Phase Conjugation Feynman Diagrams

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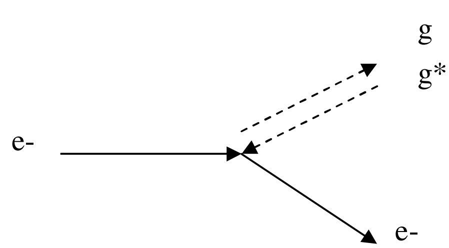
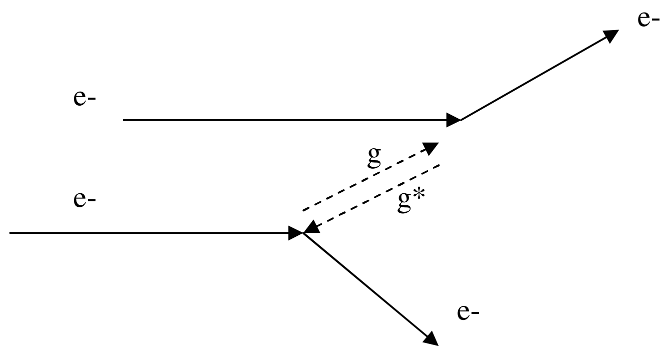
All physical phenomena are mediated by electro-magnetic (EM), gravitational (G), strong, or weak interactions. We can further simplify this scheme by noting that ALL interactions among any kind of particles or waves are governed by the laws of phase conjugation and involve 4-particle/wave mixing of some kind. Thus, in a formal sense all Feynman diagrams should take the form of 4-particle/wave mixing phase conjugation diagrams. In this way we can update some Feynman diagrams found in physics books (including some shown in **Observer Physics**, chs 11-13.)

In this article I provide a few examples of how we can use the model of phase conjugation to explore the inner workings of physics with Feynman diagrams. In the following diagrams left-to-right represents passage of time, and the vertical dimension represents translation in space. The dashed arrows represent bosons and the solid arrows represent fermions. The star wave sign (*) represents an antiphoton or other antiparticle. Mathematically it is the conjugate wave function. Charge is represented as (-) or (+), the plus sign also indicating the antiparticle of the negative particle.

Here is a Feynman diagram of an EM interaction in which an excited outer orbit electron (e-) changes energy levels and emits a photon (g). Drawn in left-to-right mirror image with arrows reversed it represents an electron absorbing a photon. The presence of an antiphoton (g*) indicates an observer. The antiphoton goes faster than light and thus backward in space/time, so its arrow direction is opposite that of the photon. Fermion particle antimatter pairs also move opposite directions in time, though they usually scatter at angles from each other in space.

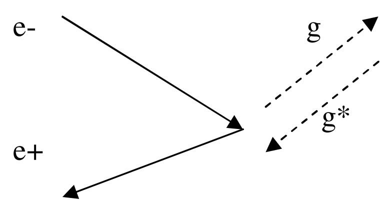


The electron in this diagram drops to a lower orbital and emits a photon. Standard Feynman diagrams of electrons or positrons interacting with photons are usually Y-shaped. They ignore an anti-photon that travels in tandem with the photon. The whole interaction is a phase conjugation quantum bubble. The anti-photon is an attention particle coming from an observer's eye (or some other absorber). The observer absorbs the photon with an outer orbital electron in his eye. This is how he "sees" the atom whose outer electron has emitted the photon. By adding the electron that absorbs the photon we can expand the process into the following perfectly balanced diagram. The observer is in the upper part of the diagram.



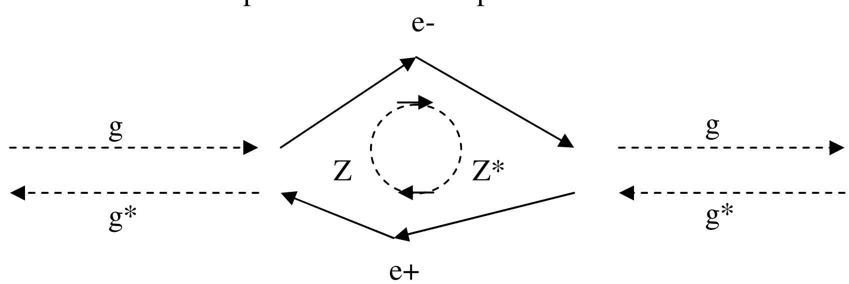
We see here where Newton's third law comes from. The observer's awareness puts the photon into a localized space/time loop. The anti-photon is the opposite phase of the photon loop as it circulates in space/time. The electrons get scattered apart in space/time according to Newton's law as a result of the EM distortion. The time distortion is represented by the shift in electron energy (orbital level). The g/g* loop for a single photon can stretch out indefinitely far in space/time.

Here is an electron-positron annihilation event. Again the Y-shaped Feynman diagram requires a photon/anti-photon loop to show the phase conjugation.

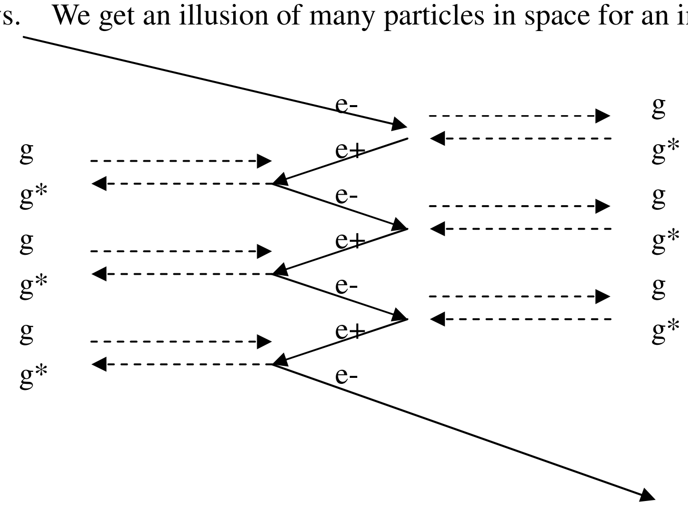


Over time charge and momentum are conserved and so is the total number of matter and antimatter particles. Every interaction event involves only two fermions and two bosons. Anti-photons correspond to the attention particles of observers (photon absorbers). This means that when a particle of matter annihilates back into energy, it frees up attention particles (anti-photons). In the case of the observer seeing an atom via the EM interaction (as in the previous diagram at the top of the page), we see that the anti-photon there is NOT free attention but part of a localized photon loop. It is bounded on one side by the observer, and bounded on the other side by the electron on the atom that was observed. The photon/anti-photon loop links the observer and the object observed. The observed atom and its electron represent fixed attention (not to mention the atom in the observer's eye.) The observer chooses to identify with one end of the link and projects the other end of the link to an "outside" location. At some future time an observer may choose to observe an electron-positron annihilation event or a photon emitted from an electron as it drops in orbit. At that time he will provide from his reservoir of free attention the needed anti-photon to complete the photon loop by observing that event. Then something like the top of the observation diagram (top of page 2) will take place as the photon/anti-photon pair interacts with an electron in his eye. The only difference for a positron is the electron's sharp scattering angle. The very energetic photon loop reflects it backward in time.

In the next diagram we have a pair creation event coupled to the pair annihilation event we just discussed. This shows a complete quantum bubble, which may be a virtual event or an actual event spread over a wide space/time interval.

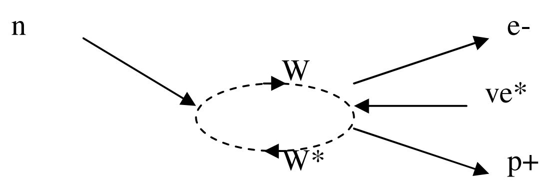


This diagram complex introduces the Z boson "neutral current reaction", a particle/wave that mediates any kind of fermion pair creation and pair annihilation event. The Z is usually thought to be very short range, but in a way this is not so. If the pair separates widely, the Z creates the illusion of the space/time that separates the two components. This is a very powerful interaction that can give us the experience of multiple particles coexisting over vast stretches of space/time. So the size of the above quantum bubble is totally arbitrary. The Z boson creates the space that allows the photons to propagate across long distances between particles that seem far separated. A Z boson loop is just a very energetic photon loop as this space-like event shows. We get an illusion of many particles in space for an interval of time.

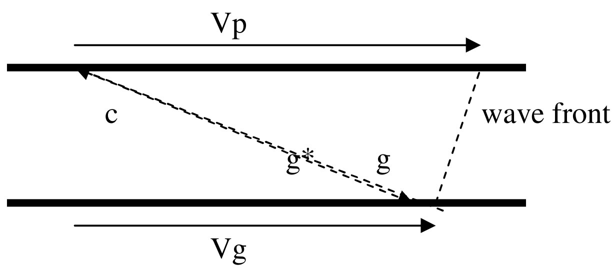


It has occurred to some physicists that there may only be a single electron in the whole universe bouncing back and forth in a space/time filled with photons.

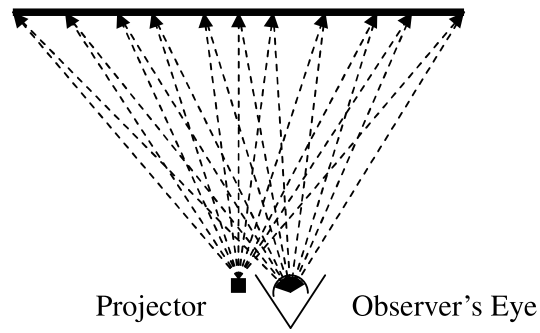
Now we consider the W boson, another highly misunderstood particle/wave that governs what is usually called the “charged current reaction”. Whereas the Z boson mediates the creation and annihilation of antimatter pairs, the W boson mediates the exchange of mass among individual fermion particles. The previous two types of diagram showed first the exchange of photon/attention energy and the creation/annihilation of antiparticles without any change in the mass of the particles. The W boson occurs in the Weak interaction (hence the letter W.) This has to do with the boosting or decay of mass/energy in a particle. The W boson has NO CHARGE, contrary to standard theory. It is merely a catalyst and passes lepton charges through. No bosons carry charge. Only the heavy leptons (electron, muon, tauon and their antiparticles) carry charge. All other particles (bosons, neutrinos, and quarks) lack charge. The apparent charge on some quarks is due to attendant leptons. The heavy leptons have charge because they carry the apparent vortex spin of a self-interacting photon wave guide (See **Observer Physics**, ch. 11), whereas the other particles do not. The next diagram shows the decay of a neutron into a proton as it is usually seen, except that the W here forms a loop. (This updates **OP**, 11.8)



The charge balances out on both sides, but the mass of the neutron (n) shifts down to that of a proton (p+) as it emits an electron anti-neutrino (ve*) and an electron (e-). The anti-neutrino has switched sides in the time sequence of the interaction because the decay releases a lot more energy than the mass of an electron when it drops to proton status, and the anti-neutrino must carry that excess energy away. This shifts its trajectory forward in time to make up the difference and the direction of the trajectory reverses from neutrino to anti-neutrino. When we look back at the photon interaction and the pair annihilation diagrams, we see that they are the same interaction with one component of the interaction reversed in time. The general rule in decays is that each heavy lepton has a corresponding anti-neutrino sidekick, and each heavy anti-lepton has a corresponding neutrino sidekick. The W boson is a very short-range and ephemeral loop, so we can almost ignore it except for the rule that bosons mediate every change in state. In interaction events we always alternate boson pair, fermion pair, boson pair, fermion pair, and so on. Fermion pairs tend to scatter at angles, and boson pairs tend to hug together or loop tightly unless they are in a waveguide environment that appears to split them apart like fermions. In that case they not only scatter at angles, but one slows down and the other speeds up. Otherwise they go at light speed. Boson pairs obey the Einstein/de Broglie velocity relation: the group (slow) velocity times the phase (fast) velocity equals light speed squared. The boson is its own antiparticle, so it usually just translates at light speed in space with its partner going the opposite direction in space/time. In a klystron we can see a simple example of the Einstein/de Broglie Velocity Relation "splitting" a photon pair.

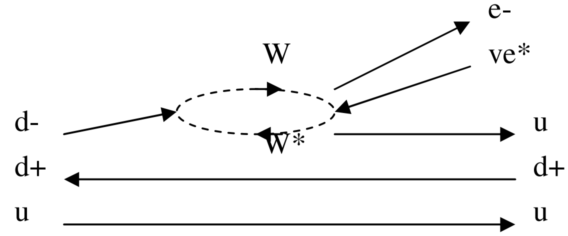


Here we see a photon (g) and anti-photon (g*) viewed as a particle zigzagging down a klystron tube. It moves at speed c, but, due to the zigzag path, its progress down the tube is only at the group velocity (Vg) which is always less than (c). However, the photon is also a wave. The wave front is a line passing through the photon at an angle normal to the photon's trajectory. The wave front moves along with the photon at (c), but, due to the angle of the photon's trajectory relative to the klystron wall, the wave front sweeps the wall at a phase velocity (Vp) which is faster than (c). The phase velocity and the group velocity are actually both "group" velocities because they both involve the interaction of the photon event with the wall of the klystron. The photon is actually moving in all directions and reflecting off the klystron in all directions. The zigzag path of the photon in the tube is the resultant of all the mutual interferences of the photon waves and the electrons in the klystron wall. In a straight tube the ratio of (Vg) to (c) is the same as the ratio of (c) to (Vp), so the product of (Vg) and (Vp) is always (c) squared. You can see from this that if an observer waiting at one end of the tube receives a signal from a source at the other end of the tube, the signal will arrive down the tube at the speed (Vg). The EM signal seems to be going slower than (c), but the actual situation is that the photon signals travel at (c) in a zigzag path down the tube. The anti-photons also travel back from the observer to the source along the same zigzag path. But the apparent path is straight down the tube at (Vg). While the signal passes down the tube once, its wave front sweeps back and forth along the sides of the tube numerous times at superluminal speed. Theoretically an observer standing away from the klystron and to the side could "see" this display of sweeping. Projecting a slide image onto a screen works this way, and we can actually see it.



The slide projector sends the image at the speed (c) from the slide to the screen, magnifying it to cover a large area. The image reflects from the screen to the observer's eye at the speed (c). But every photon of light that goes to make up the image arrives simultaneously at the screen. The whole image also reaches the observer's eye from the screen all at once. (We can curve the screen so that all the photon paths are the same length.) The observer processes the image signal consisting of thousands of bits of information at one shot in parallel at speed (Vp) rather than in series at speed (Vg) as in the case of the observer at the end of the klystron tube. He takes in the full area of the screen and all the information on it in a single glance. The paths of the anti-photons are exactly the opposite of the paths of the photons. The observer and projector can just as easily switch places. The net distance the image travels is just the distance from projector to eye. However, the image reaches the eye at a speed slower than (c), having reflected between the projector and the screen and back to the observer's eye. This creates a time lag.

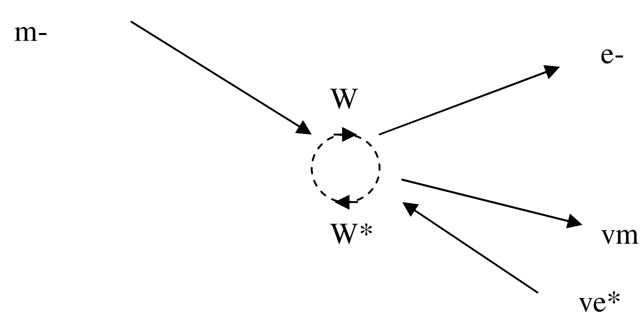
If we go back to our neutron decay diagram and take a closer look, we see it is really quark "decay". The up quarks and neutrinos have no charge. The down quarks seem to have charge, but that turns out to be due to attendant leptons that carry the charges. A neutron contains an up quark, a negative down quark, and a positive down quark (u, d-, d+) and therefore has a net neutral charge. When the neutron decays, the d- drops its attendant electron and antineutrino and becomes a neutral up quark. The result is a positively charged proton plus the emitted leptons. So we modify our previous diagram as follows, adding the more detailed quark structure.



The normal situation would be that an electron neutrino (ve) enters the scattering zone along with the (d-). But here we see the neutrino's arrow on the other side of the boson loop. This reverses it in time so it becomes an antineutrino that arrives from the future to knock the electron away from the quark. The (d+) and (u) quarks, equivalent to a positive pion (P+), pass through the interaction unchanged leaving the baryon quark cluster with a net change to a positive charge. As before an observer sees the electron pop forward in time and infers the antineutrino. There is a definite energy transition between the state when the leptons are bound to the quark, and when they are free. The W boson loop mediates this energy interaction. We begin to suspect that the true interaction here is related to a negative pion (P-) which consists of a down quark (d-) and an anti-up quark (u*). The process might look like this:

(d-), (u*) --> . . . . . --> (e-), (ve*), (g), (g*).

In the low energy range we get W boson interactions that look like the electron orbital shift except for the mass exchange. Mass exchange requires a boson with more punch than a photon loop. We need a W boson loop. In the next diagram (m-) is a muon, and (vm) is a muon neutrino. Properly speaking, a muon and its attendant muon antineutrino sidekick mediated by W boson loop decay into an electron and its electron antineutrino sidekick. However, the dominant muon decay diagram shows an energetic electron antineutrino moves backward in time and then encounters a muon head-on. This interaction throws up a W boson bubble loop in the scattering zone. The muon loses mass and drops down to a stable electron state as it passes by the scattering zone. The fast moving electron antineutrino bounces and reflects forward in time from its head-on collision with the W loop. This slows it down, reverses it in time, and increases its mass into a muon neutrino (vm). It picks up mass from the muon and also converts some of its momentum into mass.

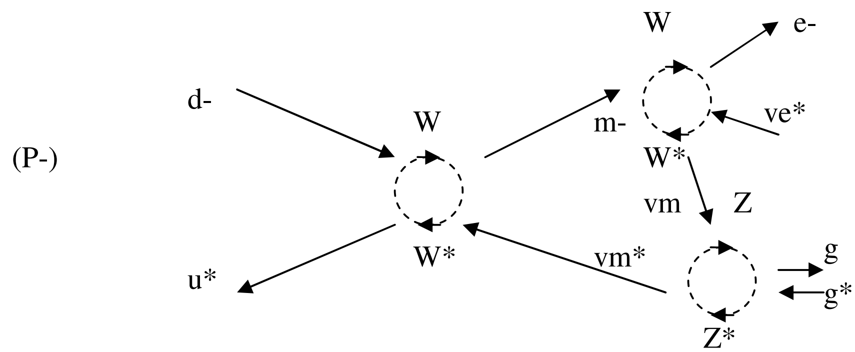


Compare this diagram to the neutron decay diagram and you find they are the same basic pattern with muons substituted for the quarks. The extremely light electron neutrino can ricochet off the scattering zone at various different angles in space/time to balance the energy equation.

The mesons are ephemeral quark pairs that form tight little loops during quark mixing and many virtual interactions very close to or within the nucleons. The lightest mesons are the pions which are composed of up and down quarks paired in various ways. In observer physics up quarks are all neutral, and down quarks are divided into positive and negative types. The decay mode of the charged pions (P-, P+) is 100% into a muon carrying the pion's charge plus a muon neutrino sidekick for positive anti-muons or a muon anti-neutrino sidekick for negative muons. The neutral pions (Po) decay almost 100% into photons through pair annihilation.

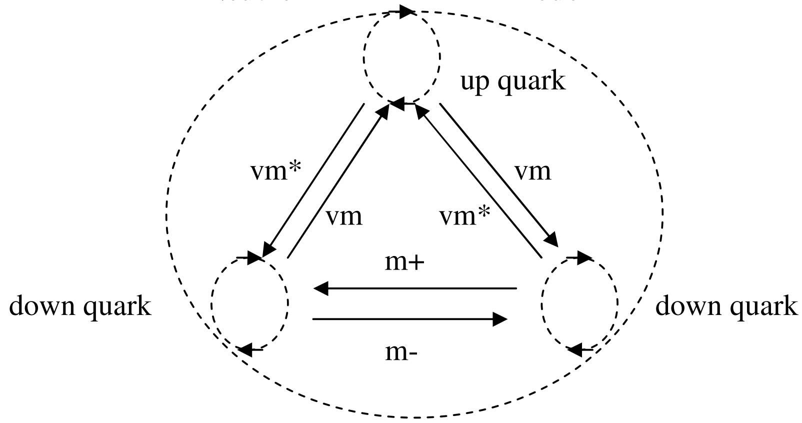
- Pion+ --> u, d+ --> m+, vm
- Pion- --> u*, d- --> m-, vm*
- Pion o --> u, u* --> vm, vm* --> g, g*
- Pion o --> d+, d- --> m+, m- --> g, g*

Here is the decay pattern of a negative pion (P-) as a Feynman diagram



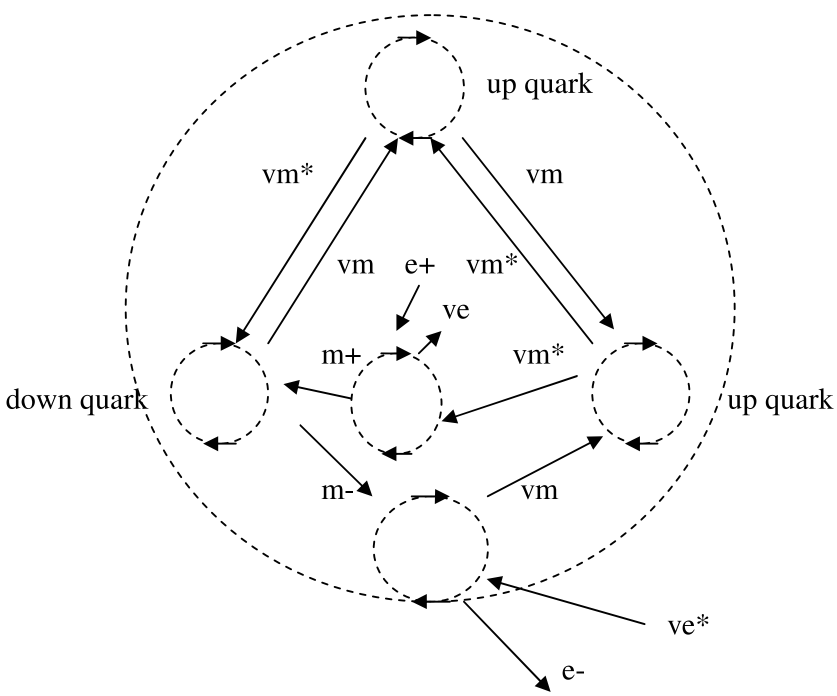
The previous diagram of muon decay shows up in the upper right hand corner of this diagram. The muon neutrino and muon antineutrino cancel out via a Z boson loop, reducing to photon radiation. The decay mode of the positive pion (P+) is the same, but with charges reversed and all particles shifted from matter to anti-matter and vice versa. Since the negative muon decays spontaneously into (e-), (ve*), plus a muon neutrino, which annihilates with the muon anti-neutrino left over from the first stage of decay releasing photons, the negative pion is really made of an electron, an antineutrino, plus some extra energy. (The positive pion is the same with particles reversed into their anti-matter partners.) The upper part of the diagram represents the path of the down quark, and the lower path represents the path of the anti-up quark. The pair annihilation of the muon antineutrino looks like the decay of a neutral pion (Po --> u, u*). If we put this all together, we have what looks like a **neutron** made of a (P+), (P-), (Po) all interacting in a triangular relationship.

Neutron Model

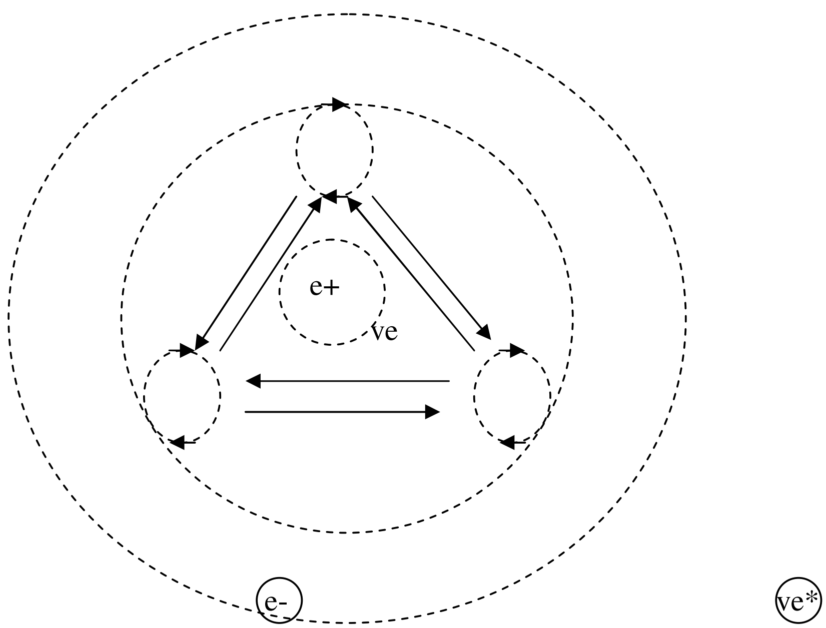


An isolated neutron is unstable and spontaneously undergoes beta decay, turning into a proton. This decay is necessitated by Heisenberg uncertainty that requires distance between the closely packed virtual leptons unless they are squeezed from outside by additional pressure.

Neutron Beta Decay Model

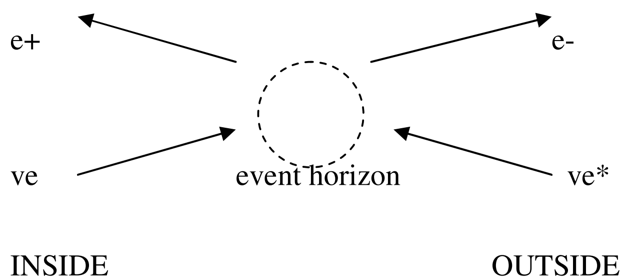


Here we see the detailed mechanics of beta decay as a neutron transforms into a proton. As soon as pressure from neighboring nucleons is relieved, the virtual muon pair that circulates between the two down quarks undergoes its spontaneous decay routine. This converts one of the down quarks into an up quark. The muon is on the outside part of the virtual loop, so the electron and antineutrino move outward, while the positron and neutrino move inward and become trapped inside the circulating neutrino energy. Once the decay completes we end up with a triangle of muon neutrino/antineutrino virtual pairs that circulates via three up quark boson loops around a core that contains a positron and an electron neutrino inside a neatly locked anti-electron trap that keeps the prisoners isolated from the electron and antineutrino on the outside, allowing the outside electron to continue as a real particle without annihilating with its antimatter partner. This model demonstrates how the matter and anti-matter of the universe remains always perfectly balanced even while apparently allowing for the long-term existence of stable matter.



The above diagram of a single hydrogen atom schematically shows an electron in orbit around a proton and a free electron antineutrino in the space outside the atom. The proton consists of three up quarks (boson loops) exchanging virtual muon neutrino pairs to form a shield around a positron and an electron neutrino. The proton bubble acts as the scattering zone for the event: No gluons are needed because the up quarks and the muon neutrinos have no charge.

The quarks are more than mere pi mesons because the total mass of three pions plus seven neutrinos plus a positron comes to less than half the mass of a proton. So this is not how we calculate the mass. The "pi mesons" act as mini black holes and suck in more and more mass energy. However, such mini black holes are paradoxes, because they are also unstable and emit Hawking radiation. They radiate and eat protons at a super-fast rate. The system reaches an equilibrium when it collapses into two overlapping boson bubbles, each around 1.86x10^-9 kg. Each is what I call a Bu boson (Unity Boson). This overlapping pair precisely reaches equilibrium when it unifies the gravitational and EM forces. The overlapping zone becomes an anti-up quark with an "inverse mass" of about 1.86x10^-9 kg^-1 (see endnote). Because the bosons are inextricably linked into a single system, we must multiply their masses. This results in the mass of four protons, or proto-Helium. Thus a single proton is actually part of a quartet that forms an atom of Helium. However, for various reasons such as Heisenberg uncertainty the quartet is usually found in pairs of Hydrogen molecules and only stabilizes in its Helium format when compressed in the cores of stars. The quartet is actually an illusion created by superluminal vibration of the boson components of a single particle just as we saw earlier in this article that a single electron can appear to be several electrons by zigzagging in space/time.



According to observer physics each heavy lepton (electron, muon, tauon) has its corresponding anti-neutrino sidekick, and each heavy anti-lepton has its corresponding neutrino sidekick. The proton mini black hole traps a positron and an electron neutrino inside the event horizon while an electron and an electron antineutrino move about outside the event horizon. The event horizon serves as a boson loop that mediates the interaction. This also fits the model of black hole radiation developed by Stephen Hawking. Because the Hydrogen molecule is really half a Helium atom vibrating rapidly across an interval of space, we realize that the secret to fusion is not to heat the Hydrogen, but to cool it. If we cool a Hydrogen gas down close to absolute zero (or at least to its liquid phase) and apply a proper harmonic vibration to it, it should coalesce into liquid Helium with an attendant release of energy. It should be possible to control this process.

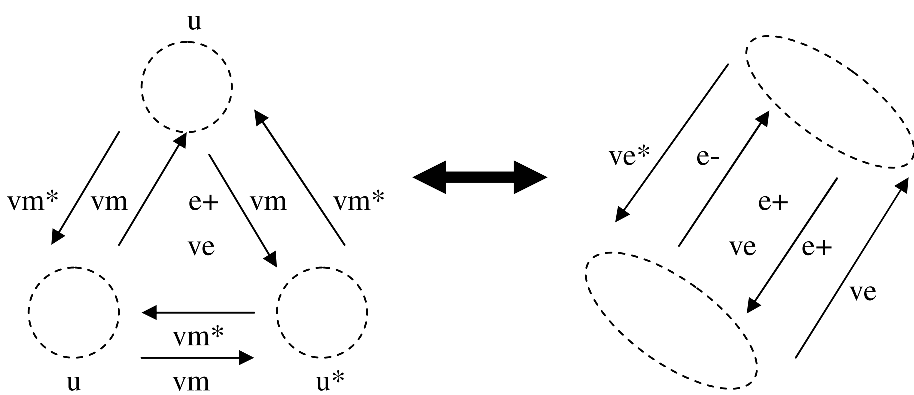
Another interesting aspect of this model is that, in addition to quark mixing, what we also have inside a proton is muon neutrino mixing. Three muon neutrinos add up to an electron (3*.17 MeV = .51 MeV). Three muon anti-neutrinos add up to a positron. This means that inside the proton we have the equivalent of two up quarks, an anti-up quark, two positrons, and an electron plus some neutrinos (as predicted in the **Observer Physics** papers, 11.26, 12.25, et al.)

- n = u, d-, d+, m+, m-, vm, vm, vm*, vm*.
- p+ = u, u, u*, vm, vm, vm, vm*, vm*, vm*, e+, ve (e- ve* external)
- p+ = u, u, d+ = u, u, u*, e+, e+, e-, ve, ve, ve* (e-, ve* external)

Of course, each positron has a tiny electron neutrino sidekick, and the virtual electron has a tiny electron anti-neutrino sidekick. These neutrinos move relatively slowly and have almost no mass compared to muon neutrinos (perhaps about 15 eV as opposed to .17 MeV), and are thus negligible components of the mass. In other words, the model I give here is virtually identical to the one I give in **Observer Physics.** However, in this paper I show how we can trace back from the known 100% reliable neutron decay mode and the pi meson decay modes to deduce the exact internal structure of the proton. The muon neutrino configuration and electron-positron configuration oscillate back and forth rather like an ammonia maser. By identifying the oscillation frequency it should be possible to set up a resonance that induces the electron-positron phase to tunnel out of the proton and annihilate, thereby causing proton decay. Ability to control such a reaction would be a tremendous source of energy. Both this scenario and the Hydrogen-to-Helium fusion scenario mentioned above involve subtle finessing rather than brute force and should be possible with relatively low-cost laboratory equipment.

In summary we find that each physical interaction can be analyzed into the scattering of a pair of fermion pairs mediated by a pair of bosons. This corresponds to 4 wave/particle mixing phase conjugation. Each conjunction involves two fermions and two bosons. The method of Feynman diagrams is a simple and useful way of visualizing these interactions. Conversely we could think of an interaction as the scattering of a pair of boson pairs mediated by a pair of fermions. But from our viewpoint identifying with the fermion aspect of the interaction, we experience that bosons tend to hug together tightly in loops, whereas fermions generally scatter at angles in space. The mathematics of these interactions follows the laws of phase conjugation and the known laws of scattering processes and other interactions. Wave guide dynamics hold when interactions are subjected to density constraints. Furthermore, by carefully observing the debris from quark decays we can trace backward to deduce what their lepton-quark ensemble structure is when they form into mesons and baryons. As an example we analyzed the structure of a neutron and how it decays into a proton and found that it consists of a trio of virtual pi mesons constantly interacting in such a way that they appear to be a trio of quarks. In proton mode the quarks exchange virtual muon neutrino pairs while trapping a positron inside their loops. The muon neutrinos are virtually equivalent to a single electron-positron pair. This gives us the equivalent of two positrons and an electron (plus some electron neutrinos) hiding inside a proton. The experimental certainty with regard to the decay modes of the neutron and the pi mesons gives us certainty with regard to the inner structures of the neutron and proton.

Muon Neutrino Oscillation With an Electron-Positron Pair Inside a Proton



The above diagram shows how the muon neutrino ensemble (on the left) oscillates with an equivalent electron-positron pair ensemble that also includes a pair of electron neutrinos (on the right). Both ensembles surround a positron and its electron neutrino sidekick trapped in the core. The positron and its neutrino sidekick interact with an electron and its antineutrino sidekick that remain outside the ensemble. The ensemble acts as the event horizon separating the core positron and the orbiting electron. The core positron and its orbiting electron partner follow the rules of Hawking's black hole radiation and Heisenberg uncertainty and mutually interact (due to the electron's angular momentum) via bremsstrahlung that remains invisible to an outside observer because it occurs between the nucleon (proton) and its electron. The bremsstrahlung is only visible when the electron drops inward from an excited state emitting a photon. The reverse of that event is the excitation of the electron by the absorption of an external photon. Photons from the nucleon to the electron reflect back to the nucleon. Photons from the environment outside an atom reflect back to the outside environment. Standard physics ignores the inner bremsstrahlung by representing the orbiting electron as a stationary standing wave via the Schroedinger equation. If the electron remains "stationary", it does not sustain EM interactions. This is like saying that if I press against the wall, and the wall does not move, that no work is done. This is true only from an external viewpoint. Lots of work is done on the internal level of my muscle cells.

Endnote: The overlapping (closely interacting) pair of Unity Boson (Bu) particles generates a mini black hole. This black hole is very dynamic, pulsating as it radiates and absorbs mass-energy. From the mass of the proton particle that results from the Bu pair's interaction we know that the black hole portion has an inverse mass. The inverse mass ranges from around 4.83x10^-9 kg^-1 to around 1.86x10^-9 kg^-1. The first case is the maximum and corresponds to a real mass of 2.07x10^9 kg. The second case is the usual minimum and corresponds to a real mass of around 5.38x10^9 kg. We represent the interactions of the Bu pair and its mini black hole as follows:

- (1.86x10^-9 kg)(1.86x10^-9 kg) / (2.07x10^9 kg) = 1.67x10^-27 kg.
- (1.86x10^-9 kg)(1.86x10^-9 kg) / (5.38x10^9 kg) = 6.43x10^-27 kg

All black holes radiate according to a simple formula developed by Hawking.

- Tbh = (1.2x10^26 K) [(10^-3 kg) / (Mx)].

Here (Tbh) is the black hole temperature on the Kelvin scale, (K) represents a Kelvin temperature factor, and (Mx) is the mass of the black hole in kilograms. So a star with a mass of 10^30 kg has a black hole temperature in the range of 10^-7 K, which means it basically almost does not radiate. But a small black hole of around 10^14 kg has a Tbh of 10^9 K and radiates photons and neutrinos. At 10^11 kg, the hole is at 10^12 K and radiates mesons. At 10^9 kg, a mini black hole has a Tbh of around 10^14 K, which is at the Quark-Hadron Transition window, and radiates protons and neutrons. As it drops to the 10^8 kg range, the radiation should be alpha particles (helium) or even heavier elements, but the process is explosive to the point where the nucleons can not stabilize into heavier particles unless the process occurs in the dense environment of stellar cores. Thus we get an upper limit that is about equal to 4 nucleons, the components of an alpha particle or helium nucleus, but usually takes the form of hydrogen molecules.

The inverse mass associated with each nucleon may be the expression of the observer's mental resistance to the particles he has created as separate from himself. This model of subconscious observer awareness as black hole inverse mass in nucleons gives an idea of the awesome amount of creative energy that an individual may expend in order to maintain the illusion of a physical universe. When a person fixates attention on certain arrays of nucleons, a tremendous amount of his reservoir of creative energy is tied up in that fixation. Therefore, freeing of attention from such fixations can result in amazing release of creative energy that previously was bound up in the fixation. Harry Palmer (**ReSurfacing**, pp 70-71) describes a simple procedure for freeing attention. It involves a method of deliberately placing attention on to and off of the object of fixation.