

The Higgs Boson and the Weak Force IVBs (Intermediate Vector Bosons): A General Systems Perspective (part I)

(A 4x3 (or 4x4) fractal pattern: a hypothetical scenario of force unification)

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Abstract

There is a very good reason why the field vectors of the weak force involve the hugely massive Intermediate Vector Bosons (IVBs) and the associated Higgs boson (while the field vectors of the other forces, the photon, gluon, and graviton, are simple massless energy forms): the weak force is the only force that creates and/or transforms "singlet" elementary particles (single particles without antimatter partners). Single particles cannot be directly produced from the vacuum "zoo" of virtual (and symmetric) particle-antiparticle pairs, as in the case of electromagnetic or strong force particle-pair production (in collisions, for example). Hence some other mechanism for reproducing the original conserved parameters of elementary particles must be employed.

Single elementary particles created today must be the same in all respects as those created eons ago during the "Big Bang", and the massive and elaborate mechanism of the weak force is the only way to accomplish this imperative of energy and symmetry conservation - the invariance of the mass and charge of all elementary particles, wherever and whenever they may be created. It is also for this reason that the whole mechanism is quantized in terms of invariant Higgs boson and IVB mass.

The large mass of the Higgs and IVBs actually recreates the energy-density of the primordial environment in which the elementary particles whose transformations they now mediate were originally created. A weak force transformation is in effect a mimi- "Big Bang", reproducing the conditions of the macro- "Big Bang", so that the elementary particles produced by each are the same in every respect. This is the only way such a replication could be accomplished after eons of entropic evolution by the Cosmos. The role of the Higgs is to select the appropriate unified force symmetric energy-density state (usually the electroweak force unification energy level) for the transformation at hand; the IVBs associated with that particular symmetric energy state (the "W" family of IVBs in the electroweak case) then perform the transformation. The Higgs provides the mass scalar for the process, the IVBs provide the actual transformation mechanism. (See: ["The 'W' IVB and the Weak Force Mechanism"](#).)

Within a particular unified force symmetric energy state, transformations appropriate to that state are but the natural course of events. At the electroweak energy level, all quark "flavors" are equivalent (and hence readily swapped or transformed), and all lepton flavors are likewise equivalent, but the quark and lepton families do not intermingle. At the next higher "G.U.T." energy level, quark and lepton families also merge their separate identities and exchange flavors. In addition to our electromagnetic "ground state", there may be three higher unified force energy-density levels - the electroweak, the "G.U.T." and the "T.O.E.", each with

its own Higgs boson ("H1", "H2", "H3") and associated IVB "family" ("W", "X", "Y"). (See: "[Table of the Higgs Cascade](#)".)

Introduction

Because it is responsible for the creation and transformation of elementary particles and matter, the weak force is the most important - and the most mysterious - of the four forces of physics. In this paper I model the weak force (with associated Higgs bosons) in its full energy spectrum, which spans three symmetric energy states or force unification domains. We are used to thinking of the weak force only in its lowest energy manifestation of "radioactive" nuclear decay, or element building in stars, reactions mediated by the "W" family of Intermediate Vector Bosons (IVBs) of the electroweak (EW) unified force level. However, the weak force also has two (hypothetical) higher energy manifestations at the "Grand Unified Theory" (GUT) energy level (strong force unification level) and the "Theory of Everything" (TOE) energy level (gravitational unification or Planck scale energy level). These higher energy force unification domains or symmetric energy states are mediated by the "X" and "Y" IVB weak force families, respectively. We therefore propose a tri-level mass hierarchy in the weak force IVB families ("W", "X", "Y") that parallels the three-family mass hierarchies seen in the quarks, leptons, and neutrinos.

It should be easier to understand and appreciate the functional activity and role of the weak force (and its associated Higgs bosons) when seen in its full-spectrum array than when glimpsed, as usual, only in its partial, low energy, electroweak domain. Whereas at the electroweak energy level the "W" IVB creates single leptons and mesons (and transforms, but does not create, single baryons), the "X" IVB at the GUT energy level creates single baryons (transforming but not creating leptoquarks), and the "Y" IVB at the TOE energy level creates electrically neutral leptoquarks (transforming but not creating primordial heavy leptons or "Ylem"). Without the "X" and "Y" IVBs, we have no source for either single baryons or neutral leptoquarks, so we need them both. The primordial heavy leptons or "Ylem" (Gamow's term) are evidently created by a group effort involving all four forces, with gravity playing a major role.

It should also be noted that not only does the weak force play the crucial role in the devolution of our Universe from the Multiverse to its electromagnetic (EM) "ground state" (as driven by entropy), but also figures prominently in the reverse process, the evolutionary "rebound" (as driven by symmetry conservation and gravity) toward our Universe's original symmetric energy state in the Multiverse (progressing through stars, black holes, and the "Big Crunch"). Thus the full range of weak force activity encompasses both the creation and destruction of matter, and the breaking as well as the conservation of symmetry. The weak force model presented below has the 4x3 and 4x4 form of other General Systems models presented on this website (see: "[Introduction to General Systems](#)").

A Hierarchy of Force Unification

(See also: "The Mysteries of Mass" by Gordon Kane, Scientific American, July 2005, pp. 41-48)

In our "ground" electromagnetic state, we do not find a Higgs boson or an IVB; they are characteristics of the higher energy levels of force unification (H1, H2, H3) (see: "[Table of the Higgs Cascade](#)"). However, we can suggest analogs. The photon is the ground state analog of the neutral weak force IVB ("Z"); the spacetime metric is the analog of the Higgs boson regulatory function. In our ground state, the spacetime metric confers upon the photon a type of entropy-energy, an invariant and specific "intrinsic motion", gauged as "velocity c", which is also a symmetry condition of "non-locality". Similarly, at the H1 energy level, the Higgs 1 scalar boson confers upon the IVBs an invariant and specific mass, gauged at about 81 proton masses (for the "W" IVB), which is also a symmetry condition of electroweak (EW) force unification. Among other conservation roles, the spacetime metric functions as a symmetry gauge for massless free

energy and inertial forces; the Higgs boson functions as a symmetry gauge for massive particles and force unification. Like all particles, the quantized Higgs and IVBs are creations of the "energized" spacetime metric as it interacts with the four forces of physics.

In the electroweak unification scheme, the photon is the 4th member of the electroweak family of bosons (force-carriers), the other three being the "W+", "W-", and "Z" neutral. Both photon and the other Higgs1 IVBs have access to the same vacuum "sea" of virtual particle-antiparticle pairs. The great difference between them is that:

A) the photon can have virtually any energy, whereas the "W" IVB is quantized to a single specific energy of (approximately) 81 GEV (the energy level of EW force unification); (the Z neutral mass is about 91 GEV).

B) the photon can only create particle-antiparticle pairs, whereas the "W" IVB can create "singlet" (unpaired) elementary particles.

The spacetime metric acts as a regulatory mechanism, not only with respect to the entropy drive and "non-local" symmetric energy state of free energy (all photons travel only at "c"), but also with respect to the mass and charge of elementary particles created by photons in particle-antiparticle pairs (the "particle metric" imposed by the metric upon virtual particles, bound energy, and the creative potential of the vacuum "zoo" or "sea"). No virtual particle or particle pair can be materialized from the vacuum "sea" as a "real" particle unless it meets the universal and invariant standard for the mass and charge of that particle. (The invariant value of Planck's energy constant h and the invariant magnitude of the electric charge e are also determined by this regulatory mechanism.) This standard is evidently established during the "Big Bang" and forever afterward maintained by some regulatory aspect of the spacetime metric, a characteristic which is also seen in the mass scalar function of the Higgs, and also like the Higgs, finds its rationale through symmetry, charge, and energy conservation. This same metric regulatory function extends to the mass of the IVBs and Higgs in the higher energy levels of force unification, as different types of symmetry come into play (the three force-unification symmetric energy levels - H1, H2, H3, with their associated IVB "families": "W", "X", "Y"). The gateway to temporal reality for single, unpaired particles is strictly regulated by the weak force and its conservation mechanisms.

(For a discussion of CERN's Large Hadron Collider see: *Science*, 23 March 2007, page 1657-8.)

The weak force IVBs (Intermediate Vector Bosons), plus their associated "Higgs" (H) bosons, form a 4x3 (or 4x4) "matrix" or pattern that complements the [fractal description of the Cosmos](#) at high energies, essentially describing the weak force creation of matter. The four-part IVB-plus-Higgs pattern occurs in three energy levels or unification regimes (4 "metric" weak force bosons in 3 symmetric energy states), above a fourth level electromagnetic (EM) "ground state". The "ground state" is the decay product of the "Electroweak (EW) Era". (See also: "[Nature's Fractal Pathway](#)".) Note in this regard that the quark and lepton "families" also occur in a hierarchy of three energy or mass levels above the ground state photon. The "metric" particles of the weak force (the IVBs and the Higgs boson) seem to be an analogous tri-level energy or mass hierarchy. All decay to the "ground state" of our familiar spacetime metric and the photon, or charge-carrying electrons and protons (in the absence of antimatter).

Perhaps a more familiar analogy from the hierarchy of biological classification will be helpful (species/genus/family/order). At the ground state electromagnetic level we find completely separate and stable elementary particle "species". At the electroweak level we find the several quark species joined together in their own "genus" (quarks), and likewise the several electron and neutrino species joined together in another genus (the leptons). At this electroweak energy level, transformations may occur within "genera" but not between genera, and single leptons and mesons can be created and destroyed. At the GUT level we

find the quark and lepton genera joined together in a "family" (the fermions), and the field vectors (except gravity) joined together in another family (the bosons). Now transformations may occur within the "family" level but not between families (creating and destroying single baryons but not yet creating leptoquarks). At the final level of force unity, the TOE level, we find the fermion and boson families (including gravity) joined into an "order" (encompassing all free and bound forms of electromagnetic energy - Gamow's "Ylem"), in which transformations between all types of particles are allowed, creating and destroying leptoquarks (primordial leptonic elementary particles composed of three quark components).

IVB "Family" Symmetric Energy Levels

Immediately above the Chemical Era or EM "ground state" of historic spacetime, photons, biology, and cold, atomic matter, is the first IVB "family" level consisting of the W^+ , W^- , and W neutral (or Z neutral), which is associated with the first-level Higgs boson, "H1" (Nuclear Era). This is the energy level of the electroweak (EW) unification, in which all transformations mediated by the "W" IVBs are continuously ongoing (quark-quark and lepton-lepton transformations). This is the level of unification within the lepton and quark "genera" separately, but not between them. In addition, the photon and the IVBs are indistinguishable at the EW unification level: at an energy density of 90 proton masses, photons and the "Z" IVB are one and the same thing. When this H1 state decays to the EM ground state, light and the IVBs separate (the photon's wave form becomes dominant over its particle form), and the mesons, leptons, and neutrinos (alternative charge carriers) spill out as separate quanta like fruit from a cornucopia. (See: "[The Particle Table](#)".) The elementary quark and lepton quanta exist in three families each of four particles, a basic example of a 4x3 and 4x4 resonant, repeating, fractal pattern found throughout the material phenomena of our Cosmos (including, most fundamentally, the 4 dimensions of the spacetime metric). (See: "[Table 1: The Fractal Organization of Nature](#)".)

Neither the photon of the electromagnetic force, nor the "EW" level IVBs of the weak force, carry the charge of their respective forces, electric charge and "identity" charge, even though they are the field vectors or force carriers of those forces. In the case of the photon, its electric charge is neutralized by an exactly compensating magnetic field, and the action of the photon field vector is accomplished by a transfer of pure energy or momentum. The photon's electrical neutrality allows it to range freely through spacetime; if the photon itself carried charge, it would be as restricted in its activities as an electron. In the case of the "EW" family of IVBs, their charge neutrality (with respect to the "identity" charge) allows them to mediate the transformation of a variety of different charges - electric, identity, color, and spin - all via virtual particle-antiparticle pairs which "piggyback" on the massive IVBs. This "lack of agenda" with respect to identity charge allows the EW family IVBs to perform all the various transformations of the lepton and quark families, including those involving heavy leptons, neutrinos, mesons, and baryons (single baryons can be transformed but not created or destroyed at the EW level). (See: "[The 'W' IVB and the Weak Force Mechanism](#)" (pdf); also available in html format: [The "W" IVB and the Weak Force Mechanism](#) (html).)

The second IVB "family" level (Hyperon Era) is the unification level of the GUT (Grand Unified Theory), in which the strong force and electroweak force are unified. This second (hypothetical) IVB family consists of the X^+ , X^- , X neutral heavy bosons, associated with a second-level Higgs boson, "H2". Whereas the E/W level IVBs transform one quark to another and one lepton to another (including the creation and destruction of leptons and mesons), the GUT level IVBs can also transform quarks to leptons (including the creation and destruction of single baryons). This is the level of electrically neutral leptoquarks, the union of leptons and quarks. "Proton decay" is a GUT level process, which is why we never see it (the "X" IVB is prohibitively massive). Single hyperons and baryons originate at the "GUT" IVB level, leptons at the "EW" IVB level. Only chemical combinations originate at the "EM" or "ground state" energy level. (See: Howard Georgi: "A Unified Theory of Elementary Particles and Forces," *Scientific American*, Vol. 242, No. 4, April, 1980, page 104+.)

The third "order" of IVBs (also hypothetical) are at the TOE (Theory of Everything) level of unification, in which gravitation is added to complete our [4x3 fractal scenario](#) of force unification (Leptoquark Era energy-level unification). We may designate these third-level IVBs as: Y+, Y-, Y neutral, associated in turn with a third-level Higgs boson, "H3". Primordial leptoquarks, as well as particle mass, originate at the H3 energy level. Whereas level two (H2) may be seen today in proton decay (possibly a commonplace in the interiors of black holes), level three (H3) unification exists only at the very beginning or ending of the Cosmos (the "Big Bang" or "Big Crunch") (the conjoining or dissolution of gravity, spacetime, and particles, positive and negative energy). Black holes do not qualify for level 3 because of their partial and extended nature. The Universe does not begin as a black hole, but as an explosion of spacetime and energy, due to its initial matter-antimatter symmetry and consequent annihilation reactions; nor is there any spacetime external to its "horizon".

The entropy-driven (expansion and cooling) decay phase of level 3 to level 2, in which gravity and the spacetime metric separate from the primordial mass-carrying leptoquarks, may be described by the "inflationary" scenarios of Alan Guth and Andre Linde. Although I don't know what to think about this highly mathematical theory, it certainly describes a bizarre spacetime with which we have no familiarity (a supercooled "false vacuum" with "repulsive gravity"), and *if* it belongs anywhere in the "Higgs Cascade" model, it would either have to be here, or possibly at the even earlier stage of the separation between our Universe and the Multiverse. In my view, "inflation", if it exists at all, may simply represent the actual destruction of the spacetime metric by the too-violent explosion of the "Big Bang". Inflation ends ([in this scenario](#)) when the initial energy input has expanded and cooled to the point that our familiar spacetime metric can accommodate and regulate it. There are, however, other ways to produce the observational effects which motivate the theory of "inflation" (see: ["A Spacetime Map of the Universe"](#)).

The "Higgs Cascade" is driven by entropy, which in its primordial form consists of the intrinsic motions of light, gravity, and time, as "gauged" or regulated by c , G , and T . (See: ["Spatial vs Temporal Entropy"](#).) The activity of the graviton, the field vector of gravity, is essentially the inverse of the photon, collapsing and heating space rather than the reverse. The intrinsic motion of the photon is the entropy drive of free energy, producing space and the expansion and cooling of space. The active principle of the gravitational "location" charge is time, which has its own intrinsic motion as the entropy drive of bound energy (at right angles to all three spatial dimensions), producing the expansion and aging of history. *A gravitational field is the spatial consequence of the intrinsic motion of time.* (See: ["Entropy, Gravity, and Thermodynamics"](#); see also [The Conversion of Space to Time](#).)

The Role of the "Y" IVBs

The role of the "Y" IVB is to extract electrically neutral leptoquarks from the H3 primordial "Ylem" (by causing the decay of electrically charged leptoquarks), delivering them to the H2 level as invariant entities. The "X" IVBs of the H2 level then proceed with an asymmetric weak force decay of these electrically neutral leptoquarks, which results in a residue of matter hyperons and leptoquark antineutrinos. Because the sub-elementary and fractionally charged quarks with their associated gluon field seem to further an agenda of manifestation rather than conservation (the latter function being equally well-served by (much) simpler massive elementary leptons with whole quantum unit charges), the primary rationale for the "Y" IVBs appears to be the production of electrically neutral leptoquarks from their charged congeners.

Exactly how these primordial leptons and leptoquarks are created is of course unknown, but according to the logic of our [table](#), their creation requires the participation of gravity, which is to say, a heavily compressed spacetime metric. Since the IVB families all seem to work by a form of metric compression or density, and the "Y" IVB is the most massive of them all, it seems likely that the "Y" IVB acts, along with gravity, to produce bound energy (particles) from free energy (waves in the metric) through extreme compression of the spacetime metric. Because the metric is apparently quite capable of creating quarks (as mesons) all by itself,

it seems the contribution of the "Y" IVBs to the group effort (of all the forces) in the production of mass-bearing leptoquarks is one of organization and transformation. As modeled here, the compressive force of gravity acting upon the spacetime metric at the H3 energy level supplies the primordial electrically charged heavy lepton, which the massive "Y" IVB splits or otherwise organizes into three parts (quarks), using the resources of the "quark soup" or "Ylem" of the H3 energy level. Note that (at least potentially) quarks are already present in the metric as gravity and the "Y" IVBs compress it into quantum particle "packages". Subsequently, the "Y" IVB further transforms the charged leptoquark into an electrically neutral leptoquark (much as the W+ IVB of level H1 transforms a proton into a neutron), sending it down to the H2 (Hyperon Era) energy level.

Once formed, these neutral leptoquarks pass directly to the H2 domain. Their necessary electrical neutrality, which is anomalous with respect to the lower energy members of their leptonic family (electron, muon, tau), is probably due to a selection process (only the neutrals survive annihilation reactions to reach the H2 energy level). Electrical neutrality is necessary to break the symmetry of the primordial matter-antimatter particle pairs, which is why the primordial mass-carrier (the leptoquark) must be a composite particle, able to arrange the partial charges of its quarks into an electrically neutral configuration (like a neutron).

Electrically neutral leptoquarks flow out of the H3 domain to the H2 energy level (as the universe expands and cools), where they may live long enough to be asymmetrically attacked by the "X" IVBs, rather than undergo the more usual matter-antimatter annihilation reactions (which is why their electrical neutrality is so necessary to this whole process - to allow enough time for weak force asymmetric decays to occur). While all this is of course speculative, it is currently the best I can do to set the stage for baryon genesis via the "X" IVBs of the H2 energy level. The H3 energy level, utilizing an unknown process requiring the cooperative effort of all the forces, acts as a leptoquark "factory", with the "Y" IVBs sending electrically neutral leptoquarks down to the H2 energy level.

The cascade passes from leptoquark genesis (H3) to baryon genesis (H2) to lepton genesis (H1) to atomic genesis (H0 - ground state). While we do not understand the cascade in detail, something very like it must have happened or we would not be here to wonder about it. The real wonder is that the spacetime metric is prepared to produce and accommodate the conservation needs of such a large variety of particles and charges - leptoquarks, quarks, leptons, mesons, baryons, neutrinos, and their charges and field vectors (including the heavy flavors of quarks and leptons and neutrinos) - and these are just the ones we know about. Despite this variety, they are no doubt the bare minimum required to produce our universe. All particles, charges, and forces are united by, and originate in, the spacetime metric.

In the H2 energy level, the "X" IVBs compress the baryon combinations so powerfully that their color charges sum to zero and vanish (in the limit of "asymptotic freedom"). A few of these electrically neutral and colorless leptoquarks will survive long enough without annihilation by their antipartners to undergo (alone) a weak force leptonic decay, exactly like a heavy lepton, via the emission of a leptoquark neutrino (or antineutrino), with the mediation of the "X" IVB (this is also the probable pathway of "proton decay"). Such a single decay isolates its former annihilation partner, which in consequence survives to expand its quarks and become a hyperon, at which point it is stabilized by the explicit appearance of the conserved color charge and gluon field. Because of an inherent asymmetry in the weak force with respect to matter-antimatter reactions, greater numbers of electrically neutral matter leptoquarks are isolated from their erstwhile antimatter annihilation partners, and so survive to expand their quarks (in a rapidly expanding Universe), becoming the hyperons (heavy baryons) of the H1 level, where they decay further via the "W" IVBs and their alternative charge carriers (leptons, mesons, neutrinos) to ground state protons and electrons, eventually forming atoms, and much later, during the symmetry-conserving "rebound", galactic systems with life forms, including us. (See: ["The Origin of Matter and Information"](#).)

Summary

The three IVB species, the "Y", "X", and "W", are all "metric" particles composed of the dense metric of their respective force unification realms, and all function by means of compression. The IVB role (in the case of the "X" and "W" IVB families) is the creation of "singlet" bound energy forms (quarks, mesons, baryons, leptons, neutrinos) peculiar to the IVB's particular force unification level or symmetric energy state, as well as the transformation of "singlets" to the next lower force unification level. Similarly, the "Y" IVBs produce electrically neutral leptoquarks from primordial charged leptons and quarks (Gamow's "Ylem"), which they send down to the H2 energy level, where the "X" IVB family takes over their decay. The IVBs provide a "lawful" conservation pathway for the decay "cascade" of energy in the material system from the "Big Bang" through three force unification regimes of decreasing symmetry and energy (but increasing entropy) to the electromagnetic "ground state" of cold atomic matter. The "Y" IVBs create electrically neutral leptoquarks, helping to create particle mass (with the aid of gravity, electromagnetic energy, and the spacetime metric); the "X" IVBs asymmetrically transform neutral leptoquarks into heavy baryons (hyperons) and leptoquark antineutrinos, creating matter; the "W" IVBs create alternative charge carriers from the "vacuum", transforming hyperons, neutrons, and heavy leptons into ground state protons and electrons. At the "ground" state EM energy level, photons, gravity and time create large-scale historic spacetime, and protons and electrons create atomic matter, chemical information systems, and eventually life itself.

The "W" IVBs (H1 energy level) combine virtual particle-antiparticle pairs (from the spacetime metric, the Heisenberg-Dirac "vacuum") with "real" particles in a "bear hug" embrace that allows them to exchange charge and energy without offending the conservation laws. The "X" IVBs (H2 energy level) compress the quarks of baryons and leptoquarks until their color charges (which are carried by gluons in all possible color-anticolor combinations), sum to zero color and self-annihilate (see: ["The Origin of Matter and Information"](#)). The "Y" IVBs (H3 energy level) compress primordial leptonic and quark particles (provided by a super-dense gravitational spacetime metric) so powerfully that bound energy is formed as massive leptoquarks. Particles acquire mass during the time they are conjoined with all aspects of electromagnetic energy and the gravitational metric of spacetime (H3 energy level). The gluon field of "sticky light" arises as a consequence of symmetry conservation, permanently confining quark partial charges into whole quantum charge units that can be balanced, canceled, and/or annihilated by other elementary leptonic charges or alternative charge carriers. Gluons appear to be a form of "split light", or split electromagnetic field vector (photons), consequent upon the splitting of an elementary leptonic particle and its unit electric charge into sub-elementary quarks with fractional charges. (Quarks are necessary subdivisions of the primordial mass carrier, allowing it to achieve electrical neutrality (like a neutron), and so survive long enough to undergo an asymmetric weak force decay.)

The common mode of action of the three IVB species (metric compression, or the re-creation of the dense metric of a specific force unification symmetric energy state), and the fact that all three have distinctly different but necessary parts to play in the creation of atomic matter - the creation of electrically neutral leptoquarks ("Y" IVBs), the asymmetric creation of single baryons ("X" IVBs), and the creation of single leptons and other alternative charge carriers ("W" IVBs) - lends a strong plausibility to the hypothetical "Higgs Cascade" outlined above. The "W" IVB level is experimentally observed fact. While the "X" and "Y" IVB levels are hypothetical, we obviously have to find a source for baryons and their constituent quarks somewhere (and for our life-friendly "given" physical constants - such as c, G, e, h, etc.). The "Higgs Cascade" at least provides a consistent hypothesis and "reasonable guess" as to these origins. No one expected or predicted the three mass-energy levels of the lepton and quark "families", and we still don't know why they exist (when one level would seem to be sufficient). The (postulated) three mass-energy levels or metric "families" of the Higgs and IVBs may be another example of Nature's penchant for tri-level energy hierarchies or resonant forms, but at least in this case we can suggest plausible/practical reasons for its existence (for example, the three symmetric energy states of progressively more inclusive force unifications, in addition to the respective origins of leptons, baryons, and quarks).

Finally, we should note that it is the weak force that brings the asymmetric material world into existence,

including ourselves. Reality as we experience it is just that form of electromagnetic energy which can be conserved in space and time, whether bound (massive, temporal) or free (massless, spatial). While the origin of energy itself and the "Big Bang" Creation Event will probably forever remain articles of faith for either science or religion, the lesser miracle of matter is contained in the conservation functions of electromagnetic energy and the spacetime metric. For a commentary on the meaning and role of humanity in the Cosmos, see: "[The Human Connection](#)"; also: "[Teilhard de Chardin, Prophet of the Information Age](#)"; and books on my father's memorial website: "[Trance, Art, and Creativity](#)".

The mass of the Higgs boson is probably not much greater than the mass of the IVBs of its associated family. That, at least, would be our expectation from this model, since the Higgs boson is the scalar gauge of the energy density or force unification symmetric energy state which the IVBs represent. The role of the Higgs boson is to gauge or scale the IVBs to the appropriate force unification energy level at which the desired transformation is simply a normal characteristic of the symmetric energy state (all "species" within a "genus" are equivalent, etc). The IVBs perform the required transformation; the Higgs ensures the proper scale and hence invariance of the product - an invariance, as we have seen, essential for charge, symmetry, and energy conservation.

Postscript I:

Connections Between the "[Tetrahedron Model](#)" and "Establishment" Physics

Most of my effort toward unification has been concentrated on the "rebound" phase of the Universe, as we find it today, driven by gravitation, symmetry conservation, and evolution, simultaneously building complex structures (both physical and biological), and returning asymmetric matter to its original symmetric state, light. Conversely, most of the effort of the "establishment" toward unification has been concentrated on the "cascade" phase of the Universe, the stepwise descent from the perfect symmetry of the Multiverse and Planck scale unity, as the forces decoupled from one another in an entropy-driven rush toward our familiar electromagnetic "ground" state. The electromagnetic "ground" state is the common domain from which we both started, but I worked forward in time toward the ultimate symmetry of the "Big Crunch", while the "establishment" worked backward in time toward the ultimate symmetry of the "Big Bang". "My" symmetries are mostly intuitive, involving the long-range forces and the macro-world, and (in general) ignore theirs; "their" symmetries are mostly mathematical, involving the short-range forces and the micro-world, and (in general) ignore "mine". Nevertheless, the two systems are neatly joined by the synthetic power of General Systems, both expressed in a 4x3 and 4x4 matrix format. (See: "[A Simple 4x4 Table of Forces and Energy States of Physics](#)".)

The micro-world of the Big Bang, symmetry groups, and the weak force in its full energy spectrum and General Systems format is presented in this and the other "[Higgs Cascade](#)" papers. The macro-world is modeled in a General Systems format in such papers as "[The Information Pathway](#)", "[The Fractal Organization of Nature](#)", and "[Nature's Fractal Pathway](#)". The general principles of physical law which underlie all our unification models, whether intuitive, mathematical, macro, or micro, are explored (also in a General Systems format) in the papers "[Symmetry Principles of the Unified Field Theory \(a 'Theory of Everything'\) - Part I](#)" and "[A Tetrahedron Model of Light and Conservation Law](#)". The interaction between non-local light and local matter is considered in the "[Global vs Local Gauge Symmetry](#)" series of papers, which also suggest connections between my work and "establishment" unification models through the common theme of *charge invariance*. The joining of both micro and macro unification models within a common General Systems model illustrates once again the synthetic power of General Systems, as well as the great value of investigating a common problem from more than one direction and perspective. (See also: "[The 'Tetrahedron Model' vs the 'Standard Model' of Physics: A Comparison](#)".)

Postscript II: See:

Higgs Table No. I: Unified Force Eras or Symmetric Energy Levels of the "Big Bang"

Links:

Unified Field Theory

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[Symmetry Principles of the Unified Field Theory \(a "Theory of Everything"\) - Part 2](#)
[Principles of the Unified Field Theory: A Tetrahedral Model](#)
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Weak Force, Intermediate Vector Bosons ("IVBs")

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