

The Higgs Boson and the Higgs Particle Metric (Postscript)

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We must use analogy to gain some level of understanding concerning the unfamiliar concepts of the Higgs field and the Higgs boson (the latter is the quantum unit of the field). We are familiar with the spacetime metric (the relationship between the dimensions: one second of time is metrically equivalent to 300,000 km of distance, as gauged by the electromagnetic constant "c") and the photon (a quantum of light). The spacetime metric is the low-energy, dimensional analog of the Higgs field and the photon is the analog of the Higgs boson. The spacetime (or electromagnetic) metric regulates the common features of our dimensionality - the symmetric relations between the dimensions for example, while the Higgs regulates the various elementary particles our spacetime contains, as manifest through the very limited varieties of virtual and real particles spacetime will produce and maintain: [the leptonic and hadronic families of elementary particles](#). The electromagnetic metric is "gauged" or regulated by "velocity c", the electromagnetic constant, which determines the "velocity" of light (actually "c" is the gauge of the entropy drive of free electromagnetic energy (light's "intrinsic" motion, causing the expansion and cooling of space), as well as the gauge of light's non-local metric and distributional symmetry: in its own reference frame, light is everywhere simultaneously). The gauge constant "c" also determines the magnitude of electric charge, the inertial properties of spacetime, the invariance of causality and Einstein's "Interval", and the energetic equivalence between free and bound forms of electromagnetic energy: $E = mc^2$.

We are composed of electromagnetic energy and live within its conservation domain. We must obey the conservation rules laid down by the electromagnetic gauge constant c and the spacetime metric which it establishes, regulates, and maintains. The invariance of velocity c, the implacable march of time, inescapable inertial and gravitational forces: this is how we usually experience the dimensional limitations of our 4-D metric, but it is also limited (as per the Higgs) in terms of the paucity of its conserved elementary particle spectrum. Of course, it is no coincidence that we have the spatial and temporal dimensions necessary to conserve the energy of both light and matter: this is an electromagnetic universe, creating both free and bound forms of electromagnetic energy (light and matter), along with their entropic drives (the intrinsic motions of light and time), which in turn produce their energetic/entropic conservation domains (space and history).

A special feature of our spacetime or electromagnetic metric is that it will produce (thanks to the Higgs) a limited spectrum of elementary particles (in particle-antiparticle pairs) when it is supplied with sufficient energy. This phenomenon tells us that electromagnetic energy exists in two expressions: 1) free energy (light) - a spatial, massless form; 2) bound energy (particles) - a temporal, massive form. There is no explanation for this fact anymore than there is an explanation for the existence of light or free energy itself. But the universe of our experience obviously depends upon it - we live in a compound conservation domain of free and bound electromagnetic energy. (A partial explanation is that the negative energy of the gravitational field of particles balances the positive energy of light in the "Big Bang", and so allows the creation of the universe from *no net energy*. Similarly, the primordial presence of antimatter originally balanced the charges of matter, allowing the creation of the cosmos from a condition of *no net charge*. This original condition of energetic symmetry (at least with respect to matter vs antimatter) was broken by the [asymmetric action of the weak force during the "Big Bang"](#), leaving us with our "matter-only" cosmos. But the fundamental question of "why there is

something rather than nothing" remains the province of religion/philosophy/mythology/conjecture rather than science.)

When our familiar spacetime metric is sufficiently compressed (as by gravity) or otherwise energized (as in collisions), its particle nature, rather than its wave nature, is revealed. The Higgs metric is a particle metric rather than a dimensional metric, and its symmetries are between particles and forces rather than between dimensions. At the high energy of the [several force-unification eras](#), the dimensional conservation constraints of our electromagnetic metric are suppressed (but they don't completely vanish), and its particle conservation constraints and characteristics come to the fore.

Now imagine our entire electromagnetic metric raised to a (much) higher energy level in which the spacetime metric is (mostly) replaced by the Higgs (or "particle") metric, the photon is replaced by the Higgs boson, and (given the absence of large spatial dimensions) the gauge (regulatory) role of the electromagnetic constant "velocity c " is (mostly) replaced by the Higgs gauge constant which we will designate as Higgs1 (since there are several higher-energy Higgs conservation domains and gauge constants). The H1 high-energy conservation domain existed in the very early universe, and is actually revisited today in the extremely ephemeral and limited form of the weak force "Intermediate Vector Bosons" (IVBs), the W^+ , W^- and Z (neutral). A defining feature of this energy level is that it is the symmetric energy state in which the electromagnetic and weak forces are unified - the domain of the "electroweak" force. The union of these forces creates an energy state of higher symmetry than that of our familiar "everyday" state, the electromagnetic "ground" state; we can designate the latter (for convenience of reference) as H0. We envision a [cascading series of force-unity symmetric energy states](#) beginning with H3 at the moment of the "Big Bang" or "Creation Event", in which all 4 forces were united, including gravity: this is the "TOE" ("Theory of Everything") state or "Planck era" in which leptoquarks are created and destroyed, ([the Planck era or domain of Gamow's "Ylem"](#),

The particles of the initial state (H3 Planck Era) were designated as "Ylem" by George Gamow, and may have consisted of a "quark soup" mixed with heavy primordial leptons. These heavy leptons were split into three parts (quarks) by the "Y" IVBs (of that era's weak force), producing electrically charged leptoquarks (which annihilate with their anti-partners) as well as electrically neutral leptoquarks. Neutral leptoquarks live long enough to become the main constituents of H2, the "Leptoquark Era", where they decay asymmetrically (via the "X" IVBs of that time) to produce the matter-only baryons of the H1 energy level ("Hyperon Era"). (This is why quarks are essential to the creation-of-matter process - they can form electrically neutral leptoquarks (heavy analogs of neutrons) which live long enough to undergo asymmetric weak force decays rather than symmetric electric-force instant annihilations.) In turn, the hyperons of H1 decay further (via the "W" IVBs), producing the protons and neutrons of our "ground state" electromagnetic or Biological Era. (See: ["Table of the Higgs Cascade"](#).)

"Mass" (the bound energy of particles) is created in H3 by the interaction of gravity with all the other forces (producing the "leptonic spectrum" of massive elementary particles, including its most massive member, the "leptoquark"). All other particles, including quarks, are derived from this elementary 4-member massive leptonic "spectrum" (electron, muon, tau, leptoquark). An "inflationary" era may have occurred before the H3 era, causing a huge expansion of the early universe, but this theory remains controversial, as it is not easy to see how any large dimensions could have existed at this time. (See: ["Inflation"](#).) Leptoquark neutrinos produced in H2 during the asymmetric decay of electrically neutral leptoquarks remain excellent "dark matter" candidates. As for "dark energy", it apparently consists of nothing more than the constant reduction of the total gravitational field of the cosmos, as mass is converted into light by various and persistent astrophysical processes (as in our Sun). (See: ["Does Light Produce a Gravitational Field?"](#))

As the universe expanded and cooled from the H3 Planck Era, it stepped down to the H2 Leptoquark Era, the force-unity symmetric-energy state in which the strong and electroweak forces are unified (the GUT or "Grand Unified Theory" symmetric-energy state). In the H2 or "GUT" state, baryons are created and destroyed - this is the Leptoquark Era ending with the asymmetric weak force creation of matter. With further expansion and cooling the universe steps down to the H1 or electroweak force-unity symmetric-energy state (the Hyperon Era), in which the class of *alternative charge carriers* - individual leptons, neutrinos, mesons, and quarks - may be created, transformed, and/or destroyed. Thanks to these alternative charge carriers, hyperons (baryons composed of heavy quark flavors) may also be transformed in this era, but not created or destroyed. The final stable ground state of the universe is that of our daily experience, H0 or the electromagnetic ground state (Atomic/Chemical/Biological Era) in which only information states (electron shell chemical combinations including living systems) are created and destroyed.

All actual creation, destruction, or transformation of particles via the "W" weak force IVBs belong to the H1 energy level or higher. The nuclear transformations of our Sun or of radioactive materials on Earth represent a partial intrusion of electroweak era processes and energies into the chemical era of our electromagnetic ground state. The weak force IVBs themselves represent such an intrusion, belonging to the H1 energy level, hence their large and anomalous mass. "W" IVBs directly contact (sample) the H1 Hyperon/Electroweak era, transforming quark flavors, producing electrons and electron antineutrinos, and releasing (partially) the enormous binding energies of the atomic nucleus. The various IVBs of every era thus represent connecting links between the distinct symmetric energy-states of the "Higgs Cascade", which brings our universe into existence.

The symmetries of these unified-force or Higgs symmetric-energy states are manifest in the union of particle identities as well as of forces. In the H0 ground state, all particle identities are separately conserved; in the H1 state all leptonic particle identities are joined and all quark identities are joined (but leptons are not joined with quarks); in the H2 state the leptonic identities are merged with the quark identities; and at the H3 state, boson and fermion identities are unified - all forms of energy, bound or free (including gravity), are united in H3. The biological taxonomic scheme in which species identities are progressively subsumed at the genus, family, and order levels of relationship presents a familiar analogy for these hierarchical energy states of increasingly comprehensive symmetry.

Each of these unified-force symmetric-energy states must be distinguished by its own Higgs boson or scalar particle, not only to unambiguously distinguish one Higgs state from another, but crucially to maintain the conservation parameters of mass, charge, identity, energy, etc., of the various particles as they fall through the cascade of manifestation to the ground state. Hence the need for quantized scalar particles or distinct Higgs bosons at each level, to ensure conservation and exact replication of the conserved parameters of elementary particles. Elementary particles created today must be the same in every respect as those created eons ago in the "Big Bang" - for obvious reasons of energy, symmetry, and charge conservation. The Higgs, IVBs, and the whole quantum-mechanical mechanism of the weak force is dedicated to this complex but necessary task. (Note that it is the creation of *single* elementary particles which makes this process so difficult. In the absence of antimatter, only the complex mechanism of the weak force IVBs can reach into the next-higher H1 era to faithfully extract, create, destroy, or transform *single* elementary particles - hence it is the weak force which is responsible for the creation of our matter-only universe (via "X" IVBs in the H2 Leptoquark era.) It is mass itself which distinguishes the Higgs eras, the IVBs, and the particles they transform or produce, since particle mass, having no intrinsic spatial motion, is immune to the entropic action of the expansion of the universe over cosmological time, and hence can today faithfully recreate energy densities and particle masses from the ancient era of the "Big Bang".

The Earth is the domain of chemical transformations, information, biological life forms, and the H0 ground state, but our Sun at least partially contains within its interior a domain of nuclear transformations where the H1 or electroweak state (as reprised by the "W" IVBs) is commonplace, as leptons and quarks are created and destroyed and baryons are transformed during the conversion of protons to neutrons and hydrogen to helium. These transformations are accomplished by the weak force IVBs, representatives of the H1 symmetric-energy state, in which all leptonic identities are equivalent and all quark identities are equivalent (H1 is the "generic" state for both leptonic and quark "species"), and hence transformations (or "swapping") of specific identities within the leptonic "genus" or within the quark "genus" [are simply the normal course of events](#).

The necessity for the Higgs mechanism is due entirely to the need for specific massive identities as carried by *single* particles of matter (not particle-antiparticle pairs). Mass is necessary because of its gravitational field, which provides negative energy to balance the positive energy of the Creation Event, allowing the universe to be born as a quantum fluctuation of no net energy. Hence mass is required for the universe to exist - it is not an accidental, incidental, or trivial component of the cosmos. (Nor are sentient beings like ourselves: we are required so that the universe may know itself and further explore its creative potential - as through art and science, for example.)

Summary

The Higgs bosons regulate, gauge, or identify the higher symmetric energy states of the particles and forces in the same sense as the electromagnetic constant c regulates the symmetric aspects of our more familiar (and much expanded) spacetime metric. The spacetime metric can and will produce (and annihilate) elementary particles in symmetric particle-antiparticle pairs, either as virtual particles or as real particles whenever sufficient energy is available (thanks to the universal presence of the H1 particle metric or "field"). It is a conservation function of the H1 particle metric and the electromagnetic constant c to ensure the invariance of such particle pairs as well as their immediate or eventual annihilation. However, if single elementary particles are to be produced, without an annihilating anti-partner, then the elaborate weak force mechanism must be engaged to recreate the original environmental conditions of the electroweak symmetric-energy state (heat, energy-density, etc.) in which these particles were first created to ensure their absolute invariance throughout space and time. (The global particle symmetry of "exact sameness within type" is locally reproduced by the massive IVBs.)

The three levels of Higgs bosons gauge (determine 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 (of force unity) to which the IVBs must rise. It is within these unified-force symmetric energy states that the charge and mass parameters of the elementary particles are fixed, transformed, and "swapped". (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 Higgs1 boson gauges the energy level for the electroweak unified-force symmetric energy state; by virtue of their quantized mass-energy, the "W"/"Z" IVBs recreate/access/sample the electroweak energy level, transforming single elementary particles via a "local gauge symmetry current" composed of particle identities drawn from the global Dirac/Heisenberg vacuum "particle sea". (See: ["The 'W' IVBs and the Weak Force Mechanism"](#).)

The Higgs Cascade (including "rebound" stages)

(See also: [The Higgs Boson and the Evolutionary Eras of the Cosmos](#))

H3: TOE - Theory of Everything - all forces unified. *Planck Era*. Gamow's "Ylem", "quark soup", electrically charged and neutral leptiquarks (electromagnetic primordial substance). Particle or Higgs metric gauged by H3 Higgs scalar boson. "Y" IVBs create and destroy leptiquarks, splitting primordial heavy leptons into three subunits (quarks). "Y" IVBs transform charged leptiquarks into neutral leptiquarks. Neutral leptiquarks may live long enough to undergo asymmetric weak force decays in H2 era (below). Creation of mass by the union of gravity with the H3 particle metric and the other forces. The electromagnetic constant "c" gauges electric charge and the mass equivalency between bound and free electromagnetic energy forms ($E = mc^2$). Union of all particles (fermions and bosons) into the "order" of electromagnetic energy. "Big Bang", "Creation Event". Separation from Multiverse with "life-friendly" physical constants. (?Inflation?) (Rebound: "Big Crunch").

H2: GUT - Grand Unified Theory - strong and electroweak forces unified. *Leptoquark Era*. Electrically neutral leptiquarks, leptiquark neutrinos. Particle or Higgs metric gauged by H2 Higgs scalar boson. Electrically neutral leptiquarks decay asymmetrically (via the "X" IVBs) to produce hyperons and leptiquark neutrinos (H1 level below). Creation and destruction of baryons. Union of leptons and hadrons into "family" level particles (= leptiquarks). Separation of matter from antimatter, creation of matter-only universe. Three "families" of quark "flavors" are required to generate sufficient numbers of electrically neutral baryons to produce our matter-only universe via asymmetric weak force decay. (Rebound: black Holes, "proton decay").

H1: EW - Electroweak unification - electromagnetic and weak forces unified. *Hyperon Era*. Alternative charge carriers (leptons, mesons, neutrinos). Particle or Higgs metric gauged by H1 Higgs scalar boson. Hyperons and baryons decay (via the "W" IVBs), producing leptons, mesons, and neutrinos; baryons are transformed but not created or destroyed. Creation and destruction of leptons, mesons, and neutrinos. Union of lepton and quark species into separate "genera". (Rebound: Stars; element building).

H0: EM - Electromagnetic Force - electric and magnetic forces unified (ground state atomic matter). *Atomic/Chemical Era; Biological Era*. (Electrons and nucleons united into atomic structure.) Chemical and biological information, DNA, genetics. History; negentropic information states. H0 = spacetime metric gauged by "c", the electromagnetic constant. Expansion and cooling of large dimensions and the spacetime metric. Massless photons travel freely. Creation of cold atomic matter from baryons and leptons; creation and destruction of chemical information, including life forms. Beginning of gravitational "rebound" and return to original symmetric energy state of electromagnetic energy (light) - via stars, black holes, "Big Crunch". All particles and forces are individually distinct. Electron shell transformations only; *no nuclear transformations in H0 ground state*. (While nuclear transformations in our Sun provide the energy source for life on earth, life obviously cannot exist on the Sun. Solar energy and radioactivity (the latter in the Earth), while important sources of energy for life on our planet, are nevertheless intrusions into our chemical/biological energy level "from above", from the H1 energy level. Life can exist without them, although perhaps not so abundantly or with such diversity.) (Rebound begins through gravity: Planets, life).

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