The Higgs Boson and the Weak Force IVBs (Intermediate Vector Bosons): A General Systems Perspective (parts II, III, IV)

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

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Revised Nov., 2010

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

(Return to Higgs Boson: Part I)

See: Table of the "Higgs Cascade"

The IVBs and the Higgs Boson: Part II

The IVBs (Intermediate Vector Bosons) are the field vectors (force carriers) of the weak force. The IVBs reconstitute the very dense, early metric of spacetime (during the "Big Bang"), and their mass is the probable consequence of the binding energy necessary to condense, compact, and/or convolute the spacetime metric. Originally, the "W" IVBs were indistinguishable from the early dense metric of which they were a part - the energy level of electroweak unification. The "Electroweak Era" existed from 10(-12) to 10(-35) seconds after the Big Bang, when collision energy exceeded 100 GEV and the temperature exceeded 10(15) Kelvins. During this time (a tiny fraction of a second in human terms) the whole of spacetime - the whole Cosmos - was in effect a single huge "W" IVB within which all the transitions of "identity" within the lepton family of particles (including the heavy leptons), and all the transitions of "flavor" within the quark family of particles (including quarks of the heavy baryons or "hyperons"), could take place freely without restriction or energy barriers (quark and lepton families were unified among themselves, but quarks remained separate from leptons.) (See: Brian Greene: "*The Fabric of the Cosmos*", page 270, Knopf, 2004.)

The "Electroweak Era" was the time of realized electroweak unification and symmetry, when it was physically possible for massive, electrically charged bosons (such as the "W" IVBs) to exist, because they were part of and indistinguishable from the energy-dense spacetime metric of their environment. But as the Universe expanded and cooled below the 100 GEV energy-density level (driven by the entropic, "intrinsic" motion of light trapped in the spacetime metric), the massive "W" IVBs could no longer be continuously maintained by the energy density of their environment. Below the electroweak unification temperature, the "W" IVBs assume the fleeting, ephemeral reality of Heisenberg "virtual particles", dependent upon borrowed energy for a "peek-a-boo" existence.

The "Higgs Cascade" model presumes three energy levels or "families" of IVBs, each with an associated and distinct Higgs boson. These three levels represent specific energy states of force unification, successively higher domains of unity (and hence symmetry) among forces, quarks, and leptons. The first (lowest energy) is the "W" family level (of the electroweak force unification energy level), which mediates transformations among elementary leptons and quarks, including their creation and destruction. The second is an analogous (but hypothetical) set of superheavy "X" IVBs (with their own Higgs), which mediates transformations among leptoquarks, including the asymmetric creation and destruction of baryons and matter, during an earlier, hotter, and more energetic era of the "Big Bang" - the GUT (Grand Unified Theory) energy level of unification between the strong and electroweak forces. A third (also hypothetical), even higher energy strata of Higgs and "Y" IVBs may exist at the ultimate unification energy level incorporating gravity (the Planck Era, in which quarks and particle masses are created). This final level is referred to as the level of "TOE" or "Theory of Everything".

The Higgs boson is not an ordinary IVB in that it does not mediate interactions, but rather determines the mass scale of the IVBs which do. The Higgs is identified as a "gauge" boson or as a "mass scalar" particle

or field. The quantized, particle form of the Higgs scalar is necessary to ensure the charge and mass invariance of the IVBs and the elementary particles they produce, whenever and wherever they may be created - as required by energy, symmetry, and charge conservation. In our best available analogy, the Higgs boson gauges the "W" IVB to 80 GEV mass, in the same sense that the spacetime metric gauges the photon to "velocity c".

The IVB "W" family of particles provides a bridge between the real particles of the sparse, low-energy metric of the "ground state" Electromagnetic Era (which we occupy), and the virtual particles of the dense, high-energy metric of the bygone Electroweak Era, an era containing the virtual particle-antiparticle "zoo" of high-energy spacetime. The IVBs are in effect time machines or "wormholes" connecting the present with the distant, high-energy, more unified and hence more symmetric past, allowing modern particles to effect transformations by participating, however briefly, in the unified regime of the Electroweak Era, when all such transformations and exchanges of charge and energy were but the normal course of events. The IVBs are "scaled" or "gauged" by the Higgs boson to reestablish or revisit a "Big Bang" force unification regime, era, or symmetric energy state, in which the desired transformation occurs naturally (because the various particle "species" are united in a "generic" level of identity); that is the essence of their transformative partnership.

The role of the IVBs is to provide for particle "singlets" a "lawful" (respecting all conservation laws) pathway of transformation and decay from the high temperature, low entropy regime of the "Big Bang", to the low temperature, high entropy regime of "ground state" atomic matter. The role of the Higgs boson is to ensure that this pathway, wherever and whenever it is taken, is invariant in terms of the energy levels of the IVBs, and therefore invariant also in terms of the fundamental physical parameters (mass, charge, spin, etc.) of the "singlet" elementary particles of matter the IVBs produce. (See: "The 'W' Particle and the Weak Force Mechanism" (pdf file); (also available in html format The "W" IVB and the Weak Force Mechanism (html file)

Why does the weak force transformation mechanism require two bosons - the Higgs plus the IVBs? The weak force IVB field vectors cannot also act as their own scalar particles, they cannot regulate or "gauge" their own mass. Because there are apparently three energy levels or "families" of IVBs, there needs to be a Higgs gauge function to distinguish and select between them, imposing order from the higher organizational level or more general symmetry principle of force unification. The IVB field vector's role is to transfer charges, masses, and forces from one particle and symmetry state to another, and they cannot do this and perform the role of a scalar gauge boson as well. This is why two bosons are needed to perform the weak force "singlet" transformations and creations of elementary particles - the IVB field vectors to do the actual transformations, and the Higgs scalar bosons to gauge or regulate the masses of the IVBs (selecting among the three putative IVB families or energy levels).

The Higgs gauges or scales the masses of elementary particles at second hand, through the agency of the IVBs. There is no strict analog in the other forces because only the weak force produces "singlets" (isolated particles of matter without antimatter partners). The Higgs boson ensures that the IVBs are of the correct mass/energy to do the job, that is, of an energy density representative of the original "Big Bang" symmetry state and unification realm in which the transformation to be accomplished first occurred. As we have noted, conservation demands that the electron created today be the same as the electron created yesterday or tomorrow, which is why the Higgs scalar is itself quantized and invariant, and why the IVBs and the symmetry states or force unification realms they visit or represent must also be invariant in terms of energy level. The IVBs perform the transformations; the Higgs ensures the invariance of the product (nature's quantized "quality control").

The Higgs boson is sometimes called the "God" particle because of its putative function in the creation of matter - scaling or gauging the mass of the IVBs, and through them, the mass of elementary particles.

The three IVB "families" ("W", "X", "Y") function as translators of "singlet" bound energy forms (elementary particles of matter lacking antimatter partners) from one symmetric energy state or force unification era to the next, and with the Higgs boson, mark the boundaries of the unification realms. The Higgs sets the scale at which the IVBs function, ensuring that all charges and particle masses they create are invariant, whenever and wherever they may be produced. Finally, certain universal constants of energy, charge, and entropy operate across all eras and forces, such as c, G, e (electric charge), and h (Planck's energy constant). These gauge constants and regulators are "given" at the multiverse level, and are necessary to conserve energy and symmetry (charge) in our particular "life friendly" Universe. These universal gauge constants (carried by the "vacuum" or spacetime metric) are why particle-antiparticle pairs created by the electromagnetic force (or its derivative, the strong force) in any era have the same value as "singlet" particles (or alternative charge carriers) created by the weak force. (These universal gauge constants are why we compare the spacetime metric to a "ground state" Higgs, since they gauge or regulate the mass and charge of any virtual particle pairs extracted from the "vacuum".)

Only the weak force creates "singlets" - isolated elementary particles of matter without antimatter partners - which is why it is such a peculiar and important force, responsible for the asymmetric creation of matter, and why all the complex weak force mechanism is necessary to ensure the invariance of its products. The IVB transformation mechanism also involves extracting virtual particle-antiparticle pairs from the vacuum or spacetime metric to function as "alternative charge carriers". The electron created by the electromagnetic force is the same as the electron created by the weak force since both are derived from the same source. The difference is that whereas the electromagnetic force only creates particle-antiparticle pairs, the weak force only creates single particles. The more one thinks about our asymmetric system of matter and the problems associated with the exact replication of single particles through time, the more one realizes that not only is the reprise of the original force unification symmetric energy state (via the large mass of the Higgs and IVBs) the way that weak force transformations function, it is the only "fail safe" method to produce the necessary invariance in elementary particle "singlets" through time and space.

The fact that electrons produced by the weak force as "singlets" and electrons produced by the electromagnetic force in particle-antiparticle pairs are exactly the same, is perhaps the most important consequence of (and rationale for) the electroweak unification - the joining of the "W" IVBs with the photon, the field vectors of the two forces. (See: "Global vs Local Gauge Symmetry and the Tetrahedron Model".)

The Higgs Boson and Symmetry-Breaking: Part III

Let us try to be as specific as we can and further examine the nature of the Higgs particle. The Higgs regulates, or "scales" the mass of the IVBs, which in turn reflects the energy density at which the forces separate (going down the energy spectrum) or join (going up the energy spectrum - see table: The Higgs Boson and the Evolutionary Eras of the Cosmos). The quantized Higgs boson is necessary to scale, gauge, or regulate the invariance of the IVBs, and hence the invariance of the elementary particles they produce, as required by energy and symmetry conservation. Energy is released and elementary particles are produced at these points of force unification or symmetry-breaking - but why? The notion advanced by the "standard model" of physics is that any point of separation of forces represents a loss of symmetry, a loss of a "degree of freedom", like a freezing, or crystallization, or condensation in ordinary forms of matter (the latter are analogous but vastly less energetic symmetry-breaking "phase transitions" which occur in our familiar E/M ground state). This symmetry loss and entropy gain is accompanied by a release of energy (as when water condenses or freezes), energy which is converted to and conserved in the form of particles, charges, photons, momentum, kinetic energy, heat, etc.

For example, above the energy level of the "W" family of IVBs (above about 81 GEV), the lepton family is unified among themselves and the quark family is unified among themselves. This unification (the "Higgs

1" energy level or "Hyperon Era") represents a symmetry condition in that the several species of leptons and neutrinos can freely transform among themselves, as can the several species of quarks among themselves. Mesons and heavy leptons are created and destroyed, while heavy baryons (hyperons) also join in the fun and transform freely without energy barriers (but hyperons and baryons cannot be created or destroyed at the H1 energy level). This is a symmetry or unity with respect to the transformation of "identity" charge or "flavor" ("number" charge) within the quark and lepton "families", which is unknown at the lower energy density of the E/M ground state. In the E/M ground state, we have only the proton, electron, and electron antineutrino for stable particles; all identities and flavors of quarks and leptons are separate, and any "singlet" transformations (transformations that do not consist of particle-antiparticle pairs) have to be imported from the H1 energy level of E/W unity by the weak force "W" IVBs. It is as if the quark and lepton flavors which exist in our electromagnetic ground state as separate "species" are united into their separate "genera" (the quark "genus" vs the lepton "genus") at the electroweak energy level of force unification.

The recently observed "oscillations" of neutrino flavor suggests that our E/M ground state represents a very low-energy form of force unification symmetric energy state, at least with respect to neutrino flavors or "identity" charges, another illustration of the functional analogy between the Higgs boson and the spacetime metric. The energy source of this elevated ground state of the spacetime metric or "vacuum" is apparently the intrinsic entropy drive (and symmetry gauge) resident in spacetime, which confers upon the photon its intrinsic motion, "velocity c". This universal positive entropy drive is the "dark energy" (or "cosmological constant") of the universe, which is opposed by the negative entropy drive of gravitation. When mass is converted to free energy, as in stars, quasars, etc., the total gravitational energy of the Universe is reduced, causing the observed "acceleration" of Cosmic expansion. "Dark energy" is only seen because of the reduction of total gravitational energy, which allows the entropic expansion of the spacetime metric to increase (rebound) toward its natural maximum value, c. (See: "'Dark Energy': Does Light Produce a Gravitational Field?")

At the H2 energy level (the "Leptoquark Era"), leptons and quarks are unified (between "genera" as well as within "genera"). At the H2 energy level, hyperons (heavy baryons) are created and destroyed, while quarks and leptons are interchangeable. There is a slight asymmetry in the weak force decay of electrically neutral leptoquarks vs antileptoquarks (in magnitude of ~1 part per ten billion), with the survivors decaying in the entropically expanding Cosmos to the hyperons of the H1 level and eventually to the protons of the E/M ground state.

With the absorption of the photon into the IVBs, and the merging of individual quark and lepton flavors into their generic identities at the H1 energy level, we have lost light and atomic matter as we (in the E/M ground state) currently understand light and matter. In the absorption of baryons into leptoquarks at the H2 energy level, we have lost nuclear matter as we currently understand it. In the absorption of the leptoquarks into the primordial gravitational metric and conjoined leptonic matter-antimatter particle pairs of the H3 energy level, we lose any sense of electromagnetic energy as we currently understand it. With the collapse of our specific Universe into the undefined energy parameters of the Multiverse, we lose any sense of our Cosmos as we currently understand it. These four stages of force unification symmetry, each lower state accompanied by a release of energy at the symmetry-breaking phase transition points, are thought to be the stages of creation of our Universe, its "devolution" or "decay cascade" from the all-symmetric Multiverse to the asymmetric E/M "ground state" of cold atomic matter.

The initial point of emergence (the "Big Bang") of an energized but gravitationally balanced mix of metric spacetime and symmetric, elementary, electrically neutral "leptonic" particle-antiparticle pairs of total energy and charge = 0 ("Yin-Yang" symmetry), derives its energy from the symmetry loss occasioned by its separation from the "Multiverse". The Multiverse is the ultimate symmetry condition of unmanifest, undefined, yet energetic reality; the lower symmetry of our Cosmos is due to the specification of its "life-

friendly" physical constants. This initial, energized but balanced state (H3 "Planck Era": Gamow's "Ylem") is entropically unstable and decays (symmetrically) to the H2 "Leptoquark Era", then (asymmetrically) to the H1 "Hyperon Era", and finally to the E/M ground state ("Atomic Era") we currently occupy. Each state (except the ground state) is scaled by a Higgs boson and transformed to the next lower state by its own IVB family, which is representative of the symmetric energy density of that force-unity state. The ground state is scaled by the spacetime metric and the electromagnetic constant c, and other "given" physical constants such as G, e, and h. The whole cascade decay is driven by entropy (the expansion and cooling of the Cosmos) and the intrinsic motion of light (initially contained within the metric as an expansive, entropic pressure, balanced by the contractile entropic pressure of gravity). The cascade, which is set in motion by the asymmetric weak force producing electrically neutral leptoquarks, is regulated in all its stages by energy and symmetry conservation.

Once formed, the ground state promptly embarks upon a return path (driven by gravitation, evolutionary forces, and symmetry conservation - Noether's Theorem) toward its original symmetric energy state as light, the unity of forces, and the Multiverse. This "rebound" is realized in the electromagnetic force through chemical reactions and matter-antimatter annihilations, in the strong force through fusion reactions in stars and through "proton decay", in the weak force through fission reactions in particle and proton decay, and by contributions to many astrophysical processes; and finally by gravity through stars, quasars, and the complete conversion of matter to light via Hawking's "quantum radiance" of black holes (or even via a Cosmic "Big Crunch" - unifying the forces, destroying the Cosmos, and returning to the all-symmetric "Multiverse").

The "The Information Pathway" (a "subroutine" of the electromagnetic force) has also constructed its own unique (biological) return route to the state of original symmetry, culminating (locally) in the human condition, and expressed through scientific, artistic, intellectual, and spiritual approaches to a personal, social, and technological "enlightenment". In the biological realm, while plants have been busy converting free to bound energy forms in a negentropic life-supporting effort, animals in general and humans in spectacular fashion have been busy converting bound energy into free energy, joining the more universal abiotic march of entropy toward the eventual "heat death" of the Cosmos (and perhaps the premature and unfortunate "heat death" of our planet).

General Systems Models and the "Anthropic Principle"

There is so much about our Universe that cannot be explained except on the basis of the "Anthropic Principle" - things have to be the way they are or we couldn't be here to ask these questions. Obviously, we can only live in a "life-friendly" Universe.

Such considerations also apply to the weak force IVBs, and to the Higgs boson. Why should either exist? Only to create "singlets", unpaired particles of matter with no antimatter partners. In other words, they exist for the same reason that matter exists, whatever that may be. You can't get matter without them, and you can't get us without matter. Do IVBs exist in three energy levels or "families" of "metric" particles as our model suggests? Probably, as we can't otherwise account for the origin of bound energy/mass (level H3) or of leptoquarks (level H2). Level H1 contains the heavy baryons (hyperons), quarks and leptons derived from the decays of the leptoquarks of H2; hyperons in their turn decay (via the EW IVBs) to the ground state (EM) electron, electron neutrino, proton and neutron. Level H1 is experimentally confirmed, insofar as the "W" IVBs are concerned, although the Higgs boson remains undiscovered. Furthermore, we have three energy levels or plateaus of force unification or symmetry states (EW, GUT, TOE), plus three energy or mass levels in both the quark and lepton families, the latter hierarchy serving as an unexplained but highly suggestive "precedent" for the proposed three energy levels of "metric" particles (the "W", "X", "Y" IVBs and their associated Higgs bosons) in the "Higgs Cascade".

The IVBs and the Higgs seem to be linked properties associated with, and required by, the particle or asymmetric aspect of each force-unification energy level, properties which allow the "singlet" bound energy forms of that specific unification or symmetry level a "lawful" pathway of decay, as driven by entropy, and in accordance with all conservation laws. The IVBs are necessary to regulate the creation, destruction, or transformation of "singlet" elementary particles; the Higgs bosons are necessary to gauge or scale the IVBs and thereby ensure the invariance of their products - as clearly necessitated by energy, charge, and symmetry conservation. "Singlet" elementary particles produced today must be the same as "singlets" produced in the "Big Bang". The "cascade" pathway produces neutral leptoquarks from primordial leptons ("Ylem"), hyperon "singlets" from neutral leptoquarks, and ground state (EM) atomic matter from the electroweak decays of hyperons.

The "X" level (H2) of leptoquarks may be experimentally accessible through currently ongoing searches for "proton decay". If proton decay is seen, it may also show evidence for a leptoquark neutrino. Failing this, we would have to conclude that leptoquark and proton decay proceed by different mechanisms, and leptoquark neutrinos can only be seen with leptoquark decay. The "Y" level of IVBs, unfortunately, are so energetic as to appear to be forever beyond experimental confirmation. Nevertheless, the fact that baryons so clearly resemble "split" leptons, and carry within them a miniature 3-dimensional spacetime (the massless gluon field), speaks volumes for the reality of the "Y" level IVBs and their conjoined gravitational metric - which furthermore seems necessary to explain the origin of mass.

If nothing else, there is enormous heuristic value to this and other General Systems models. The models organize our data, facts, and ideas, give us something concrete to think about (and/or attack), and suggest new ways of thinking about the Cosmos, how it functions, and our place within it. Finally, General Systems models suggest new relevance for ancient cosmologies, so often expressed in patterns of threes and fours. (See: "The Fractal Organization Of Nature"; also: "Table 1".)

The Higgs "Big Bang" Devolution and "Big Crunch" Evolutionary Sequence

0) Multiverse. (Unification of all possible Universes)
1) "Big Bang". Creates our Universe with specific life-friendly physical constants and balanced positive and negative (gravitational) energy (no net energy), with symmetric matter-antimatter components (no net charge).
"Cascade" decay ensues through three Higgs levels - regulated by the asymmetric weak force mechanism and driven by entropy and light's intrinsic motion - causing the expansion and cooling of spacetime.

2) H3 - Planck Era, TOE unification. All forces unified. Era of Gamow's "Ylem"; gravitational unification with the other forces, the "Y" IVBs, and "quantum gravity". Balanced positive and negative (gravitational) energy (total energy = 0), with matter-antimatter symmetry (total charge = 0). Decay via "Y" IVBs creates electrically neutral leptoquarks, quarks, quark partial charges, color charges, the gluon field and particle masses by fracturing primordial, elementary "leptonic" particle-antiparticle pairs. Creating electrically neutral leptoquarks is the unique role of the "Y" IVBs (with help from gravitational spacetime, which supplies the primordial leptonic particles). Decays to H2 neutral leptoquarks with separate gravitational spacetime. Possible era of "inflation" during transition between H3 and H2 energy levels(?) - Guth and Linde.

3) H2 - Leptoquark Era, GUT unification. Strong and electroweak forces unified. Era of quark and lepton unity: leptoquarks. The specific role of the "X" IVBs is to mediate the decay of leptoquarks by first vanishing their color charge through compression (in the limit of "asymptotic freedom"), then canceling or conserving leptoquark "number" charges via leptoquark neutrinos. "X" IVBs produce an asymmetric weak force decay of (single) electrically

neutral antileptoquarks; the unreacted matter leptoquark expands its quarks, revealing its conserved color charge, which prevents the total decay of the hyperon thus formed: this is the creation pathway of baryonic nuclear matter. Associated heavy leptons and mesons act as "alternative charge carriers", both for the hyperons and for each other. Leptoquark antineutrinos produced in these reactions are "dark matter" candidates. (See: "The Creation of Matter and Information".)

4) H1 - Hyperon Era, Electroweak unification. Weak and electromagnetic forces unified. Era of heavy baryons, heavy leptons, and Heisenberg's "vacuum" virtual particle "zoo". Quarks unified among themselves and leptons unified among themselves, but quarks and leptons separate from each other. Specific role of "W" IVBs is to create (single) electrically charged leptons and alternative charge carriers (leptons, mesons, neutrinos), allowing hyperon and heavy lepton decay and transformation without antimatter annihilations. Decays to electron, electron antineutrino, proton, and ground state atomic matter, including free photons.

5) G - "Ground state" - Atomic Era. Electromagnetic unification. "Ground state" photons, neutrinos, electrons, quarks, protons, neutrons, and gravity create atoms, space, time, and historic spacetime. Electric and magnetic forces unified; light and gravity remain unified with the spacetime metric. Neutrino "oscillations"; "vacuum" virtual particle "sea" regulated by universal energy constants of the spacetime metric.

6) Return or "rebound" pathway to (locally) higher energy and (globally) higher symmetry states - driven by gravity, evolutionary forces, and symmetry conservation (Noether's Theorem - creating the Information or Biological Era). (See: "Nature's Fractal Pathway (text)" (table).)

G - Planets; humans (locally) create fire, chemistry, fission, fusion; (gravity plus the electromagnetic force; matter-antimatter annihilations, but also chemistry, information, biology, consciousness, thought, experience, symbolic information)
H1 - Stars; fission, fusion (creation of heavy elements); (gravity plus strong and weak forces; nuclear transformations; the nucleosynthetic pathway)
H2 - Galaxies; quasars and black holes; quantum radiance, proton decay; (gravity)
H3 - "Big Crunch"; reunites forces, destroys Universe, returns to Multiverse; (gravity)
Multiverse; (rebirth of Universe?)

(See: "The Information Pathway (text)" (table).)

Symmetry, Entropy, and Gravitation: Part IV

In the "Higgs Cascade" table we plot the entropy-driven decay of the Cosmos from its initial symmetric state in the "Multiverse" and the H3 force unification energy level, to the "ground state" Atomic Era, followed by a symmetry-driven "rebound" phase which recapitulates the energy levels of force unification upward: from ground state planets, to stars, to galactic quasars and black holes, to the gravitational collapse of the Cosmos.

In this "rebound" series, we are seeing not only another kind of symmetry conservation in the reconstitution of the force unification sequence, but another conservation rationale for gravitation: evidently, gravity is trying to reconstruct the original force unification regimes or symmetric energy states of the Cosmos (the H1, H2, and H3 energy levels).

Once again, we understand this conservation drive in terms of symmetry conservation as required by

Noether's Theorem. However, this is a different type of symmetry, more complex and on a different energy level and scale than we have investigated heretofore. In most of the papers on this website, and especially in the "flagship" paper: "Symmetry Principles of the Unified Field Theory", I have investigated symmetry conservation in the relatively simple terms of bound vs free energy - asymmetric matter vs symmetric light. In this simple scenario, we have been able to discover a rationale for gravitation as it converts bound to free energy in stars, supernovas, quasars, and finally the complete gravitational conversion of bound to free energy in Hawking's "quantum radiance" of black holes. It is also probable that black holes convert atoms to light internally as well as externally, through gravitationally induced "proton decay" at the central "singularity". Black holes are probably filled with nothing but gravitationally bound light, which is slowly evaporated away by Hawking's "quantum radiance". In the conversion of bound to free energy (by all the forces, not just gravity), we see the fulfillment of Noether's Theorem regarding symmetry conservation, even to the extent of converting the asymmetric entropy drive of bound energy (the intrinsic motion of time) to the symmetric entropy drive of free energy (the intrinsic motion of light).

All this notwithstanding, one cannot escape the conclusion that the "Higgs Cascade" and "rebound" series reveals yet another rationale for gravitational action, although once again it is in the service of Noether's Theorem of symmetry conservation: the gravitational reconstruction of the force unification regimes or symmetric energy eras of the "Big Bang". In stars (and supernovae), for example, we reach level H1, with the weak force transformation of the elements via the "W" level IVBs. Nuclear transformation energies, which require the mediation of the "W" family of IVBs, represent level H1 energies (while planets and chemical transformation energies characterize our atomic "ground state"). At the galactic level, the supermassive black hole and quasar represents energy level H2, since we find not only proton decay in its interior (via leptoquarks or their equivalents), but the complete conversion of quarks and leptons to their common denominator, light, via Hawking's "quantum radiance". Level H3 is reached in the "Big Crunch", the cosmic gravitational collapse which recapitulates the "Big Bang" and destroys the Universe in the gravitational unification of all forces, particles, and spacetime.

The two (major) symmetry-conserving processes evidently operate simultaneously: the return of bound to free energy and the reunification of the forces, as for example in the Sun and stars. There is a problem, however, in that force unification is opposed by entropy, both in the "Higgs Cascade", which is driven by entropy to lower symmetry levels of force unification, and in the gravitational "rebound", in which the release of bound to free energy opposes and (for a time) prevents the gravitational collapse of stars to higher force unification symmetric energy states. In fact, we find one type of symmetry drive - force reunification - opposed by another - the conversion of bound to free energy. This struggle ends violently in a supernova, signaling the transition from energy level H1 to H2. Locally, gravitational force unification wins the day in the creation of black holes, but globally it seems that the conversion of bound to free energy is victorious through quantum radiance, proton decay, and the "heat death" of the Cosmos rather than a "Big Crunch". This is apparently because the conversion of bound to free energy works with entropy rather than against it (as in the gravitational drive, which is negentropic).

Force unification takes place only at very high temperatures and energy densities, which are low-entropy environments and states. This is why the "rebound" must be driven by a negentropic force, gravitation. But even while gravity is seeking to reunite the forces, the symmetry conservation drive to release asymmetric bound energy to its original symmetric form, light, is working hand in hand with positive entropy to expand and cool spacetime via the intrinsic motion of light. The action of these four drives, one of contractile negative entropy (gravity), one of expansive positive entropy (the intrinsic motion of light), one of symmetry conservation seeking to reconstitute the unity or symmetric energy state of the forces (gravity), and another symmetry conservation drive (gravity again) seeking to convert bound to free energy (via the electromagnetic, strong, and weak forces) - results in a standoff that produces the balanced force field of our Sun (for example). The Sun balances the radiative, expansive forces of light produced by the conversion of bound to free energy against the contractile forces of gravitation. The Sun will radiate quietly for billions of

years due to this relentless tension between opposing forces. If (in larger stars) the forces become unbalanced in favor of gravity, a supernova and a black hole may result as the negentropic force unification drive proceeds upwards to symmetry state and energy level H2 (a black hole), where "proton decay" is commonplace, quarks and leptons are interchangeable, and both are converted to light. If gravitation wins on the cosmic scale, then force unification becomes complete as the Universe collapses in the symmetry state of H3 and gravity reunites all forces, particles, and spacetime.

Whether or not the Universe collapses, symmetry conservation carries the day, either sooner in the negentropic triumph of force unification via a gravitational "Big Crunch", or later in the total conversion of bound to free energy via Hawking's "quantum radiance" of black holes, proton decay, and the slow "heat death" of the Cosmos, in which both positive entropy and symmetry are victorious. In the latter case, force unification is not achieved, even though it remains the driver of the gravitational process until the last black hole evaporates.

While we have previously (and correctly) understood the gravitational rationale from the point of view of energy, symmetry, entropy, and causality conservation (the gravitational creation of time from space, providing the temporal entropy drive, energy accounting system, and a causal linkage for bound energy, including the historical arena for charge conservation), the point of view of symmetry conservation (the gravitational conversion of bound to free energy, as in stars), and even as the source of negative energy (balancing positive energy in the "Big Bang"), the gravitational recapitulation of force unification symmetric energy levels allows us to understand the gravitational rationale from a completely new perspective, embracing only the unification of the four forces. This new understanding provides another strong link between the "Tetrahedron Model" of symmetry conservation and unification theory, and the "Standard Model" of "establishment" physics.

Links:

Weak Force, Intermediate Vector Bosons ("IVBs")

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