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

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

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Revised Dec., 2012

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The IVBs and the Higgs Boson

Abstract

The IVBs (Intermediate Vector Bosons) are the field vectors (force carriers) of the weak force. The IVBs reconstitute (or revisit) the very energy 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 to a particular symmetric energy state, defined by a specific force-unification era (such as the Electroweak Era, for instance), with a specific energy density and temperature. 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" (EW) 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 (during the EW Era, 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.)

Introduction

The "Electroweak Era" (EW) 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 in "real time" rather than as "virtual" particles, 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 (photons) 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/Dirac "virtual particles", dependent upon borrowed energy for a "peek-a-boo" existence.

The "Higgs Cascade" model presumes three energy levels, tiers, 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 and lowest energy (beyond our cold electromagnetic (EM) "ground state") is the "W" IVB family level (of the electroweak (EW) force unification energy level), which mediates transformations among elementary leptons and quarks, including their creation and destruction. The second IVB "family" is an analogous (but hypothetical) set of superheavy "X" IVBs (with their own Higgs), which mediates transformations among leptoquarks, including the asymmetric destruction of leptoquarks, and the creation/destruction of baryons and matter, during an earlier, hotter, and more energetic era of the "Big Bang" - this is the GUT (Grand Unified Theory) energy level of unification between the strong and electroweak forces. A third (also hypothetical) even higher energy family of Higgs and "Y" IVBs may exist at the ultimate unification energy level incorporating gravity (the Planck Era, in which primordial leptonic massive particles and leptoquarks were first created). This final level is referred to as the level of "TOE" or "Theory of Everything" (the level of

"quantum gravity") (see Part I).

The uncharged Higgs boson is not an ordinary IVB in that it does not mediate interactions, but rather determines the mass scale of the unified-force symmetric energy states (such as the EW), and all the particles (including the IVBs) they contain. (Three different Higgs bosons are necessary to scale and distinguish between the three possible unified-force symmetric energy states.) 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 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 photon gauges the spacetime metric to "velocity c", determining in one case the mass and symmetric relations among elementary particles, in the other the size and symmetric relations among the dimensions.

The IVB "W" family of particles provides a bridge between the real particles of the sparse, low-energy metric of the cold "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 particle-antiparticle "zoo" of high-energy spacetime (heavy leptons, quarks, mesons, neutrinos, and baryons ("hyperons"). 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 transformations occur naturally (because the various particle "species" are united in a "generic" level of identity); that is the essence of the Higgs-IVB transformative partnership.

The role of the IVBs is to provide, for particle "singlets" (particles without antimatter mates), 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" cold 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 mass/energy parameter of the "singlet" elementary particles of matter the IVBs produce. (See: "The 'W' IVBs and the Weak Force Mechanism".)

Why does the weak force transformation mechanism require two bosons - the neutral Higgs plus the charged IVBs? The weak force IVB field vectors cannot also act as their own scalar particles: their specific charges prevent them from gauging the completely general mass parameter of any energy level of force-unification. Furthermore, 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 in terms of the higher organizational level (or more general symmetry principle) of the unified-force symmetric energy states. The IVB field vector's role is the transformation and/or creation/destruction of *single* elementary particles within its Higgs domain, and IVBs cannot do this and perform the role of a generalized, symmetric energy state, 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 charged IVB field vectors to do the actual transformations, and the neutral Higgs scalar bosons to gauge or regulate the masses of the IVBs (by selecting between the three IVB families or symmetric energy plateaus of force-unification).

The three levels of Higgs bosons gauge (fix the energy of) three levels of unified-force symmetric energy states which the IVBs must access (energize) to perform their transformations. Hence the Higgs determines the IVB mass indirectly, by setting the energy level to which it must rise. It is within these unified-force symmetric energy states that the charge and mass parameters of the elementary particles are fixed. (This is not the same as the "standard model" Higgs boson action mechanism. See: "The Higgs Boson vs the

Spacetime Metric".) The weak force "massive IVB" mechanism works because the unified-force symmetric energy states (the energy levels at which the forces join or separate from one another) are discreet, well defined, and invariant. They can therefore be accessed by a quantized high-energy particle (the IVB) whose mass reproduces exactly the necessary unified-force symmetric energy level for a specific transformation. As a typical example, the Higgs boson gauges the energy level for the EW unified-force symmetric energy state; by virtue of their quantized mass-energy, the "W"/"Z" IVBs recreate/access the EW energy level, transforming single elementary particles via a "local gauge symmetry current" of virtual particle-antiparticle pairs drawn from the Dirac/Heisenberg "vacuum". (See: "The 'W' IVB and the Weak Force Mechanism".)

The Higgs gauges or scales the masses of elementary particles at second hand, through the agency of the unified-force symmetric energy states and their 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 force-unification realm in which the transformation to be accomplished first occurred. As we have noted, conservation demands that the electron created today *must* be the same as the electron created yesterday or tomorrow, which is why the Higgs scalar is itself quantized and invariant, and why the (likewise quantized) IVBs and the symmetric energy 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 IVB and its 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 unified-force states, their IVBs, and through the IVBs, the mass of elementary particles.

The "W" and "X" IVB "families" 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 force-unification realms. The "Y" IVBs create electrically neutral leptoquarks (by splitting primordial charged leptons into three quarks); neutral leptoquarks live long enough to survive into the H2 or GUT energy level (of an expanding and cooling universe). The Higgs sets the scale at which the IVBs function, ensuring that all particle masses they create are invariant, whenever and wherever they may be produced. Finally, certain universal constants of electromagnetic and gravitational 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 (including charge) in our particular "life friendly" Universe. These universal physical 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.

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 Heisenberg/Dirac "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 "vacuum". The difference is that whereas the electromagnetic force can only create particle-antiparticle pairs, the weak force can create/destroy or transform *single* elementary 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. (Despite billions of years of the entropic expansion of spacetime, the mass of the Higgs, the IVBs, or the particles and charges they create is not attenuated. Particle mass and charge is not affected by entropic enervation, which is why the weak force mechanism employs massive gauge bosons and scalar particles to effect transformations which must be invariant throughout 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

Let us try to be as specific as we can and further examine the nature of the Higgs particle. The Higgs gauges, or "scales" the mass-energy of the unified-force symmetric energy states and all the particles they contain (including the IVBs). The unified-force symmetric energy states are defined or characterized by the specific 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). 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 EM ground state). This symmetry loss and (total system) entropy gain is accompanied by a release of energy (as when water condenses or freezes), energy which is converted to particle-antiparticle pairs, radiant heat, and/or random molecular motion.

For example, above the energy level of the "W" family of IVBs (above about 81 GEV), the various members of the lepton family are unified among themselves, and likewise, the quark family members are unified among themselves. This unification (the "Higgs 1" (EW) 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 can be created and destroyed; heavy baryons (hyperons) can be transformed, but hyperons and baryons cannot be created or destroyed at the H1 energy level. This is a symmetry or unity with respect to the merging, swapping, and transformation of "identity" charge or "flavor" ("number" charge) within the quark or lepton "genera", which is unknown at the lower energy density of the EM ground state. In the EM ground state, we have only the proton, neutron, and electron for stable particles (the neutron is stable within certain compound atomic nuclei; neutrinos apparently oscillate among themselves, so we can only call them quasi-stable); 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 EW symmetry 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 hadron "genus" vs the lepton "genus") at the electroweak energy level of force unification.

The recently observed "oscillations" of neutrino flavors suggests that our EM ground state represents a very low-energy form of force-unification symmetric energy state, at least with respect to neutrino flavors or "identity" charges. The energy source for this elevated ground state of the spacetime metric or "vacuum" is apparently the intrinsic entropy drive (and symmetry gauge) resident in the photon, which confers upon light (free electromagnetic energy) its intrinsic motion, "velocity c". This universal spatial positive entropy drive is the "dark energy" (or "cosmological constant") of the universe, which is opposed by the temporal 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 cosmic gravitational energy, which allows the entropic expansion of the global spacetime metric to increase (rebound) toward its natural maximum value as gauged by "velocity 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, electrically neutral leptoquarks are destroyed (but not created), and hyperons (heavy baryons) are created and destroyed ("proton decay"), 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 energy level and from there to the protons and neutrons of the EM 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 EM ground state) currently understand light and matter. In the absorption of baryons into leptoquarks at the H2 energy level, we lose 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 ("Ylem"), 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 EM "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, "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 of electromagnetic and gravitational energy. 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 EM ground state ("Atomic/Chemical Era") which 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 photon, 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) due to the intrinsic motion of light (initially contained within the metric as an expansive, entropic pressure, balanced by the contractile negentropic pressure of gravity). The cascade, which is set in motion by the asymmetric weak force producing electrically neutral leptoquarks (via the "Y" IVBs), 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 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, accidental, and tragic "heat death" of our biosphere).

In our effort to control nuclear fusion reactions, we are making common cause with gravity and our Sun to restore matter to its original symmetric state, light. We are also moving from the EM chemical realm of our planetary origins to the EW nuclear realm of the Sun and the IVBs. This is surely one of the greatest achievements of not only humans but of life itself - and we see that it is (naturally) coincident with the initiation of our space programs. Both are fraught with great danger and technical difficulty, but also with great promise for a better future. We are entering a new domain of the Sun, the Solar System, and the EW symmetric energy level.

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, or understand the connection between leptons and quarks (leptoquarks) (level H3); or account for baryons and our matter-only Universe (level H2). Level H1 (which is experimentally verified) contains all the exotic quark and lepton flavors, the hyperons, heavy quarks and leptons derived from the decays of leptoquarks in H2; hyperons and heavy leptons of H1 decay in their turn (via the EW IVBs) to the familiar ground state (EM) electron, electron neutrino, proton, and neutron. The H1 Higgs boson may also have been experimentally verified (as announced at CERN July 4, 2012). 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 Higgs and IVBs 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 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 electrically neutral leptoquarks from primordial leptons ("Ylem"), hyperon "singlets" from neutral leptoquarks, and ground state (EM) atomic matter from the electroweak decays of hyperons and heavy leptons.

The "X" level (H2) of leptoquarks may be experimentally accessible, but only 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 and spacetime 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 understanding the Cosmos, how it functions, and our place within it. Finally, General Systems models suggest new relevance for ancient intuitively generated cosmologies, mythologies, and religions, so often expressed in patterns of threes and fours. (See: "The Fractal Organization Of Nature"; also: "Table 1".)

Symmetry, Entropy, and Gravitation

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 (Planck Era) force unification energy level, to the "ground state" Atomic/Chemical 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 (symmetry conservation) 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 temporal entropy drive of bound energy (the intrinsic motion of gravity and time) to the symmetric spatial 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 toward level H1, with the weak force transformation of the elements via the "W" IVBs. Nuclear transformation energies, which require the mediation of the "W" family of IVBs, represent level H1 energies (while chemical transformation energies characterize our planetary and atomic "ground state"). At the galactic level, the supermassive black hole and quasar is representative of 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 reunification 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 reunification 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 symmetry 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 (if a black hole results). Locally, gravitational force reunification 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 the natural increase in positive 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 stars larger than our sun) 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 (presumed) 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 (Planck Era TOE) and gravity reunites all forces, particles, light, 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 reunification is not achieved, even though it remains the driver of the gravitational process until the last black hole evaporates.

We have previously (and correctly) understood the gravitational rationale from the perspective of: 1) energy, symmetry, entropy, and causality conservation (the gravitational creation of time from space, providing the temporal entropy drive, energy accounting mechanism, and a causal linkage parameter for bound energy, including a historical arena for charge conservation); 2) symmetry conservation (the gravitational conversion of bound to free energy, as in stars); 3) 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 4th viewpoint, embracing only the reunification of the four forces. This new understanding provides yet another strong link between the "Tetrahedron Model" of symmetry conservation and the "Standard Model" of "establishment" physics, as both pursue Einstein's dream of a Unified Field

Theory.

Links to other parts of this paper:

The "Higgs" Boson and the Weak Force IVBs: Part I
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The "Higgs" Boson and the Weak Force IVBs: Part 3
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The "Higgs" Boson and the Weak Force IVBs: Part V

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
(Postscript and Commentary on paper above)
Synopsis of the Unification Theory: The System of Spacetime
Synopsis of the Unification Theory: The System of Matter
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Global-Local Gauge Symmetries and the "Tetrahedron Model"
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The "Tetrahedron Model" vs the "Standard Model" of Physics: A Comparison

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The Weak Force: Identity or Number Charge
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