpoint. If it is not so, then the viewpoint becomes an object of observation rather than a viewpoint and is separate from the observer viewpoint. In that case it may or may not be at rest relative to the observer. Another fundamental principle is that an observer is not a meat body. Meat bodies are organisms. An observer may choose to view his world from a set of beliefs that are organized around a meat body. But a viewpoint is a non-physical idea. It is a belief that it is possible to view something from a particular physical, mental, imaginary or whatever kind of location or condition. An observer is also a non-physical condition of awareness. An observer is not limited to a meat body or any particular time, place, or condition.

Therefore, it is possible for an observer to create her own Big Bang -- simply by resisting boredom or desiring diversity, love, companionship, fun, adventure, or -- you name it. In such an act of radiating diversity from unity there is no speed limit, because it is all created from within the observer's own self as something to observe and even to make physical and play with. The diversity is an expression of the definition potential of undefined awareness. The decision, "Let it be thus" proclaims how it should be, and thus it becomes -- a huge resistance to the way it "has been". This is the mysterious inflaton. The full blast of creation emerges in one shot -- a ball of quark soup that in a microsecond spreads out into a ball of nucleons -- protons and neutrons. Within three minutes the era of nuclear fusion is over, and the basic material of the primordial universe becomes hydrogen, deuterium, helium-4, and lithium.

The momentum of the expansion carries the matter past the fusion window before most of the nucleons can fuse into helium or heavier elements. The universe might have ended up almost as boring as before the Big Bang broke the unity if it just became an ever expanding ball of inert helium. Fortunately, localization of observer attention due to all the diversity that was happening released the cosmos from continued focus on resisting unity. So, although the expansion continued, unity started to reassert itself as a relaxation of the resistance. This showed up as gravity and the particles of hydrogen and helium began to cluster into nebulae and then form stars. The stars cooked elements up to iron in their fusion furnaces. Then powerful supernovae compressed atoms into the even heavier elements, even into the actinide series.

It turns out that the quantum fluctuations at the beginning of inflation allowed for just enough density variation that the clustering could lead to clumping and soon stars clustered into galaxies. Except for a few special main points, such as the identification of the inflaton, the nature of dark energy, the location of the missing antimatter, and the resolution of dark matter issues related to galactic rotation curves that is all we will say about cosmology at this stage. However, just these fresh viewpoints are enough to provide a whole new impetus to the study of cosmology.

Dark Energy

According to Observer Physics the source of the dark energy is the stubborn resistance of human consciousness. One of the results of relativity theory is that, if the universe expands, the local viewpoint of any observer who believes with great certainty he is a local observer, necessarily shrinks relative to the wholeness of the universe. The more strongly an individual identifies with a local identity, the more his awareness seems to shrink. The way this shows up on the level of experience is that her cosmos seems to grow larger in comparison and may even accelerate in its expansion. The power of certainty is extremely strong and can dominate an individual's view of reality. This is very clearly seen in individuals who are fanatic "fundamentalists" -- those who are absolutely certain about some Type I belief system -- any system that insists that this is the way it is with no exceptions or alternatives. That is the nature of "dark energy". It is dark, because it is completely transparent to the individual who holds such rigidly bounded or contracted beliefs, with certainty that this is the only way it can be. Other possibilities naturally become invisible to the perception of such an individual by virtue of his own chosen definitions of reality, so his mind shrinks and his universe expands. Physicists with great intuitive acumen call this strange phenomenon "dark energy". It is not dark because it is evil, it is dark because it creates and increases separation of component parts.

Turning on the Light within the Dark Energy

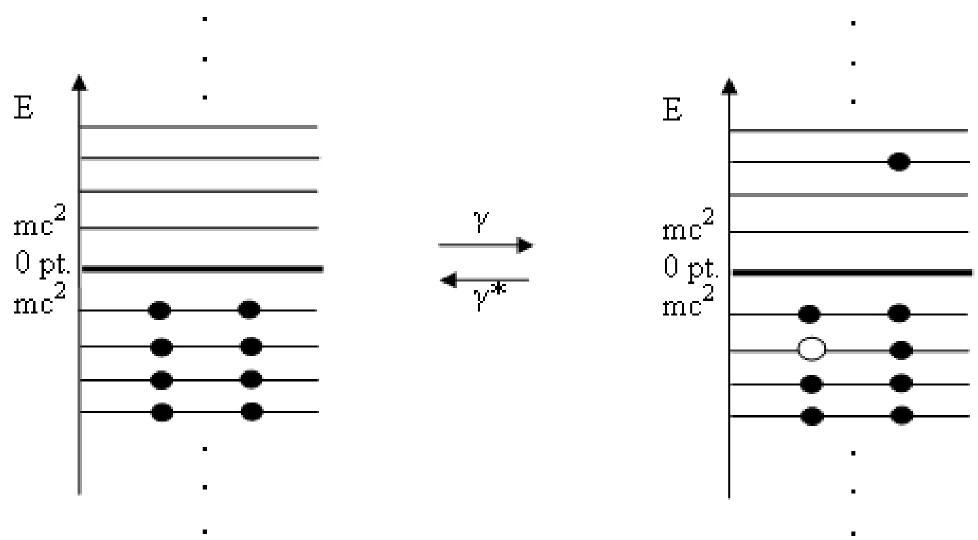
It is easy and effortless to understand and even to counteract the effects of dark energy. Do the "Expansion" exercise (#26 in **ReSurfacing**). In a nutshell, relax and let the boundaries of your attention expand to include more and more aspects of your universe. Keep going until you have expanded your boundaries of attention to include the whole cosmos and then some. The universe becomes indistinguishable from an elementary particle, and you, as an observer, are outside watching it. This returns you immediately to some sense of the state of unity. If you do this well -- and it may take a little practice -- you find that the universe exists as undefined awareness. Gravity disappears, but due to deeply embedded habits, the diversity of the universe may continue to roll on (and even appear to continue expanding) within that unity awareness that is beyond wherever the universe might expand to. With a little more practice it is possible to sustain the sense of unity even while fully engaged on a local level in diverse activities and interests. This is a powerful physics of consciousness. If large populations shifted to such a viewpoint, the physical momentum of the universe in general might shift. However, we know that as residents on a planet we already have placed ourselves in an environment that tends to contract and hold all participants to it, so much so that it seems to take a great deal of effort to physically leave that environment.

The Missing Antimatter

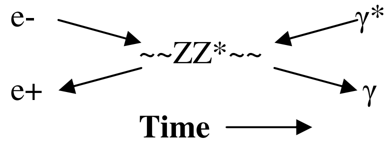
For the rest of this chapter we are going to focus on the problem of finding all the "missing" antimatter. You may have guessed from the discussion of the inflaton and the dark energy that the missing antimatter has a great deal to do with observer awareness. Modern physicists have mostly adopted the notion of the aether as the Dirac Sea, and the idea that every fundamental particle has a corresponding antiparticle. In the vacuum state there is a constant bubbling up of virtual particle pairs that then subside back into the Sea of Mass-Energy.

The Dirac Sea and Particle Pairs

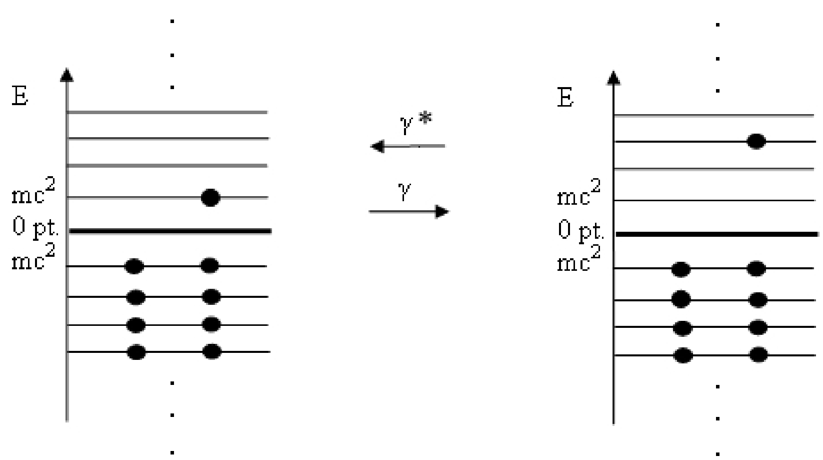
When Paul Dirac formulated his wave equation, he found that there were positive and negative energy solutions. In an attempt to explain this (as a good scientist he did not want to just throw away part of his mathematics just because he did not see how it conformed to experience.) -- he suggested that the vacuum state is like a giant ocean of possible energy states, and it has various quantized energy levels at which particles may appear. He imagined that if a particle became energized and rose up from sea level as a wave or a drop of ocean, there would have to be a corresponding trough or "hole" in the ocean so that the integrity of the whole ocean was conserved, especially if it were a quantized ocean. For any given particle he conceived of a little diagram based on Einstein's mass energy formula.



The zero point represents the state of equilibrium, when there are no excited states. The upward arrow indicates the level of energy, and the horizontal lines indicate the quantized energy levels, for example, of an electron. Each level has room for two electrons, one with spin up, and one with spin down. The minimum energy level for a particle to appear above the zero point is mc^2, where m is the particle's rest mass and c is light speed. In the diagram on the left there are no excited electrons, and so the vacuum is in its lowest state of excitation. When a pair gets created, the spin and charge are opposite. A photon-antiphoton pair is involved, and both terminal particles are shown. The white circle represents the positron that appears in the negative energy. Not shown is the ZZ* boson pair. Below is my Feynman diagram for pair annihilation. Pair production goes in the opposite direction. As you can see, there is no real annihilation or production – only a shift of state.



In the diagram below (right side) a valence electron is in a position where it is not adjacent to a positron but has extra energy. It may then emit a photon and drop to a lower energy level. Or it can absorb a photon and rise to a higher energy level. In this case the charge and spin do not change, and there is no positron directly involved. Only one photon is involved, because the other photon terminal is not shown.

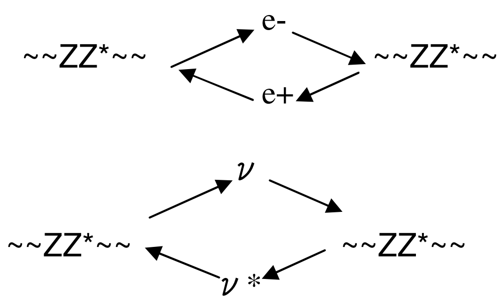


(Diagrams based on Martin and Shaw, **Particle Physics**, pp. 6, 9, 10.)

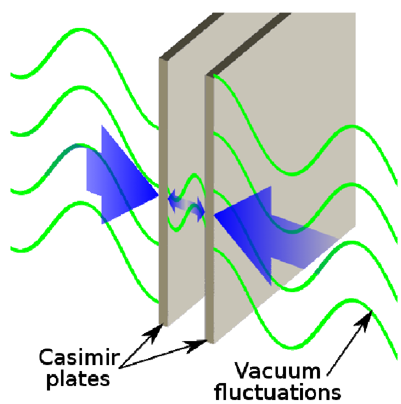
In my notation when an electron is only boosted by an energy level, then we only add the photon energy to the electron that gives it the appropriate energy. This may also change its direction of velocity. When the energy causes the production or annihilation of a particle pair, I often prefer to use a unitary notation. Both these reactions can go either direction, depending on circumstances, but the pair production reaction tends to go to the right, and the second pair of drawings tends to go to the left for valence electrons in the excited state that relax to the least excited orbital. The minimum energy for electron-positron pair creation requires $\geq 2\, m_e\, c^2$.

* $e^- / e^+ \rightarrow \gamma / \gamma = 1$ (Here there is mass energy conversion)
* $e^- + \gamma \leftarrow e^- + K$ (K is the electron's kinetic energy.)

In the first interaction the 1 means that the energy remains conserved, symmetric, and remains unitary as it evolves. It retains the wholeness of the vacuum state. The slash mark / represents the zero point energy of the vacuum state. The γ to the right of the slash mark represents an anti-photon. We could write γγ*. The particle pair exactly balance. The photon is its own anti-particle, so γ / γ is the end of the line. Refer back to the Feynman diagram above of the same interaction, and you see that the anti-photon will have been emitted from an electron somewhere, and the photon will be absorbed by a positron somewhere. If those interactions are at no significant distance, then we get a virtual bubble pair in the vacuum.



Above are virtual electron and virtual neutrino interactions motivated by virtual Z bosons. All sorts of particles from photons to the heaviest fundamental particles, and even elephants, umbrellas, petunias, neutron stars, galaxies, and anything that can possibly be imagined is constantly boiling up as a virtual possibility in the vacuum state. What becomes a physical reality is what is filtered out from all possibilities by the observer's viewpoint that resists all possibilities except those deliberately or non-deliberately selected by the observer’s attention. Thus, creativity is not about making something, it is about filtering out all that you do not intend to have at the moment, and what is left is what you prefer or can no longer resist for some reason. The Casimir effect demonstrates this in an extremely simple way. Two uncharged flat metal plates placed closely together in a vacuum can filter out certain wavelengths and allow others.



(**Wikipedia**, "Casimir Effect")

This suggests that our minds may also operate by a similar principle, and what we experience is due to a series of choices and habits regarding how we filter the totality of all possibilities in which we exist and that constantly presents itself. The current level of physical application of the Casimir effect is mainly in the fields of microelectronics and nanotechnology. The very small gaps involved in this effect may bring into play aspects of the equilibrium point between the gravity and EM forces. The study of selective filters is a vast science barely emerging in human consciousness.

The Generations of the Constants

The constants interact, forming combinations. Because space and time imply energy, all constants imply net energy unless the combination is dimensionless. What I call Generation 0 includes dimensionless constants such as a and π. What I call Generation I is just a constant cluster that by itself expresses a mass. There are four Gen I: ($\hbar$, G, e, ε_o) plus photons [$a_W \approx 4.2\times10^{-3}$; (Ss π % / As Ao)$^{4/2} \approx 10/9$; (Ss π % / As Ao)$^{9/2} \approx 11.5 / 9$.]

* ($\boldsymbol{\hbar}$ / c λ_o) = photons,
  ($\boldsymbol{\hbar}$ / c %) = neutrinos (hypothetical)
  ($\boldsymbol{\hbar}$ / a_o a c) = electrons (a_o is the Bohr radius: $a_0 = \frac{4\pi\varepsilon_0\hbar^2}{m_e e^2} = \frac{\hbar}{m_e c \alpha}$ = 5.29×10^{-11} m)
  ($\boldsymbol{e}$ R / c a_W) (Ss π % / As Ao)$^{4/2} \approx$ W bosons
  ($\boldsymbol{e}$ R / c a_W) (Ss π % / As Ao)$^{9/2} \approx$ Z bosons
  (π $\boldsymbol{e}$ R / c) = protons, neutrons
  (R c^2 / G) = 4.5×10^{26} kg (mass of a small jovian planet, a bit larger than Saturn)

The core constant relation for the Planck Mass is what I call a Generation II constant cluster. That means that it is made from a minimum combination of two mass-bearing constants, and we must take a square root to get its average value as a single particle.

* $B_u = (\hbar\ c\ a\ /\ G)^{1/2}$. (Below is the same mass expressed as Gen III and Gen IV)
* B_u = (Ss / π $\boldsymbol{\varepsilon_o}$ $\boldsymbol{k_C}^2$) ($\boldsymbol{k_C} = (4\ \pi\ \boldsymbol{\varepsilon_o})^{-1}$ **=** Coulomb constant)
* $B_u = (\boldsymbol{k_C}\,\boldsymbol{e^2} / \boldsymbol{G})^{1/2}$

There are five other combinations of the constants in Generation II. There are many Generation III and IV combinations. For example, the Bohr radius shown above expressed via Coulomb's law comes out to be a Generation V copy of the electron mass, since it contains altogether five iterations of constants that involve mass: e^2, $\hbar^2$, and ε_o. We find that there are multiple ways of expressing the various stable particle masses using the fundamental constants, and the actual physical value may be some average of the various versions, in the same manner that values in QM have to take into account the various possible virtual couplings to get a recommended value.

We introduced in the last chapter how the positrons and electrons are encoded naturally with the up-quark "neutrinos" to make ensemble particles such as protons, neutrons, and other hadrons. That gives us all the ingredients for building a universe right from the fundamental constants interacting with space and time through gravitational and electromagnetic exchanges: photons, neutrinos, electrons, W and Z bosons, protons, and Higgs-Bu bosons.

The W and Z boson duo includes the Planck factor:

* (Ss π % / As Ao) = 1.054.

For the W boson we square the Planck factor, and for the Z Boson we take the same factor to the (9/2) power. The former gives 1.433×10^{-25} kg, or 80 GeV / c^2, right on target for the experimental value of the W boson. The latter gives us 1.624×10^{-25} kg, or 91.12 GeV / c^2, for the Z boson, which is within the range ± .01 of 91.11 GeV / c^2.

From our newly acquired details about the inner structure of the proton, we can now answer another question. Why does the electron seem to behave like a point particle? The positron at the center of the proton is formed by the vortex of the energy swirling "down the drain" out of the B_u quark region. There is nothing else going on "inside" it. Everything is going on "outside" it. The same is true for the electron. What we see as the electron is like a mirror's reflected image. When you stand in front of a mirror, another version of you seems to be standing in a space "behind" the mirror, "inside" the Looking-Glass World. If you are a positron whirling at the center of a proton, you look out at the event horizon and see your self reflected as in a mirror. That reflection seems to be "outside" the proton. It seems to whirl around the proton. It is a conjugate reflection. The "guts" of the positron are "outside" it.

From the electron's viewpoint, its "guts" are also outside it. Narcissist that it is, it is always drawn to look at itself in the proton mirror. The reflection it sees is itself "inside" the proton phase conjugate mirror. That reflection is the positron at the proton's core. The "guts" of the positron and the "guts" of the electron are the same thing -- the three up quarks plus some neutrino energy adjusters. Actually what we have is two B_u particles with the "squark" mass. These three play the roles of three up quarks, and the foci of their orbits form the positron-electron pair.

This is our "five point" binary system that we spoke of before. The squark forms the center of mass located where the two inner foci overlap, and the two B_u particles form the binary black hole system. What remain are the two outer foci. These are the positron and the electron. However, in the case of the proton there is an important difference from the binary star system. In the latter case the two stars move in an orbit, each moving around its corresponding outer focus. However, in the proton's case, we are dealing with binary mini black hole dynamics. The space/time becomes extremely warped and twisted so that one of the foci is inside the orbits and the other one is outside. (This may start to remind vaguely of Roger Penrose's twistors.) Since energy circulates at velocity *c* around the three foci, each carries a quantum unit of charge once the charge threshold has been crossed, and each also generates a magnetic moment.

There are at least six possible clusters of Generation II:

* $(\hbar\, c\, a / G)^{1/2} = 1.86\times10^{-9}$ kg. (This is the Bu boson/Planck Mass).
* $(\hbar\, e / c)^{1/2}$ (As^2 / Ss π %).= 9.1×10^{-31} kg. (This is the electron.)
* $(\hbar\, \varepsilon_o$ As^2 Ao^3 / c Ss^2 π^3 %$^2)^{1/2} = 1.67\times10^{-27}$ kg. (Another version of the proton.)
* $(e\, c$ %^{2} / G$)^{1/2}$ = 2.683 kg.
* $(e\, \varepsilon_o$ %^{4} / $c)^{1/2} = 6.876\times10^{-19}$ kg.
* $(\varepsilon_o\, c^2$ %^{4} / G$)^{1/2} = 1.093\times10^9$ kg. (This is the threshold range for gravity to begin superceding EM in macrospace.)

There are at least 24 Generation III constant clusters. You can play around with them and find various windows with relatively stable masses. However, the most important ones are the four fundamental Generation I classes plus the photon. The others are echoes and overtones or other ways of saying the same thing.

We recall that our original B_u derivation came from an apparent Generation IV constant cluster: $(e^2 / 4 \pi \varepsilon_o G)^{1/2}$. But now we see that we can also derive it abstractly in Generation II and Generation III.

The beauty of this system is that it "automatically" generates the masses of the various elementary particles from constant physical relations and constants of geometry. Thus we have unified physics and geometry. All the physical constants that represent mass also relate it to space and time. Space and time are dimensions derived from geometry when it interacts with energy. This system also holds us within a quantum limit in all dimensions, so that our equations do not explode when we bring particles too close. The key is that we work only in the framework of our universal constants and the way in which they interact within the framework of unity, not a continuum that can range between zero and infinity. In our quantum world with its dynamic vacuum state there are no mathematical conditions such as zero or infinity.

Black Hole Mass and Girth

An interesting property of black holes that Hawking discovered is that they have a minimum possible area and an irreducible mass. In other words, a black hole can grow fatter, but not thinner. This appears to guarantee the law of entropy. However, since black holes also radiate via the Hawking quantum evaporation process, that means during radiation rotational energy is lost first in the case of a large black hole. Then it shrinks to its irreducible mass (keeping its fixed surface area but losing density). Beyond that it can only explode. The irreducible mass recalls our ratchet and saw discussion. When we get to subatomic black holes, this shows up as the fixed rest masses of fundamental particles below which there is only pair annihilation.

However, subatomic particle black holes can not slow down their rotation, since they are "rotating" at the fixed speed of *c*. The rotation is automatically quantized by the number of component particles (in ensembles) and the constant speed of light. The rest mass energy is also fixed. Thus they stay fixed at an energy quantum level or go through a phase transition and release their energy in one blast (particle pair annihilation). Hawking radiation always involves release of a particle and absorption of an antiparticle (or vice versa) at the event horizon. This is what happens when, for example, a proton annihilates with an antiproton. The two quanta perfectly match and annihilate each other. This is the limit of Hawking radiation. The conjugate process of the limit of Hawking radiation (pair production) is pair annihilation. Ordinarily, however, the B_u pair in the proton state stays in equilibrium with positron vortexes inside and electron vortexes outside. If it did not, our physical universe would explode.

Our discussion thus far brings me to a model from a thought experiment about quantum gravity developed by Roger Penrose in his thought-provoking work, **The Emperor's New Mind**. In this work Penrose proposes that a theory of quantum gravity must be based on a time-asymmetric theory. Aside from being inelegant (why should time be asymmetric other than to provide another viewpoint?), I believe his premise regarding the time-asymmetry in quantum mechanical state reduction is incorrect. At least the example he gives as evidence is not convincing. However that may be, his thought experiment is extremely interesting and relevant for what we are discussing, which is why I bring it up.

But first, let's dispose of the state-reduction-time-asymmetry problem so it doesn't nag at the back of your mind. We'll save a full discussion of the time-symmetry problem for our consideration of thermodynamics, because that is where the greatest apparent time asymmetry problem lies. What Penrose calls the "unitary evolution" phase of quantum mechanics is time symmetrical. There is no problem with that. The issue Penrose has is with "state reduction", also known as "collapse of the wave function." He claims that if you run a quantum process of state reduction backwards, you do not get the same results that you do when you run it forwards. His example is a photon source (S) that produces a recorded beam that is then split in half by a 45 degree angled half-silvered mirror. Each half-beam is sent to a photon detector (Da or Db). The two detectors are at right angles. (He only uses one, but using two is clearer.) Running forwards in time we ask:

* ⟨Da | Do⟩ "If photons leave the origin (Do), what is the probability they will reach detector (Da)?"

The probability amplitude is $1/\sqrt{2}$. The absolute square of this amplitude is 1/2, which is the correct answer. Penrose then tries to turn the process around and say that the reverse process gives a different answer. He calculates an amplitude of $1/\sqrt{2}$ for a photon from Da to reach Do, and a similar amplitude for it to reach Dc, which is opposite Db. He also considers the probability that a time reversed photon from Dc reaches Da.

His time-reversed statement of the original proposition is as follows:

* ⟨Do | Da⟩ "If photons leave detector Da, what is the probability they will reach detector Do?"

According to Penrose the answer is 1, not 1/2. But the trick is that Penrose has shifted viewpoints. We are now only locally aware of the photons that arrive at Da, and we know that they all originated at Do, so the answer has to be "one". But we have to ask the time-reversed question in terms of the full set of photons, not just the ones that went to Da.

This is not the whole picture. We must think holistically.

We ask our first question:

* "If photons leave Do, what is the probability they will reach Da?" (Answer: 1/2.)

We should also ask a second question:

* "If photons leave Do, what is the probability they will reach any one of the detectors?" (Answer: 1, given our defined assumption for the experiment that all photons go to their potential targets.)

The true time reversed first question is:

* "If time reversed photons leave Da, what portion of the photons reaching Do will they form?" (Answer: 1/2.)

The true time-reversed second question is:

* "If photons leave any particular detector, what is the probability they will reach Do?" (Answer: 1, also by virtue of our initially defined assumption that they will all return to their source).

If we use Penrose's setup, the answer to question one is still ½, and the answer to the true time-reversed (first) question is also still ½ of the time reversed photons that reach Do, the other ½ time reversed photons coming ultimately from Db. In this way we see that the system as a whole maintains time symmetry. But if you take the first time-forward question and match it with the second time-reversed question (which is worded in the reversed manner and thus SEEMS to be the correct time-reversed partner of question one), you get the wrong answer. If all photons return to source by time reflection, then those from Da will be ½. If you interleave the questions according to the proper viewpoints, then they match up nicely and you get the same answer going each direction in time within the same viewpoint framework. Which are photons and which are anti-photons is arbitrary as long as we are consistent.

Now that we have used the principles of phase conjugation to salvage quantum time symmetry from the attack of Mr. Penrose, let's get on to his wonderful thought experiment, which is actually based on an idea by Hawking, called "Hawking's Box". (We paraphrase Penrose's argument that starts on p. 360 of his book.)

Thought Experiment: We imagine a huge box (size is relative to our viewpoint.) In the box is some undefined material, and the box is sealed off from everything else. The experiment involves doing nothing to the contents of the box. You are to leave it alone forever. The question is this: What happens to the stuff in the box?

We presume according to the second law of thermodynamics that entropy grows until equilibrium is reached, and then nothing much happens other than fluctuations. This situation recalls our discussion of Poincaré Peaks. Penrose considers the situation in terms of phase space. He divides the phase space into two areas, one space A has no black holes, and another space B contains one or more black holes. (Are you starting to see some resemblance to our model of the proton-electron system? Notice also that he imagines stable black holes exist and can be put in a container of some size.)

The largest portions of each area, A and B, will be in thermal equilibrium. However, the presence of at least one black hole in space B keeps it from thermal equilibrium. Next we visualize a vector field on the phase space. This tells us the time evolution of the physical system. The arrows will mill around, and some will flow from A to B marking the formation of the black hole(s) in area B. Some vectors will flow back from B to A, marking the Hawking evaporation processes of the black hole(s).

At some point equilibrium is established between the black holes sucking material in and radiating material out, so that regions A and B are balanced. This equilibrium sounds exactly like what we discussed as the dynamic equilibrium for the proton-electron system. If you do the bathroom sink experiment to study the model, you can actually see in the water's flow some lines that resemble the vector arrows of the system. It resembles very much the drawing Fig. 8.5 in his book that Penrose labels "The Hamiltonian flow of the contents of Hawking's box."

Penrose goes on to invoke Liouville's theorem to show that the phase-space fluid is incompressible, so material can not accumulate in either of the two regions. Hawking arrives at the conclusion that the Hawking radiation process can be considered a "white hole" and thus the white and black hole aspects form a conjugate pair. White holes are the time-reversed versions of black holes. Black holes swallow, and white holes regurgitate.

Penrose objects to this, because he believes that white holes do not exist, and he also wants to throw in some time asymmetry because that is HIS pet theory. He brings up the problem of the destruction of information as it enters the black hole. This merges flow lines. You seem to imagine this happening when you look at the water flowing down the drain in the sink. Penrose believes this violates Liouville's theorem. The problem with this argument is that it again involves an unannounced shift of viewpoint. Penrose stands outside the black hole talking to us, and then tells us that information has been lost by something falling into the black hole. How does he know this? He only knows this by going into the black hole. He can't see in, just like you can't see down the drain. If he retains his original position as an outside observer, what he may see is all the information slowing down and standing still just outside the black hole at the event horizon. If you look at the flow lines (and have adjusted the flow of water so there is not too much turbulence), you will see that they form a standing wave pattern that sits on the water above and outside the vortex. This is just the way the "information" structure of an object appears to float just above the event horizon of a black hole when we "know" that the object obviously falls right in just like the water obviously falls right down the drain.

So there are two viewpoints on the black hole side -- one outside and detached, the other jumping in and going down the drain. What about the other side? Penrose suggests that the merging of vectors on the B side may be balanced on the A side by vector bifurcations due to state reduction (wave function collapse). But once again he is making an observer viewpoint shift. He starts out detached as a transcendent observer uninvolved even in watching the time evolution (leaving the box alone forever).

Suddenly he jumps in and makes measurements. Only by making observational measurements do you pop the qwiff and collapse the state vector. Penrose has contradicted himself. Collapsing the state vector by observing is clearly not leaving the system in the box alone forever.

In conclusion, we see that the Penrose puzzle with the Hawking box is just like the Penrose puzzle with quantum time reversal. He again has "four wave mixing" with two pairs of conjugate situations, this time fermion particles rather than only photons. Taken all together, the two pairs of viewpoints and the two styles of function all balance out. If we stick to a transcendental observer viewpoint, then we just see smooth time evolution taking place and all is symmetrical, but we do not know details. Phase state vectors do not merge or split. If we jump into an area B black hole, we cause vectors to merge. If we jump into area A anywhere outside the black hole and make a "measurement", we collapse the state vector and cause splitting.

What this all suggests is that the observer viewpoint is intimately involved in the whole experiment. The observer determines what he knows about how many vectors there are moving about in phase space by the viewpoint he chooses. We may even propose the idea that the attention of an individual consciousness functions as a white hole. It can create any number of new creations by simply defining them to be so. It can shift mental creations into physical creations by simply intensifying the level of attention and belief that it bestows on them. It can also toss creations out into "empty space" and abandon them. This is consciousness functioning as a white hole. However, when consciousness turns around and attracts its creations to itself, swallows them, and fully digests them, they "disappear", leaving only the energy of undefined awareness, with its potential for cancellation and boundaries. These are the three original properties from which all creations are built, whether mental or physical. This experiential mode of consciousness is its "black hole" phase. The two phases, "white hole" and "black hole", creative and experiential, are two sides of the same coin, two cycles of the same engine.

At the end of his discussion of the Hawking box Penrose suggests a model for identifying and measuring a graviton. In an effort to "externalize" and "objectify" the role of the observer's attention, Penrose hypothesizes that when a quantum particle reaches a certain critical threshold, it automatically collapses the wave function. He describes a particle passing through a cloud chamber. He proposes that the particle has a quantum wave function that describes its possible paths. Many of these paths pass through the cloud chamber producing a linear superposition of many strings of condensing droplets. Penrose believes that the point at which the wave function condenses into an actual string of droplets that can be observed is the quantum threshold of one graviton. This is another very intriguing idea and is worth further investigation. The fact remains, however, that without an observer there to see the trail of droplets, the wave function essentially remains un-collapsed in the same manner that the cat in Schrödinger's box remains in an undetermined "quantum wave function" state of existence. Therefore, I believe that we must go back to the Hawking box thought experiment and clearly understand that the appearance of the condition of the system in terms of experience heavily depends on the viewpoint decisions of the observer.

The observer always has two fundamental viewpoint choices. He can choose to create, or he can choose to experience. Another way of saying this is that he can exercise will and shape his world, or he can relax and just be, taking it as it comes. These are two conjugate phases of the same observer. You can not have one without the other. Otherwise you violate Liouville's theorem and get a logjam. Liouville's theorem about the conservation of density in phase space states that: *The distribution function is constant along any trajectory in phase space.* (**Wikipedia**, "Liouville's theorem (Hamiltonian)".)

Here is what physicist John Hagelin has said about the observer's choice of viewpoint and its importance for determining a physical system (Hagelin, 1992, p. 41). He starts from the transcendental viewpoint of the vacuum state.

"If the field were to remain in a state which was a superposition of all classical shape states, the field would not possess any definite amplitude and the measurement could not yield a definite result. Hence the effect of a measurement is to collapse the initial quantum-mechanical superposition of all classical field shapes to some definite, well-defined classical shape. However, this localized classical state of the field is highly unnatural from the standpoint of quantum mechanics, since it represents a state of infinite energy density. From the Heisenberg uncertainty principle, the fact that the uncertainty in the field (*df*) is zero in a definite classical shape state implies an infinite uncertainty in its canonically conjugate momentum. Such a field shape will therefore immediately explode from its classically definite value to assume, once again, a quantum-mechanical superposition of all possible shapes. However, the resulting superposition of classical field shapes will no longer possess the precise and definite balance of shapes which characterizes the vacuum state. (The vacuum state is the unique superposition of field shapes which is stable in time, unbounded in space -- i.e. Lorentz invariant.) The initially perfect balance of the vacuum state, once disturbed by the quantum measurement process, becomes unstable: the field continues to reverberate forever in a highly nontrivial time evolution."

Because the "collapse" of the vacuum wave function would take it to a highly excited state, this also would take much energy, which would have to be accounted for. Also, and more importantly, there seems to be no evidence of state reduction when there is no observer. Thus Hagelin goes on to suggest that (p. 43)

"It seems much more plausible, from the standpoints of both modern science and Vedic Science, that the 'collapse of infinity' does not constitute an actual collapse of the vacuum wave function, but merely represents a shift in attention -- from the quantum-mechanical superposition of all possible field shapes, which represents the true structure of the quantum vacuum, to one of the infinite number of field shapes which comprise this state . . . . The overall structure of the vacuum remains completely unchanged and retains its perfectly balanced and symmetrical structure."

The collapse of the wave function represents a simple shift of attention by the

observer, a change of viewpoint which may be virtually effortless. It may seem trivial, but the whole universe looks different from a different viewpoint. This is a fundamental principle of Observer Physics. The eternal vacuum state superposition of all possible field shapes remains forever as an unchanging template of possibilities with which attention may play.

A simple way of summarizing the human condition on planet Earth in our age (from one point of view) is that there is a large fluctuation of group consciousness taking place in which people prefer to create but not to fully experience. They also prefer to create with great gusto of attention and belief, play with the creations for a while, and then abandon them without having fully experienced them. The result is that the environment gets cluttered up with a lot of un-experienced or partially experienced abandoned creations that just float around and eventually begin to come up as "problems". But it's all OK. Eventually the fluctuation subsides and, one way or another, the created system returns to the vacuum state equilibrium from which it never actually departed. At the same time that all the “mess” is being made, consciousness is waking up and getting very lively, discovering many things about itself, and rediscovering and recovering many long lost creations of great subtlety and beauty.

Quark Theory and the Major Hadrons

Before we move on into a more detailed consideration of a unitary theory, quantum gravity, and thermodynamics, let's give a summary of the major hadrons in the light of our proton model, integrating this with current quark theory.

Each quark has an anti-quark partner. If the quark "has a charge", its anti-quark partner has the opposite charge. The neutral up quark is its own antiparticle, and so also is the neutral charm quark its own antiparticle. They go to whichever state is appropriate in a particle. As a convention I shall write the positive quarks as "anti-quarks". All positively charged particles are understood to be fundamentally what we call antimatter, and all negatively charged particles are what we call matter. Neutral particles can be their own antiparticles. So in this text we will mark a neutral particle that is functioning in antiparticle mode with a star (*) after it.

We have seen how an antiparticle can survive inside a dynamically configured particle ensemble. Also we must remember that the quarks in a sense are not really particles in our density of reality since they can not exist alone. They represent resonant transients -- except for the proton and its nucleon quanta increments -- standing wave patterns inside an energized proton B_u pair. **Thus all baryons and mesons except the proton are unstable.** With our notation everything seems to work out, and we do not have to make up ad hoc fractional charges. However, we do introduce the notion of leptons participating in the hadron ensembles. Our quark notation therefore automatically includes charge and isospin as well as the six well-known flavor quantum values.

Quark	Symbol	Charge
up	u, u*	0
down	d^-	-
down	d^+	+
strange	s^-	-
strange	s^+	+
charmed	c, c*	0
bottom	b^-	-
bottom	b^+	+
top	t-	-
top	t+	+

The **u**p quark and the **c**harmed quark both seem to be neutral. The charmed quark is probably another "neutrino" window above the up quark. The down quarks have positive and negative sub-flavors, as do the strange, bottom, and top quarks. They are up quarks with lepton ensembles. The top flavor is a bit less studied, since it is so unstable at our collider energy levels. I assume it is charged in parallel with the strange quark. The up, down and strange quarks match with the charmed, bottom, and top quarks. The three quark families match to the three lepton families.

LEPTON DETAILS: e^- = electron; e^+ = positron; μ- = muon; μ+ = anti-muon; ν_e = electron neutrino or eutrino; ν_e* = electron antineutrino or anti-eutrino; ν_μ = muon neutrino or mutrino; ν_μ* = muon antineutrino or anti-mutrino. The taus and their neutrinos are τ-, τ+, ν_τ, ν_τ*. (In the following chart we show the lepton quark relations, but leave out the neutrinos and understand that wherever there is a lepton, its antineutrino sidekick joins it, and antileptons have neutrino sidekicks: e.g., e-, ν_e*.)

* u = u (e+ e-).
* u = u (μ+ μ-).
* u* = u (e+ e-).
* u* = u (μ+ μ-).
* d- = u e-.
* d+ = u* e+ e+ e-.
* s- = u μ-.
* s+ = u* μ+ μ+ μ-.
* c = u τ- τ+ (Each version of u is possible.)
* c* = u* τ+ τ- (Each version of u* is possible.)
* b- = c e-
* b+ = c* e+ e+ e-
* t- = c μ-.
* t+ = c* μ+ μ+ μ-.

Note that a d+ quark consists of an anti-up quark plus TWO positrons and TWO neutrinos. The same is true for an s+, but with muons, and for the positive bottom and top quarks, with their anti-charm, double positrons and double antimuons. The charged leptons are tiny vortexes located at energy foci.

The up-quark mass is considered to be approximately one third of a proton mass. Since quarks are confined within hadrons, their average masses can be estimated from interactions in which there occur quark mixing and decay processes. That also means that their effective masses are multiplied rather than added. The parentheses indicate an option in which all members in the parentheses must be included. Quarks come with their appropriate leptons.

SOME BARYONS (All baryons consist of quark triplets.)

		(spin 1/2)	(spin 3/2) [For spin 3/2 see baryon decuplet comments below.]
p^+	=	u d+ u	
n	=	d- d+ u	
Λ^o	=	u s+ d-, u d+ s-	
Σ+	=	u s+ u	u s- u (e++)
Σ^o	=	u s+ d-, u d+ s-	u s- d- (e++)
Ξ^o	=	u s+ s-	u s- s- (e++)
Ξ^-	=	d- s+ s-	d- s- s- (e++)
Ω^-	=	s- s+ s-	s- s- s- (e++)
Λ+	=	u d+ c	
Ξ+	=	u s+ c	
Ξ^o_c	=	s- d+ c, d- s+ c	
Ω^o	=	s- s+ c	
Λ^o_b	=	u d+ b-	

SOME MESONS (All mesons are quark-antiquark pairs and have 0 spin.)

π^+	=	u d^+
π^-	=	d^- u*
π^o	=	u u*, d^- d^+ / $2^{1/2}$
K^+	=	u s^+
K^-	=	s^- u*
K^o	=	d^- s^+
K^o*	=	s^- d^+
Δ^+	=	c d^+
Δ^-	=	d- c*
Δ^o	=	c u*
Δ^o*	=	u c*
Δ^+_s	=	c s^+
Δ^-_s	=	s^- c*
B^+	=	u b^+
B^-	=	b^- u
B^o_s	=	s^- b^+
B^o_s	=	b^- s^+

BASIC BARYON OCTET (Jp = 1/2+)

	n (940) ($d^- d^+ u$)	p (938) ($u\ d^+ u$)	
	Λ^o (1116) ($u\ d^+ s^-$)		
Σ^- (1197) ($d^- d^+ s^-$)			Σ^+ (1189) ($u\ s^+ u$)
	Σ^o (1193) ($u\ s^+ d^-$)		
	Ξ^- (1321) ($d^- s^+ s^-$)	Ξ^o (1315) ($u\ s^+ s^-$)	

You can see from this chart that the neutral lambda is basically the same as the neutral sigma in the Standard Model, but our notation makes clear the difference between them and why the energies are different, because the s^+ is heavier than the d^+ and also less stable. The sigma transitions with a mean life of 10^{-20} s into the lambda, which transitions with a mean life of 10^{-10} s. All members of this octet are just excited states of the proton-neutron ground state baryon into which they decay by emitting pions.

RESONANT BARYON DECUPLET (Jp = 3/2+) (MeV Range)

Δ^- ($d^- d^- d^-$)	Δ^o ($u\ d^- d^-$)	Δ^+ ($u\ d^- u$)	Δ^{++} ($u\ u\ u$)	(1232)
$\Sigma^{\sim -}$ ($d^- s^- d^-$)	$\Sigma^{\sim o}$ ($u\ s^- d^-$)	$\Sigma^{\sim +}$ ($u\ s^- u$)		(1384)
$\Xi^{\sim -}$ ($d^- s^- s^-$)	$\Xi^{\sim o}$ ($u\ s^- s^-$)			(1532)
Ω^- ($s^- s^- s^-$)				(1672)

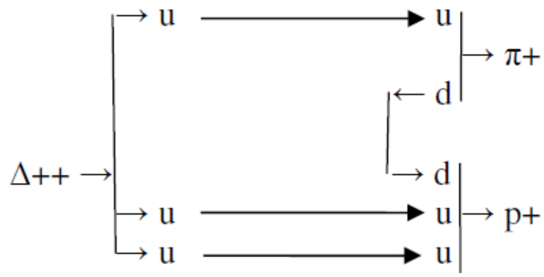
The ~ symbol on the sigmas and cascades (Ξ = Xi's) is to distinguish them from the sigmas and cascades in the Octet. The (Δ^o) and (Δ^+) look similar to the neutron and the proton. In fact they are all quite different. Each of the decuplet baryons is a triplet of quarks with NO antiquark component. This gives each one a total isospin of (+ 3 / 2). In each of these particle ensembles the quark charge is shifted in the positive direction by two positive charge units. This is due to the extra energy it takes to make decuplet resonant particles. Two extra positron-electron pairs and a lot of energy puff up each one. The extra energy load speeds up the pump mechanism, so the particle must vent more quickly. The electron input vent members of the extra pairs are pushed way outside the ensemble and the positron outlet vents are all put to work inside the ensemble draining out the excess energy. Thus the total charge on each ensemble is boosted by two positive charge quanta. The exiled electrons go off a distance from the ensemble and effectively become free electrons. The decuplets are "super-ionized". The deltas are around 1232 MeV, and the "fat" sigmas are around 1384 MeV as opposed to the "skinny" sigmas that are around 1193 MeV. The cascades (Xi's) are 1532 as opposed to 1315. The omega minus is the heaviest at 1672. All decuplet members are considered resonances except the omega minus. But it too is really just a pumped up proton resonance, as are all quark triplets. Notice that they are not quite pumped up enough to form a pair of protons or a proton and a neutron so they could stabilize.

In our system the quarks and other fermion components inside the B_u ensemble all have spin +1/2 for quarks and -1/2 for antiquarks. So the notation automatically indicates the spin orientation. As we discussed earlier, a fermion's spin is always a multiple of 1/2 because it is a boson split in half. It takes a pair of fermions to make a boson partnership. The boson ensembles are in pairs, and tend to stay together, and are not split apart. So we get spins of 0 or 1 for them. For each baryon quark cluster there generally will be two quarks and an antiquark, or two antiquarks and a quark. That is how the B_u ensemble is put together. In our notation we follow a convention of placing the antiquark in the middle surrounded by the quarks (or vice versa) because that is the way the quark wave forms are generally arranged inside the B_u system. The antiquark charge is reversed, and so is its spin orientation. Thus the lighter anti-quark baryons have the configuration (+1/2 -1/2 +1/2 = +1/2). The spin sign is arbitrary and only needs to be consistent. The baryon decuplet members are more energized than the octet members, so we end up with three quarks or three antiquarks. Each quark has spin +1/2, so we get a total spin of + 3/2. The opposite is true for the antiquark decuplet. The down quarks are slightly heavier than the up quarks, so the decuplet ensembles with d quarks are a tad heavier than those that have u quarks. Interestingly the cascades in the octet overlap the deltas in the decuplet energy-wise. This is due to the extra heaviness of the cascade strange quarks. A lot of the extra decuplet energy can be carried by the extra neutrinos that come along with the positrons.

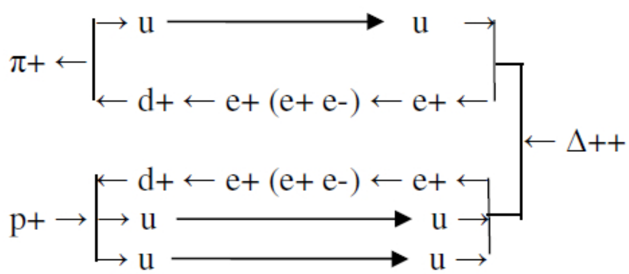
The series of delta resonances forms an interesting pattern. Each delta has the same core structure. The only difference is in the number of internal leptons. Each succeeding delta subtracts one electron (and its partner antineutrino) as we move across from negative charge to positive charge. In the chart below I leave out the neutrinos for simplicity.

* Δ^- = (d- d- d-). = (u u u), (e++, e- - -).
* Δ^o = (u d- d-) = (u u u), (e++, e- -).
* Δ^+ = (u d- u) = (u u u), (e++, e-).
* Δ^{++} = (u u u) = (u u u), (e++).

The lack of an antiquark helps the three quarks buffer the extra positrons, but these ensembles are quite unstable and disappear as soon as their resonant energy window is passed in either direction. The Δ^{++} is a puzzle from the viewpoint of the Standard Model. It turns up when highly energized positive pions are shot at proton targets (liquid hydrogen). The various deltas are possible outcomes of this interaction. The Standard Model maps the quark interaction (here showing the decay process) as follows. Go from right to left adding kinetic energy to make a (Δ++).



The quark analysis does not tell us the inside details. Here's how the Δ++ production process works in our system.



Positive Pion Interaction with Proton to Generate Δ++ Resonance

It looks a little bit more complex, but you get the same final result written in our notation. The main distinction is that we do not write our delta++ with only an up triplet (u u u), but with (u u u) (e++), which clearly includes a double positive charge in the form of two internal positrons. This explains where the double charge comes from. The production process probably results in a heavy neutral pion that goes undetected because it lacks charge. The up quark easily oscillates with its antiquark mode in the same way a photon does. So when two up quarks or two up* quarks meet, one flips over, becomes a "neutral pion", and then they annihilate. A pair of quarks is always unstable and forms a transitory meson. In the standard model it is not clear how three up quarks can generate a double positive charge. They have the right quark flavors, but the distribution of charges and the reasons for such a distribution is unclear.

What our diagram tells us is that the delta++ is a true triple up quark ensemble that has been jazzed up with extra energy so it forms a positron doublet drain hole to let out all the extra juice.

What is the original ground state triple up quark particle that contains a u* quark? We know it has no net charge, and its energy is much lower than a delta++.

* u
u* → u* e+ e-.
u

Bingo!! It's positronium! The energy of an ordinary triple u quark ensemble is too low to have a central drain in its core. It only supports a positron and an electron in orbit around each other. The triple u antiparticle (u* u u*) is the other kind of positronium. So this gives us ortho- and para- positronium as two possibilities.

With our new quark model and notation we can construct all the weird lepton "atoms". For example, we can also make muonium in the same way as positronium by just adding more energy to our triple u with a pair of muons. We can get all kinds of combinations of leptons forming temporary wave patterns, but at too low an energy level to develop a nucleon with a central drainage system. Here are some additional possibilities; (3u) indicates an up quark triplet or anti triplet (u u* u) or (u* u u*).

* (u u* d-) = (u u* u), (e+, e- -)
* (d- u* d-) = (3u), (e+, e- - -).
* (u u* s-) = (3u), (e+, e-, μ-).
* (d- u* s-) = (3u), (e+, e- -, μ-).
* (s- u* s-) = (3u), (e+, e- -, μ- -).
* (u c* u) = (u* d- s+) = (3u), (e-, μ+).
And so on.

Hey, wait a minute! What are we doing here? We are describing lepton ensembles in terms of quark ensembles! If we recall our proposal that the up quark is actually the "fourth" neutrino, the "missing link" between the leptons and the hadrons, then the above expressions contain nothing but leptons. The up quark, just like the other neutrinos, functions as our quantum energy accountant. We realize that by making a slight adjustment to the Standard quark notation to fit our B_u ensemble theory, we have also in one stroke achieved an elegant lepto-quark unification. In fact, if you look back over all the quark expressions given above, you will see that with our system all hadrons are made from up quark "neutrinos" and leptons as their basic building blocks. Aside from the up quark "neutrinos" all other quark labels are just macros. So we have achieved another deep level of simplification and unification.

Before taking leave of the delta series, we should mention that there are two sigma series, one of which is in the light baryon octet, and one which is in the Resonance Decuplet just below the delta series. These two sigma series work the same way as the delta series. The only difference is that the sigmas have one muon replacing an electron. Here is the octet sigma triplet.

* Σ- = (d- d+ s-) = (3u), (e++, μ-) e- -.
* Σ^o = (u d+ s-) = (3u), (e++, μ-) e-.
* Σ+ = (u u* s-), e++ = (3u), (e++, μ-).

The decuplet sigmas just have the anti-up quark flipped into an up quark:

* Σ- = (d- s- d-) = (3u), (e++, μ-, e- -) (2 e- expelled)
* Σ^o = (u s- d-), (3u), (e++, μ-, e-) (2 e- expelled)
* Σ+ = (u s- u), (3u), (e++, μ-) (2 e- expelled)

The octet ensembles are less energized versions of the decuplet particles. Both are written in the Standard Model with the same quark signatures, which does not distinguish the fine structural differences. In our notation the neutral lambda, the octet sigma and the decuplet sigma are each written differently in ways that signify the differences in their masses and decay times.

Although the Octet series and Decuplet resonance series look the same in Standard quark notation, they have very different energy levels. The Standard Model does nothing to explain this. With our notation we can clearly indicate which series we are talking about and we know exactly why that series has the energy level that it displays.

Now let's take a quick look at the mesons.

LIGHT (0-) MESON OCTET (NONET)

K^o (d- s+)		K+ (u s+)
π- (d- u*)	π^o, η (u u*, d- d+ / $2^{1/2}$)	π+ (u d+)
K- (s- u*)		K^{o}* (s- d+)

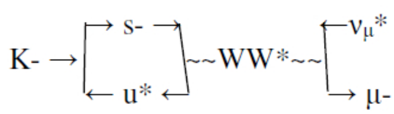
The η is an eta meson which usually decays into a triplet of pi mesons with net zero charge. There is a heavier octet/nonet that has rho mesons in the middle row as well as omega and phi mesons. The high energy neutral mesons are formed by (u u u* u*), (u u d+ d-), (u* u* d+ d-), . . . ensembles. We can mix and match all the pair combinations of up and down quarks that give neutral values. The up quark alternates with itself, so in a situation where two up quarks are joined, one oscillates to its anti-quark mode, and then the two annihilate. The upper and lower ranks of the meson octet are filled with heavier kaons that have strange quarks in them. **The rule for mesons is that they always consist of a quark paired with an antiquark.** We also follow that rule, although our notation shows explicitly the spin and charge on each meson, so we do not need all those other quantum numbers. A key observation we might make at this point though, is this. If the mesons are all made from combinations of quarks with anti-quarks, and they have mean lives about the same as most of the baryons, why is it that no one has considered the possibility that the baryons with their triple quark ensembles might also combine quarks and anti-quarks? I believe our theory provides justification for this approach, and it makes just as much sense as building mesons from quarks and anti-quarks combined. We have shown with a simple physical model that a dynamic energy system can be formed of very opposite components that find a joint condition of homeostasis, thus allowing for the stable existence of the proton.

The Roles of W and Z Bosons in Mesons and Baryons

One important principle in Observer Physics is that all bosons have no net charge. The W, Z and H (Higgs) bosons have mass in Standard Theory. The W bosons catalyze redistribution of energy, mass, and charge. The recently found H bosons (at about 125 Gev) are so evanescent that it will take some time to see what, if any, their role is. They may just be fat Z bosons. It is hard to imagine (as claimed by many) that a particle with mass is responsible for the magical creation of mass in the gauge field theories and by extension also the mass of the fermions. If H gives out mass but already has mass, then who gave it its mass other than Mr. Higgs? Maybe it mediates interactions with very heavy fermions. In Observer Physics I propose that nothing in the universe has intrinsic mass. We as observers parcel out the mass when we introduce resistance by our own decisions. We encode this in a measurable way with the universal constants, but then absolve ourselves of responsibility and then wonder where all the inertia came from. In the next chapter we will reveal the details with a mathematical description of how this happens.

The W bosons are funhouse mirrors that deflect and distort particle systems by shuffling the energy and momentum among the participants in the system. Their interactions may be reversible, but are below the energy threshold to reflect a particle in time without distortion. Z bosons act like conjugate mirrors and primarily reflect particles in time as well as space. They are associated with creation and destruction, but if you count up all the particles, what goes in and what comes out is always equivalent. The most relaxed state is the photon condition. Oddly, because photons are bosons, you never can be sure just how many there are. They can all glom together. From an observer viewpoint, the only limit on photons is how many the observer can handle. That, of course, depends on the design of the apparatus used for perception and cognition. It would appear that the number of photons is undefined but finite due to the inherent limitation of the apparatus of perception (measurement). The vacuum state willingly coughs up as many as the observer wishes to experience, and these may be ramped and amped via the Z and W bosons to whatever level is sustainable.

Our next example is a negative kaon (K-) decay interaction via the W boson. The negative kaon meson is made of a negative strange (s-) quark and an anti up quark. The quarks are looping in time in almost parallel trajectories, so they look like one particle that quickly annihilates.



The muon antineutrino bounces off a WW* boson pair, time-reverses, and juices up into a muon. The negative charge is transferred by the W boson pair from the s- quark to the negative muon. Notice how when particles reflect in time they seem to change mass and can seem to lose or gain a charge that comes from or goes to elsewhere. There is mixing and matching.

Recall that the negative strange quark "decay pattern" is:

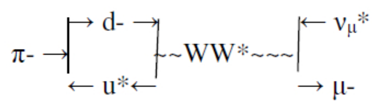
* s- → u, μ-, ν_μ*.

If we swap the up quark over to the s- quark side, it flips into its anti-quark identity and forms the negative kaon:

* s-, u* → μ-, ν_μ*.

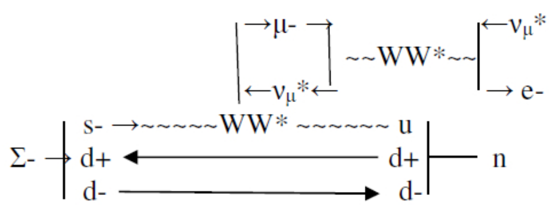
The WW* boson pair catalyzes this process, as the diagram above shows.

Here is negative pion decay by the same mechanism, but running at a lower energy:



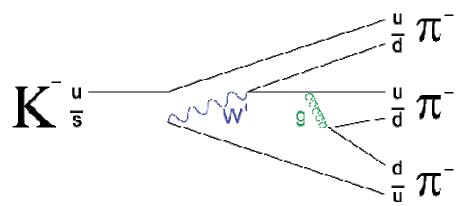
The quarks loop in time forming the negative pi meson. The W reflects a muon antineutrino around, and in the process amps it into a muon. It also passes the d- quark's negative charge over to the muon. Note the gravitational slingshot effect the heavy (W) particle often has. This slingshot effect is a typical W boson function. The Z boson does it also, without changing the mass of the particle, but flipping its charge.

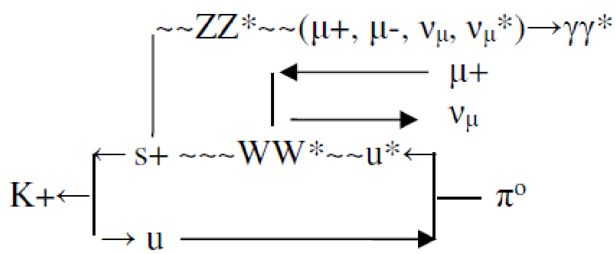
Here is a sigma minus decay pattern, resulting in a neutron and a negative lepton:



Here the s- quark decays dropping the sigma into a neutron (n). The W boson pulls off the muon and an antimutrino, transmitting the s- quark's negative charge to the muon. Later the muon decays into an electron. The antineutrinos mix with the lepton energy exchange as the muon decays. This shows the other way a W boson operates -- down-stepping quarks by pulling off lepton whorls, and then stepping them down to electrons or positrons and neutrinos. The neutron later beta decays.

Over 63% of positive kaon (K+ = s+, u) decay goes via WW* to μ+, ν_μ, but there almost surely is additional energy carried off during this process as an invisible neutral pion and also a pair of muons and mutrinos that immediately decay to photons via ZZ*. About 20% of the time you get a positive pion (d+, u) instead of the anti-muon and then the invisible neutral pion (or two). The d+ carries more energy. A little over 5% of the time you get two positive pions and a negative pion, all of which continue decaying. You can see that the positive and negative pion pair are the same as two neutral pions and decay via ZZ*. The **Wikipedia** Feynman drawing of that outcome shows a gluon connecting to the dd* pair. We know from our analysis that the positive strange quark has two anti-muons and a muon associated with it, so it is really loaded. The anti-muons will decay into positrons, which is the same as a positive strange decaying into a positive down, which gives us the positive pion (d+, u). The other extra energy manifests as a down quark pair and an up quark pair that can be analyzed as a pion pair or a neutral pion pair. The gluon is just another way of representing the shedding of energy during the decay that becomes a shower of particles that return to leptons and photons.





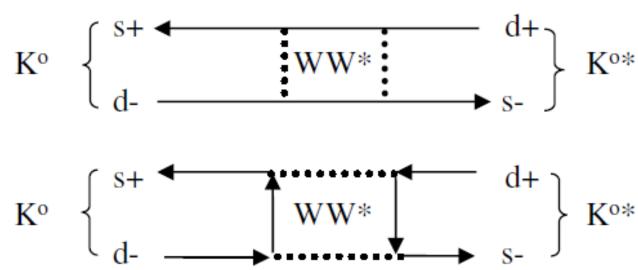
This is a slightly more complex version, showing how the excess energy drains off. The gluon is not necessary to understand what happens. The bottom line is that the kaon is an energy overloaded meson that is very unstable and has multiple decay pathways.

The Z boson is closer to the photon-coupling interaction, and there is always a certain amount of background Z interaction in any photon-dominated interaction. At high energies Z dominates, and photon coupling accompanies. Here is a sample of a Z interaction: e+, e- ~~~ZZ*~~~μ+, μ-. This interaction can go either way, depending on the energy. Toward the right is formation, and toward the left is decay. The Z can take a particle pair right down to a photon pair, because the charges balance.

Further research is needed to fully understand the role of the D-Shift Operator % in these interactions, although it seems reasonable that the bigger boson (Z) would take on the responsibility for pair production and annihilation. Both the W and Z intermediate bosons are doing energy step-up/step-down transformations, which is just what the D-Shift Operator does in mathematical space. This may be the connection. Space has an innate energy density, as the vacuum permittivity constant ε_o indicates.

We see that gravity in the form of the G constant plays a key role in the structure and operation of the B_u, Z, and W bosons. The photons do not play this game of operating on mass, because they are without [detectable] rest mass -- although large masses such as stars, galaxies, and black holes can distort the photon trajectory. The gravity-operation bosons are all bosons that carry "mass". The primary role of photons is to define "motion" and facilitate energy transport over "distances".

When we say that the B_u, Z, and W have "mass", this is actually a bit misleading. We often associate mass with stability. Perhaps this is a misconception. You will never see one of these particles hanging around. They are highly transitory. It turns out that EVERYTHING is highly transitory, even the apparently stable proton. Therefore it is better to think of these particles as big bubbles of energy that well up from the vacuum state to echo the energy transitions that occur among the particles. This is simply an expression of Newton's third law of action and reaction. If you drop a rock into the water, there is a kerplunk, and then a big glob of water rises into the air for a moment. Then the water settles back down with ripples disturbing the whole body of water. In other respects these heavy bosons are no different from photons. The only remarkable thing is that the heavy B_u bosons can form a pair that finds a stable range of equilibrium that allows matter to build into complex structures.



The above diagram shows how standard theory explains "neutral particle oscillations" in terms of the neutral kaon meson. This type of mixing interaction is general and is particularly common with neutral particles that can easily flip into their own antiparticles. One of the fascinating results of this oscillation is the occurrence of CP violation among the neutral kaons. Parity violation already exists with the neutrinos as we have seen. This deeper symmetry violation is only restored at the level of CPT. The decay rates of the various (T) neutral kaons balances the CP violation. So far the neutral kaons are the only particles known to have CP violation, but there may be other CP violations with the higher energy particles called hyperons that have not been studied very much yet. However, a unified theory demands that there be overall CPT symmetry. The kaon asymmetry at CP level may be a useful way to orient oneself in strange corners of the universe. It also may help explain how there got to be more matter than antimatter, and thus should be considered together with the theory that much of the missing antimatter is preserved inside the stable baryons (protons, and neutrons when protected by protons).

Baryon and Atomic Structures

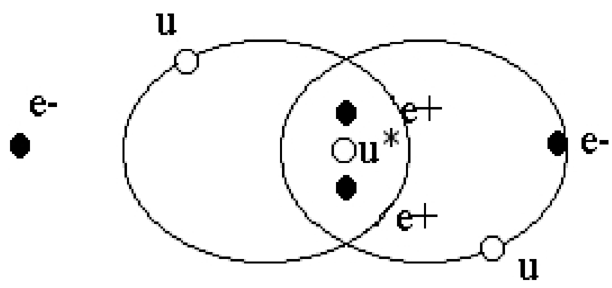
Below is a set of rough sketches of what some of the baryon/nucleon structures may look like. The components of these drawings are not to scale, and they may not be completely accurate, but they give a flavor of what we are talking about. The diagrams all resemble two hearts, apples, or eggs having sex. The basic structure is a four-particle mixing phase conjugation system with a twist. Instead of using mirrors, we use the black hole force of gravity and the white hole force of Hawking radiation to direct the energy flows. This generates spin, polarity, charge, and so on. It also causes the space-time in and around the particle to be thoroughly warped.

The drawings are all variations on a single structure. As the structure grows in complexity, its inner core undergoes a series of bifurcations in its wave structure. I suspect the whole thing is a fractal, and that the core grows with a binary cascade system bound within the lens vesicle.

A binary star system is configured as two overlapping ellipses. Each ellipse has two foci, a positive and a negative one. The positive focus has a positive mass and a positive charge. The negative focus has a negative mass and a negative charge. These are relative values. When the two massive objects of the binary system have equal masses, the positive foci overlap in the center-of-mass position. Thus they look like a single particle with a double charge. The quark formulas produce such "doublets". To save space sometimes I write e++ for the positron double vortex in the center of the proton and (μ++) for an anti-muon doublet. The positive charge centers there. The two negative foci swing about outside like yellow jackets attracted to autumn apples. Because of quantum uncertainty, the paths may not be flat like stellar orbits, but three dimensional with rapid precessions. In the proton case one negative focus is internal and cancels the charge of one positive focus. The other negative focus is spinning around at a distance and appears to be an electron attracted into an orbit around the proton to balance the charge of the second positive focus. In the neutron case both negative foci are internal, so the particle as a whole seems to have a neutral charge. The charges always gather around the foci, just as with magnets the magnetic flux gathers at the north and south poles. The foci themselves have no "internal" structure. They are just vortex points where energy gathers or disperses. This is why we see internal structure for protons, but not for electrons. The electron's "internal" structure is "externalized" and found in the proton. The structure of electrons and neutrinos is dependent on and integrated with the ensemble structure of the proton. After the subatomic diagrams, we will briefly introduce a theory of the atomic structures.

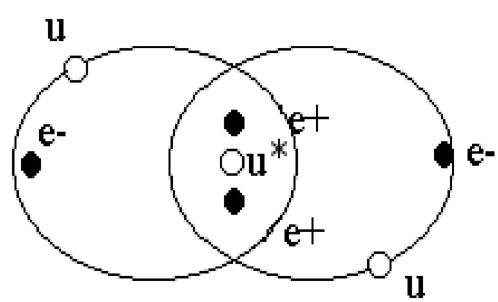
Examples of Baryon Internal Structures

These drawings are not to scale, nor are the relative positions of the components any more than a rough estimate of a dynamic environment. Neutrino sidekicks are understood to accompany each lepton in some form to balance the spins as well as the particles and antiparticles. Orbital electrons are much farther away from the baryon and tend to spin, precessing in ring-like patterns I will discuss later.



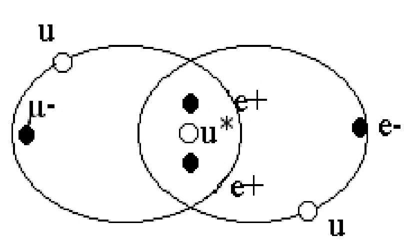
Proton

u
p+ → d+ = u* e++ e-
u



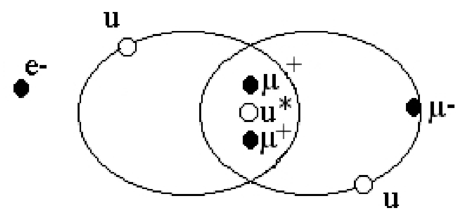
Neutron

u
n → d+ = u* e++ e-
d- = u e-



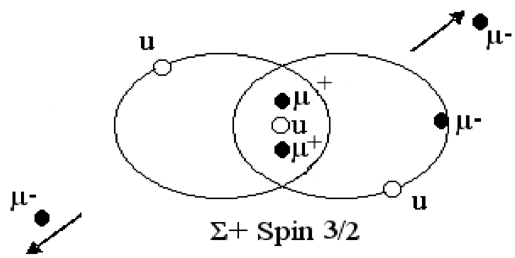
Λ°

u
Λ° d+ = u* e++ e-
s- = u μ-



Σ+ Spin 1/2

u
Σ+ → s+ = u* μ++ μ-
u



Σ+ Spin 3/2

u
Σ˜+ → s- = u μ-
u
μ++ (2μ-)→

Charge comes from "internal" lepton components, and resultant spin comes from chargeless quarks, since the internal leptons always are in spin balance. The sigma plus has a more energized resonance. Its decuplet resonance has 3 up quarks, a muon, and two anti-muons. Two muons are pushed away, leaving the particle "ionized". Thus the charge is the same as an ordinary sigma plus, but the spin is 3/2. The exact positions of the anti-muons are uncertain, but they are highly transient. The sigma minus (Σ- → d- d+ s-), cascade neutral (Ξ^{o} → u s+ s-), cascade minus (Ξ- → d- s+ s-) and omega minus (Ω- → s- s+ s-) shown below all have resonant versions in the decuplet: (d- d- s-), (u s- s-), (d- s- s-), and (s- s- s-). The resonant particles look like their lower energy cousins, but have a different spin value due to the core quark not being an anti-quark.

d- = e-
Σ- → d+ = u* e++ e-
s- = u μ-

u
Ξ^o → s+ = u* μ++ μ-
s- = u μ-

d- = u e-
Ξ- → s+ = u* μ++ μ-
s- = u μ-

s- = u μ-
Ω- → s+ = u* μ++ μ-
s- = u μ-

The spin (3/2) Ω minus version has three s- quarks plus two extra muon pairs -- with 2 anti-muons inside and two muons rapidly pushed away.

s- = u μ-
$\Omega^{\sim}$- → s- = u μ- μ++ μ-- →
s- = u μ-

u
$\Lambda+_c$ d+ = u* e++ e-
c = u τ+ τ-

The charmed quark is a neutrally charged composite of an up quark, a tau minus and an anti-tau plus. Thus it is pretty wound up and unstable in our normal energy environment. Below is another example of a charmed baryon -- the charmed omega neutral.

s- = u μ-
Ω^o_c → s+ = u* μ++ μ-
c = u τ+ τ-

u
Λ^o_b → d+ = u* e++ e-
b- = u τ+ τ- e-

A negative bottom quark is a charmed quark with an extra electron attached to it. All the swirling vortexes balance out, so the bottom lambda has a neutral charge.

Deuteron

3 u
d+ = u* e++ e-
(u d+ u) + (d- d+ u) d+ = u* e++ e-
d- = u e-

The deuteron is a combination of a proton and a neutron into a single particle. There are four internal positrons and three internal electrons, resulting in a net positive charge. The third internal electron rides in a girdle orbital. A fourth electron is in the 1 s orbital to balance the charges. By comparing with the charmed particles, we find that a deuteron is similar to the heavier baryon particles, but has three extra quarks.

Hydrogen Molecule

$$2\ (u\ d+\ u) + 2e- \rightarrow 2\ (u\ d+\ d-)$$

A hydrogen molecule is a two-proton system. The two protons form a double neutron configuration. The charges all balance. So the only difference between a hydrogen molecule and a deuteron is that one of the s-orbital electrons is inside. A deuteron is considered an isotope of atomic hydrogen, and the hydrogen molecule is much more prevalent than the deuteron, because the two electrons like to form a Cooper pair in the s orbital. Two neutrons clumped together tend to be unstable and they usually each emit an electron into the s orbital and form a hydrogen molecule. A few hang on as deuterons. Sometimes three neutrons clump together and one electron pops out (p+ n n). This forms tritium, which is an unstable isotope of hydrogen that decays into helium 3, which is a quite stable, but relatively rare, isotope of helium 4. Nevertheless it is found in the Earth in very small quantities.

* $^{3}_{1}T \rightarrow {}^{3}_{2}He^{1+} + e- + \nu_e*$.

Helium 4 is probably the most balanced of all elements. It has 2 protons and 2 neutrons. The two protons each provide an electron to the s orbital, so that orbital is filled with a spin-balanced Cooper pair

Helium Atom

8	up quarks
4	anti-up quarks
8	positrons
6	electrons
2	s orbital electrons forming a Cooper pair

Helium 4 completes the first period of the periodic table of elements and has two protons and two neutrons. The helium 4 system is very stable and chemically inert because all the charges are balanced and both positions in the first orbital are filled.

Mechanical Physicality of Forces

I have already described how the gravitational force at a very close nuclear distance overpowers the repulsive force between positively charged protons and allows them to cling together and form atomic nuclei. Adding neutrons increases the gravitational force without increasing the electrical force. The gravitational force is much stronger than one would expect from the mass of a proton with its gravitational mass of 10^{-27} kg.

The binding force derives from the mini black hole that is formed from the overlapping interaction of two B_u particles. Maybe my theory is just an alternative explanation for the theory of gluons, but it is much simpler and does not require inventing a new kind of force with a funny rule about asymptotic freedom, lots of new gluon particles and color charges.

We definitely need to move toward a mechanical explanation of the electrical force. I proposed that all the forces originate from types of resistance in the awareness of the observer. However, on the physical level we require that the resistance manifest as a mechanical form of repulsion or other mechanism. The attraction of gravity arises when attention shifts from resisting unity to perceiving and interacting with local phenomena. The initial resistance remains as a momentum to separation, but a global tendency of physical phenomena to rebound to the original equilibrium of unity not only persists, but gathers momentum as the attention continues preoccupied locally. The initial push into separation occurred in a state without inertial mass, but the relaxation occurs when there already is inertial mass from the observer's viewpoint, so there are physical consequences.

The electrical force is a secondary resistance that always acts locally. It also is bipolar and has the characteristic that like charges repel, whereas opposite charges attract. It would appear that charged particles emit a form of virtual particle that affects space between the particles. Space, time, and mass are three inseparable components of physical reality. Photons (attention particles) have an effect on space. The grand tendency of the universe is to return to unity. Unity is broken by splitting it into complementary pairs. When the photons and anti-photons emitted by complementary pairs mutually encounter, they mutually annihilate and cancel an amount of space between them. So the interaction of opposite charges appears to make the oppositely charged objects draw closer together. If the charges are the same, then it is photon against photon or anti-photon against anti-photon and the result appears to push the EM-emitting charged particles further apart. The bias is in the charged leptons, not the photon pairs. They just transfer the energy as a force between the biases. The photons have a force that we can describe as the energy divided by the wavelength (or the energy times the period). From this we can calculate the effective photon mass via a wavelength for the charged particles and the Coulomb force that operates between them.

* $F_\gamma = m_\gamma c^2 / 2\pi r = k_C e^2 / r^2$, where $k_C = 1 / 4 \pi \varepsilon_o$.
* $m_\gamma = e^2 / c^2 2 \varepsilon_o r$ and $m_p \approx (\% e / c)$.
* $m_\gamma = m_p^2 / 2 \varepsilon_o \%^2 r$, where $r = \lambda / 2\pi$.
* $m_\gamma = m_p^2 \pi / \%^2 \lambda \varepsilon_o$.
* $m_\gamma \approx 10^{-43}$ kg m / λ.

If our photon wavelength happens to be high up in the gamma band (around 10^{-17} m), then we get a photon with a mass of 10^{-26} kg, which is right around the nucleon watering hole. So two protons interact via a high energy photon with the electrical permittivity of the vacuum state and the "Coulomb force" relation and we get protons and neutrons. Slightly longer wavelengths (about 10^{-13} m) produce electrons. And so it goes.

High energy gamma is like a cosmic ray and can pop protons right out of the vacuum under the right conditions. In the formula we have two protons interacting, while the photon interacts with the vacuum permittivity (an inherent matter density of the vacuum = 8.854×10^{-12} kg/m^3 in a space defined by its wavelength times the ratio of $\%^2/\pi$).

I calculated for a proton or an electron emerging from a single photon pair. The basic electrical interaction is between a proton and an electron, between a proton and a proton, or between an electron and an electron. The flow of photons is a constant flow of photons between the charged particles exchanging energy and exerting force. Thus the average photon energy will be much less. For example, the ionization energy for a hydrogen atom is 13.6 eV, so that is its "binding" energy. If an electron gains that much energy, it becomes "free" and is not held in an orbital. The electron in its ground state absorbs a photon with 10.2 eV energy and moves to its second level. Then its binding energy to the proton drops to 3.4 eV. From level 2 to level 3, it gains a photon with 1.89 eV and ramps up to 12.09 eV of what it needs to gain freedom. Each level requires less energy (.66, .3, .17, .1, .07 until the 13.6 is reached). At the same time it absorbs and emits external photons and shifts energy levels, the electron is constantly emitting photons that flow into the proton as inward-directed bremsstrahlung, and this interaction keeps its inherent Heisenberg volatility curving in its bounded path connected to the proton. The bremsstrahlung photons destroy space that the momentum of the electron would use to move away from the proton. Absorption by electrons of incoming photons (from other electrons) boosts the electron energy up by the resistance so it can move in a path further away from the proton, so these photons produce "space". Now a 10.2 eV photon has less energy than an electron neutrino and corresponds to about 1.81866×10^{-35} kg, which is about 50,000 times smaller than an electron mass-wise. The photon is in the ultraviolet range, about .12157 μm, 2.466035 PHz. However, it does not need to create an electron, just boost an existing one to a higher level, converting the photon energy into the electron's kinetic energy. The electron will soon relax and shed the energy by emitting a similar photon and returning to its ground state. Associated with the shift of level will be .866 nm wavelength that is perhaps the size of the orbital boost.

The boost to level 3 only takes a photon with 1.89 eV, which corresponds to a mass of 3.369×10^{-36} kg and comes to about 656 nm, or 456.941 THz. Associated with the shift will be a shift of about 4.675 nm. Each level takes less energy but boosts the electron a greater distance, given its existing kinetic energy. Eventually there is not enough force binding the electron, and it floats or zips away into free space and gets involved with other adventures leaving the proton ionized and perhaps ready to form a chemical bond with another atom or pick up another electron as the local energy level relaxes back down.

How does an electron move when bound to an atom? In chemistry books they draw a spherical shell around the proton for a hydrogen atom’s s orbital, with a lozenge shape or two slightly overlapping spheres for a hydrogen molecule. The electron is moving very fast in a curved trajectory that means it must be losing energy constantly and should quickly spiral into the nucleus. It does not do so, because there is a constant exchange of energy with the positrons in the nucleus. The motion of the electron is also a tiny electrical circuit with three components: the photons going to the nucleus, the electron going in a path orthogonal to that radiation as an electrical flow, and a magnetic force forming around the path of the electron like a tube, so that the electron motion forms a roughly torus shape. Physicists like to use a time-independent wave equation to describe the electron as if it forms a fuzzy stationary probability shell around the nucleus. This is misleading in many ways, because the bound electron is a very dynamic phenomenon.

So we need a clearer model of the electron itself and then we can move to a model of how it behaves when "bound" to an atomic nucleus. We recall that phenomena emerge from three "twists" of resistance made by an observer plus a shift of attention from global to local, holistic to particular. Resistance to unity results in a pretended separation of reality into self and not-self. Placing attention on the local details of the not-self then relaxes the attention on maintaining the resistance that started the pretense, and the system rebounds back into unity -- which manifests as gravity. However, in the meantime, the various twists of viewpoint generate the appearance of electromagnetic forces and real physical phenomena. Solidity of the real world is merely local electrical resistance to other local electrical resistance -- electron pushing against electron in the charade that the observer has created for herself. Welcome to the “Fight Club”. (A movie starring Brad Pitt and Ed Norton.)

There is only undefined awareness. Awareness defined as "objective" becomes light (EM phenomena). Light (EM phenomena) only transmits between charged leptons. All perception depends on organizing a set of charged leptons to emit and absorb EM photons from another set of charged leptons. Nuclides and nucleons are a handy means to set up grids of charged leptons for various kinds of perception and other photon exchanges. They hold the charged leptons into reliable patterns so the exchanges are not just random chaos.

The electron-positron pair is the fundamental dynamic unit for setting up such grids. The positrons are embedded in nucleons and hold electrons in their periphery. Everything that passes as experience and perception is exchanges of photons between peripheral electrons. Only with advanced technology can we learn to manipulate the basic molecular and atomic grid structures so as to manipulate the photon laser tag video game at a deeper level. (For an undetermined length of time this knowledge has been habituated and dropped into the “subconscious” area of mind to function as an automated system. Only recently is it beginning to resurface as people begin to bring some attention to the way in which attention functions within awareness. There is much to relearn, and we live in exciting times when our magical mind box is reopening.)

We described how an electron-positron pair is created at a point in space-time by knocking it out of the zero point surface of the Dirac energy sea. It is like knocking a marble out of its hole on a Chinese checkerboard. The marble then rolls around on the board, and relative to its motion, the hole it came from also appears to roll around in space and time. As long as the pair can be kept separate, they interact by exchanging photons across space-time. (Ah, the limitations of analogies.) If the marble, or another identical marble, encounters an empty hole, it falls in and stops the motion of both the hole and the marble. The marble returns to the zero point and releases all its rest and kinetic energy as two photons -- one for the electron, and one for the positron. So the number of "particles" remains the same, but the photons have no rest mass, but spread the energy back throughout the whole board until and unless they are “absorbed” in such a way that they knock another particle-hole pair loose.

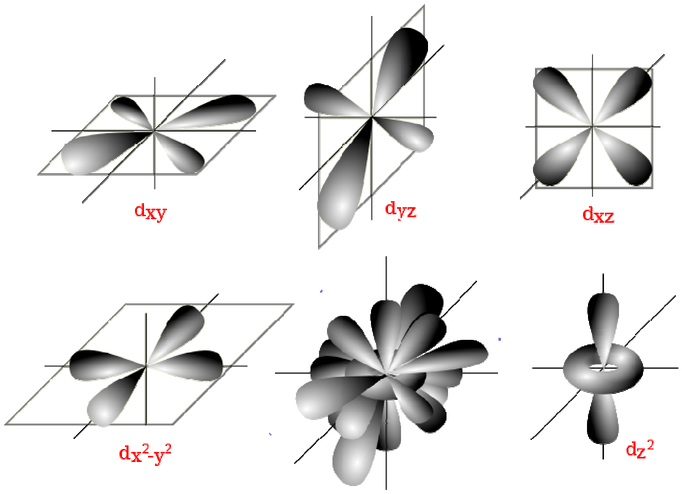
The electron behaves like a point from which photons flow into space-time. The photons expand outward from the point in a spiral motion that starts slowly in the dense central origin point and then accelerates according to the cyclotron pattern as its model until the photons reach c from the external observer's viewpoint. Then they radiate as probability waves in all directions through space-time until they collapse into a specific photon impulse when they encounter another electron or a positron or other charged lepton. In the case of a positron, they then wind inwards in a time reversed version of the electron until they pass out of space-time at the singularity point in the center of the positron's disc. The photons then emerge from the nearest partner electron's core point and complete the ongoing local and nonlocal circuit.

The photon moves along and the electrical force radiates outward from it. The magnetic force then wraps around the trajectory. That is why we experience electrons exchanging photons, radiating electrical force and generating a magnetic tube that when wrapped around the core point forms an axis with an up and down pole. The "spin" of the electron is due to the unwinding disc of the photon motion, but is not really an object spinning like a top. The apparent kinetic rotational motion of the disc and its radius are:

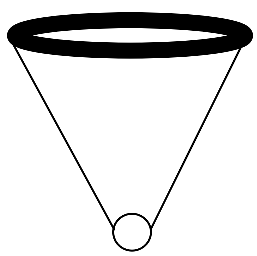
* $\omega_e = E_e / h = 5.111\times10^5\ 1.602\times10^{-19} / 6.626\times10^{-34} = 1.235\times10^{-20}\ s^{-1}$.
* $r_e = (E_e/m_e\ \omega_e^2)^{1/2} = [5.111\times10^5\ 1.602\times10^{-19} / 9.109\times10^{-31}\ (1.236\times10^{20})^2]^{1/2} = 2.426\times10^{-12}$ m. We can also express r_e simply as $\lambda = h / m_e c$.
* $r_e \omega_e = c$.

We imagine the photon-antiphoton pair looping around the perimeter of the disc at speed c and then radiating through space-time at the same speed. Notice that the radius of the electron perimeter (10^{-12} m) is much larger than that of the proton (10^{-15} m). So charged leptons have to be crunched down to exist inside the proton event horizon. Of course, the photon is also crunched down inside the lepton's disc by the energy density. Because of the magnetic effects we might imagine the electron gets to look more like an apple wrapped around a core, and the photon disc might appear to be like a ring, although we are unable to see it, since we can only perceive via the photons that the electron radiates and extrapolate from there and from larger scale phenomena that suggest the microstructure.

The basic electron structure is a circulating photon motion with a magnetic axis and precession. The structure tends to be attracted by the positive charge of the proton, but stays at a distance due to its large disc, precession, and Heisenberg uncertainty requirements. Although the s orbital is usually drawn spherical, I think it is more likely lopsided because there is still an electron in the proton. A bound electron also tends to push away from other bound electrons connected to the same nucleus. So we end up with something that in chemistry books looks like balloonish flower petals that stick out in various directions, keeping as far apart from each other as possible.



Above is an example of how the d orbital system is put together. Below is Kanarev's model of a hydrogen atom. He envisions the electron ring pushed to one side, so the charge is lopsided on the atom.



The hydrogen molecule is 2 protons with a pair of electrons (1 spin up, and 1 spin down). The first is parahydrogen, and the other two are orthohydrogen.

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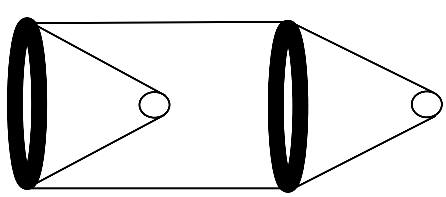
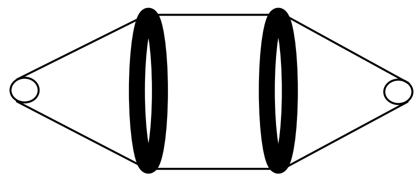
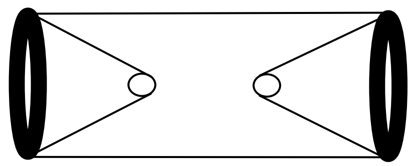


parahydrogen



orthohydrogen

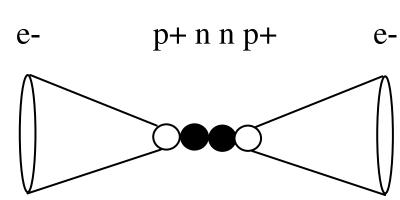


orthohydrogen

Diagram of molecular hydrogen based on Ph. M. Kanarev, **Foundations of the Physics and Chemistry of the Microworld**, 10-3 "Models of the Hydrogen Molecule", p. 68. (Not to scale) In orthohydrogen the electrons are more separated between the protons or are positioned outside the protons. In the case of parahydrogen the electron and proton alternate in sequence. The vectors of angular momentum ***h*** and the magnetic moment ***M*** have the same direction in a given particle. There is also a possible but unstable molecular ion of hydrogen in which two protons share one electron between them. The hydrogen molecule is stable at normal Earth temperatures.

Once the 1 s orbital is full as in molecular hydrogen or atomic helium, the charges and spins are pretty well distributed in the ensemble. Atomic helium is extremely stable and chemically inert. From the 1 s orbital onward the 2 s, p, d, and f orbitals fill according to the usual description.

You can extrapolate from these rough sketches past helium on up the periodic table with the usual electron orbitals and corresponding nucleons. As the nucleons grow heavier -- even from lithium on -- they look more and more like clusters of proton and neutron balls with their components all shifting about and exchanging. To me that does not make much sense. Professor Kanarev believes that the neutral neutrons tend to be in the center with the protons on the periphery where they can also interact with the electrons in their thrall. So, for example, he believes that helium 4 has two neutrons lined up in the center with a proton at the far side of each neutron. Then the electrons extend out from each proton.



Kanarev's Model of Helium 4

Moving on up to lithium Kanarev shows three neutrons in a row with a fourth branching out 90 degrees from the middle neutron. The three protons are appended to the three neutron branches and an electron protrudes from each proton. Beryllium then forms a cross shape with 5 neutrons in the center. Boron extends out with a fifth proton in the third dimension. Carbon completes the other side of that dimension and we have three intersecting dumbbells, which may also form a flat hexagonal shape. Nitrogen extends a seventh electron out orthogonal to the flat hexagonal version. Oxygen then completes the axis on either side of the hexagon. To go further into these aspects of atomic and chemical structures gets beyond the scope of this writing.

The Rule of Helium

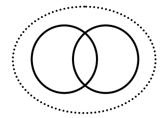
Among all the atomic elements the simplest and most fully balanced is probably helium 4. It is so balanced that it is chemically inert. The helium nucleus has two protons and two neutrons. The mass of an alpha particle, the nucleus of a helium atom, is $6.64465675(29)\times10^{-27}$ kg. An atom is about 6.64648×10^{-27} kg. The mass of a neutron is $1.674927351(74)\times10^{-27}$ kg, and four times that is $6.699708404\times10^{-27}$ kg. There is a difference of about$.053229404\times10^{-27}$ kg. The helium atom is lighter than four neutrons. The proton mass is $1.672621777\times10^{-27}$ kg. Two neutrons and two protons added together have a mass of $6.695098256\times10^{-27}$ kg. So there is a gap of mass that makes the helium atom lighter than the sum of its parts. This tells us that helium is really the ground state of hydrogen, and this is the energy released during the fusion reaction, famously derived in the hydrogen bomb and promised as a solution to the energy challenge if the technology of controlled fusion reactions can be mastered.

The missing mass is released as photons and kinetic energy during fusion reactions. We are lucky that hydrogen does not like to fuse into helium easily, otherwise much of the material of the universe would become inert, and we would lose the valuable and chemically very active hydrogen atom that plays a critical role in the water molecule and all sorts of organic molecules. Life might not happen in such a universe.

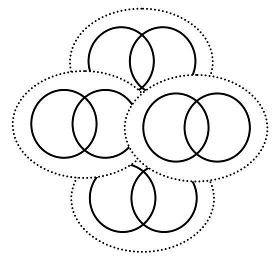
The ability of the B_u pair to be stable whereas a single B_u particle is unstable is also of great importance to the buildup of diverse elements in our universe. The relative instability of neutrons as opposed to the extreme stability of protons is another aspect of this issue. Let's see how hydrogen and helium are connected through the B_u interaction.

A B_u ensemble in its ground state has a "rest" mass of $1.85927308591\times10^{-9}$ kg. A pair interacting has $3.45689640798\times10^{-18}$ kg^2. Notice how the interaction of the two bosons **reduces** the net mass in a counterintuitive fashion. If we suppose that the third component mini black hole has another mass of $1.85927308591\times10^{-9}$ kg^{-1}, then the outcome of the three interacting will be $6.42731445213\times10^{-27}$ kg. The third component acts like a powerful anti-mass that anchors the whole ensemble.

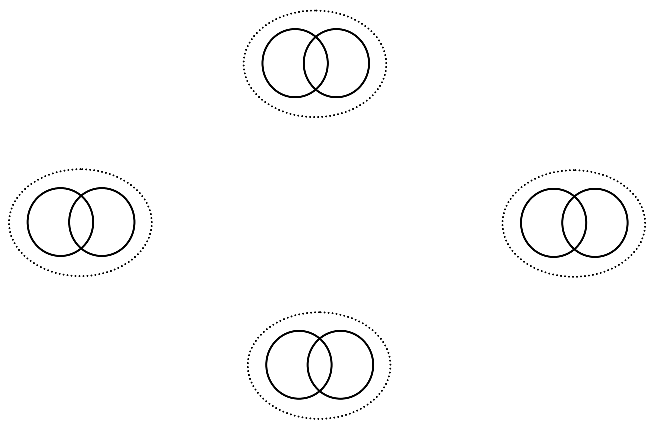
* $(1.85927308591\times10^{-9}\text{ kg})(1.85927308591\times10^{-9}\text{ kg})\ (1.85927308591\times10^{-9}\text{ kg}^{-1})$



B_u pair vibrating mass: 6.43×10^{-27} kg



Helium atom (6.6447×10^{-27} kg)



Four atoms of monoatomic hydrogen ($6.690487108\times10^{-27}$ kg)

The Big Bang is all around us all the time. The expansion happens instantly in about 10^{-43} s as the observer's habit of attention drops down to the local level of awareness to which we are accustomed. Fortunately during inflation in the early universe we expand and cool too fast past the fusion window temperature, so the fusion of lots of active hydrogen gas is left to cook slowly into helium and heavier elements in the cores of stars.

The illusion of diversity comes from the super fast vibration of the B_u pairs. By 10^{-12} seconds into the Big Bang expansion (10^{15} K) the electroweak unification breaks down and matter starts to appear distinct from energy. But radiation still dominates. The quarks become bubbles of resistance and the radiating photons hold the space between them. By around 10^{-8} to 10^{-6} seconds (10^{13} K) the quark-hadron transition occurs, and quarks and anti-quarks mutually annihilate into EM energy, leaving only the few B_u ensembles that happen to be overlapping. The quarks condense into hadrons that are still tightly packed -- fundamentally neutrons interfaced with pions and some other mesons. The universe at this stage is a very dense neutron star. Heavier proto-particles occur and decay as the expansion continues. Clusters of four neutrons form proto-helium, and some form real helium, but the energy is still too dense for it to stabilize. The hadrons in soup form behave a bit like the way water molecules interact in their liquid phase. At around 10^{10} K, 1 second after the Big Bang, nucleosynthesis begins.

The neutron soup thins into neutron plasma, and proto-helium in the form of loosely associated nucleon clusters becomes more common as the neutrons begin to decay into protons. From 10^9 K the cosmos enters the lepton era. At this density leptons and anti-leptons still survive in large numbers and dominate. At around 10^5 or 10^4 K (10^{12} seconds) almost all the electrons and positrons annihilate into photons leaving only the ones that can drop into orbits around nucleons or are already trapped inside nucleons. From this point on we enter our current era in which there mostly remain just the surviving ensembles of nucleons floating in a soup of neutrinos and antineutrinos, photons and anti-photons. The density of radiation keeps dropping as the expansion continues. The photon wavelengths get longer and longer and the background temperature of the photon soup gradually drops to the 3 K it has today.

The neutrons spread, decaying into protons generating hydrogen plasma. As the temperature cools to below 3000 K, the plasma condenses into molecular hydrogen gas, which is quite stable, but capable of active chemical reactions in a suitable environment, once the heavier elements are available. At the lower density the positive charges on the protons do not allow them to cluster and fuse naturally into helium or heavier nuclei on their own. So we end up with a primarily hydrogen gas universe, instead of helium, and the secondary observer resistance of electric charge created a buffer zone.

The early universe has a dominance of hydrogen and small amounts of helium, tritium, and deuterium. Over time the hydrogen clouds collapse gravitationally and condense into stars, cooking helium and the heavier elements by the fusion process. This has gradually raised the amount of helium up to its current level of about 25%, plus enough heavier elements to make planets and moons possible with a great variety of ecosystems.

Over the long haul an ultimate gravitational collapse back into the primordial singularity of the B_u particle is inevitable, and beyond that an undefined state of pure light awareness continues unchanged. By virtue of the reality that all phenomena consist of cyclical wave forms, the universe as a whole is also a cyclical wave form that must go through its cycle, whatever its period, and return eventually to its Poincaré Peak, that we can think of as an "origin" or simply as a moment in a cycle that passes through various phases.

For the universe to keep expanding requires that organisms and their minds must keep shrinking relative to the universe. This certainly does not match the evidence we have in terms of either inorganic or organic evolution. It suggests that the belief in "separation" becomes a permanent reality that leads eventually to a reduction down to point value isolation. However, such a description of reality is self contradictory. Any system that has a beginning and an ending is not a permanent and sustainable reality.

What we have here is definitely a "view-point" in which an observer looks at a point and then convinces himself that he is that point. Even the process of "convincing", by itself, is contradictory. It suggests that there is a series of phase transitions from one state to another state that an individual does not know about. The problems with that include finding where the first state came from and where or what the final state is. And what comes after the final state? If it is all a permanent equilibrium after the final state, why is it not in that permanent equilibrium final state right now? And how is that any different from an arbitrary initial state? What we are left with is a subtle awareness that we already and always have known that reality is a permanent state of equilibrium, and that all experiences, whether physical, mental, spiritual, or whatever, are local viewpoints regarding various aspects of that permanent equilibrium.

If the universe is expanding from a unitary starting point as physicists are fond of saying these days, why is human consciousness unable to expand with it? Does not an expanding physical universe mean that our bodies and minds are shrinking in comparison? If we are all expanding together, then how is that expansion? We may return to the "Expansion Exercise" (Avatar Mini Course #4, "Perspective: Creating Definition", Exercise 7, downloadable from www.avatarepc.com) that suggests how any individual may expand her viewpoint to embrace more and more of what has been defined as separate, unconnected, and unrelated. This process is effortless unless a person has a strong resistance to it -- in which case the only obstacle is the person's own resistance. As the process continues, more and more aspects and components of the individual's reality can be incorporated into the expanding viewpoint. Eventually it is possible to make the "quantum leap" and include everything -- physical, mental, spiritual, or any other dimension, quality, quantity, or property -- within a unitary viewpoint. That being achieved, all that exists is observed to be within the viewpoint of the observer, and the Gnab Gib occurs.

It may turn out that cosmology is more a matter of observer viewpoint than anything else. If we include within our viewpoint the notion that the fundamental property of EM phenomena, which not only include light, but all other forms of experience, is that light from its own viewpoint never moves and therefore is not subject to the passage of time. Time is only involved with transformations of mass-energy in space relative to separatist viewpoints. The unitary viewpoint of light never moves or changes.

Since we as human observers only experience via the EM (light) interaction, and always experience from the viewpoint that we have chosen, we also never move, or change -- and therefore by definition are immortal light beings. Notions about gravity, strong, weak, and mechanical forces are all discovered to be secondary beliefs that are never subject to our direct experience -- once we put our experience to the test of close inspection. Oh, I feel my feet pressing down on the ground due to the attraction of gravity. Actually, I only feel the electrons on the bottom of my feet resisting the electrons on the surface of the ground. (I have never seen an electron, so my experience is just the skin on the bottom of my foot pressing against the ground.) That is an EM phenomenon, and gravity is only a secondary excuse to explain "why" those particular electrons or pieces of skin and soil happen to interact electromagnetically. Closer inspection reveals why those particular electrons happen to interact in that way.

In chapters 14 and 15 we will examine the properties and mechanics of gravity in more detail. For now, my suggestion is to practice the expansion exercise until a simplistic sense of familiarity develops with regard to the unitary viewpoint. Then, in our next chapter (13) we will develop a general mathematical framework that clarifies the coherent structure of a unitary viewpoint, and the permanently stable universes that it describes. **I do not say "creates" because a permanently stable system by definition is never created or destroyed -- it simply exists.** The good news is that we can describe such realities, and modern science has come closer than many people realize to realizing how it all is. And maybe now we can see the truth and begin to play creatively with that insight on a whole new level of familiarity.

The universe appears to keep expanding as the consequence of a habit of focusing attention down toward a point value while failing to assume responsibility for that initial impulse to focus down from an experience of the whole. Every material object and organism that does this downshift of attention eventually does so simply by habit and does not seem to know any better. From time to time a few beings step out of this habit and gain the freedom to roam the universe at will. Perhaps mankind soon will awaken his full power of attention and awareness that quietly waits as the certainty of everyone's true nature. Then we will consciously enjoy the value of wholeness as we enjoy the values of the parts. So let's "build" some universes that of necessity already always have, and always will exist.