Unification Era	Symmetry Group	IVBs (Decay Path)	Field Vector Temp/Time/GEV	Charge	Era Role
Leptoquark Era; T.O.E. "Theory of Everything" (Gravity and Spacetime Unified with Light, Particles) Creation of Leptoquarks	Higgs 3; All Forces Unified; G2 (?) (Strings?) (Dimensions?) (Massive Particles) Gamow's "Ylem" "Quark Soup"	"Y" IVBs; Create Charged Leptoquarks; Transform Charged to Neutral Leptoquarks	Graviton (Gravitational Force); 10(32) k; 10(-43) sec. (Big Crunch) 10(19) GEV	"Location" (gravitational charge); Negative Energy; Total Energy = 0; "Local" Mass Asymmetry	Gravity Provides Negative Energy; "Ylem"; Primordial Leptoquarks; Particle Mass; ?Inflation?
Hyperon Era; G.U.T. "Grand Unified Theory" (Quarks Unified with Leptons) Asymmetric Leptoquark Decay; Creation of Matter, Hyperons	Higgs 2; Strong, E/W Forces Unified; SU(5) (Neutral Leptoquarks)	"X" IVBs; Transform Neutral Leptoquarks; Create/Destroy Matter Hyperons and Baryons; Symmetry-Breaking; "Proton Decay"	Gluon (Strong Force); 10(28) k; 10(-35) sec. (Black Hole) 10(16) GEV	Color Charge; Total Color = 0; Partial Charge Asymmetry of Quarks "Asymptotic Freedom"	Asymmetric Decay of Leptoquarks Creates Matter, Hyperon "Singlets", Leptoquark Neutrinos; ?Dark Matter?
Nuclear Era; E/W Electroweak Union (Quarks Unified, Leptons Unified); Creation of Lepton/Meson Alternative Charge Carriers	Higgs 1; E/W, E/M Forces Unified; SU(2), SU(3) (Leptons, Quarks)	"W" IVBs; Transform Hyperons and Heavy Leptons, Create and Destroy Alternative Charge Carriers (lepton, meson, neutrino)	IVB (Weak Force); 10(15) k; 10(-10) sec. (Stars, Supernova, Neutron Star) 10(2) GEV	"Identity" ("Number" Charge); Total "Number" = 0; "Identity" Asymmetry of Leptons and Baryons	Creates and Transforms Leptons, Neutrinos, Mesons, Leptonic "Singlets"; Transforms Baryons
Chemical Era; E/M Electromagnetic Unification; Electric/Magnetic Fields Unified; Creation of Atoms, Spacetime, Information, Life	"Ground State"; Spacetime Metric (Scaled by c, G); U(1) (Phase) (Light)	Photons; Transform E/M Fields, Space and Time; Create and Destroy Chemical Combinations, Molecules, Information	Photon (Electromagnetic Force); Temp. 2.7 K; Historic Spacetime; 13.7 Billion Yr. (Planets) 10(-3) EV	Electric; Total Electric Charge = 0; 4th Dimension Asymmetry	Creates Spacetime; History; Atoms; Life. "c" Regulates Metric. Virtual Particle "Sea"

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

"Multiverse": Non-dimensional "vacuum" source of undefined symmetric energy and creative potential - produces our 4-D universe as a quantum fluctuation of *no net energy or charge*, conserving energy, with "life-friendly" physical constants ("Anthropic Principle"). Balanced pos-neg (gravitational) energy and matter-antimatter charge symmetry. (Cosmos, Multiverse united). "Big Bang": Cosmos devolves from "Multiverse".

Information and Biological Eras evolve as ground state "rebounds" from entropy-driven cascade. Rebound is driven by symmetry conservation, negentropic gravity, and evolutionary forces, creating planets, stars, black holes, galaxies, "Big Crunch", heavy elements, chemistry, information, life, humanity.

John A. Gowan
Revised Dec., 2011

Abstract

We explore the hypothesis that there are 3 "families" or energy levels of the Higgs bosons and their associated Intermediate Vector bosons (IVBs), analogously to the three families or energy levels of the quarks and leptons. With its origin in the "Multiverse", our Universe apparently devolves (rapidly) downward in an asymmetric "Higgs Cascade" to the electromagnetic ground state, and evolves (slowly) upward again in a "rebound" driven by negentropic gravity and symmetry conservation (Noether's Theorem) toward the Multiverse or a state of pure electromagnetic radiation (light).

Unification Eras (or Symmetric Energy States) of the "Big Bang":

Force Unity Eras: Multiverse Era

Multiverse Era: A-dimensional, "vacuum" potential of undefined creative energy, producing infinitely (?) many energy-conserving Universes (with various and unique physical constants) via quantum fluctuations of *no net energy or charge*, one of which (constrained by the limitations imposed by the "Anthropic Principle") becomes our own. "Inflation" from a "false vacuum" state may be involved (?). Scalar Higgs particles, "Standard Model" symmetry groups, transformative IVB families, and field vectors of the four forces are listed for an entropy driven decay "cascade" through 4 successive levels of force unification. Major roles and productions of the eras are suggested. Unification eras correspond to a specific temperature (absolute degrees Kelvin) and time period (after "time zero") of the "Big Bang" decay sequence (For table data see: Brian Greene: "*The Fabric of the Cosmos*", P. 270, Knopf, 2004, and Frank Close: *The New Cosmic Onion* Taylor and Francis, 2007, page 196. For symmetry discussion, see : Ian Stewart, "*Why Beauty is Truth*", P. 239-73, Basic Books, 2007).

Force Unity Eras: Leptoquark Era

3) Leptoquark Era (Planck era, quantum gravity era, primordial "Ylem" era). Y+, Y-, Y neutral IVBs, Higgs 3, - TOE unity (Theory of Everything): unified positive electromagnetic and negative gravitational energy ("Yin-Yang"). All forces unified. 10(32)k; 10(-43) sec. Unified gravity, light, spacetime, and bound energy forms (primordial, electrically charged leptoquarks). "Quantum gravity". Negative gravitational energy exactly balances positive electromagnetic energy. Matter-antimatter symmetry. "Y" IVBs transform primordial, massive, elementary, electrically charged leptoquarks (a trisected heavy lepton produced by the combined energy of all the physical forces) to electrically neutral leptoquarks, creating the possibility of symmetry-breaking. Neutral leptoquarks decay further in level 2 (Hyperon Era). Separation of the spacetime metric (including gravity) from primordial leptoquarks, and the entropic expansion

and cooling of the Cosmos. This separation may correspond to the "inflationary" era of Guth and Linde (?). Matter-antimatter annihilations. (*Creation of primordial leptoquarks and particle mass; "Big Bang" Creation Event; separation of universe from Multiverse; "Big Crunch".*)

Force Unity Eras: Hyperon Era

2) Hyperon Era. X+, X-, X neutral IVBs, Higgs 2, - GUT unity (Grand Unified Theory): unified quarks and leptons with separate spacetime and gravity. Strong and electroweak forces remain unified. 10(28)k; 10(-35) sec. Entropy driven expansion and cooling of spacetime. Quark partial charges allow the existence of electrically neutral leptoquarks. "X" IVBs compress leptoquarks, causing color charge to self-annihilate in the limit of "asymptotic freedom". With color charge absent, a weak force decay proceeds (via the "X") with the emission of leptoquark neutrinos. Asymmetric weak force decay of electrically neutral leptoquarks vs antileptoquarks produces level H1 Nuclear Era and matter asymmetry of Cosmos. (*Asymmetric creation of matter and single hyperons; leptoquark antineutrinos are "dark matter" candidates. Proton decay; black holes.)*

Force Unity Eras: Nuclear Era

1) Nuclear Era. W+, W-, W neutral IVBs, Higgs 1, - E/W unity (Electroweak Unification): hyperons, (heavy baryons), heavy leptons, protons, neutrons, electrons, neutrinos, and virtual particle "zoo". Weak and electromagnetic forces unified. 10(15k); 10(-12) sec. Matter dominated asymmetry. Leptons and quarks separate into unified lepton families and unified quark families. "W" IVBs transform quarks into other quarks and leptons into other leptons (but not leptons into quarks). Hyperons and heavy leptons decay (via "W" IVB family) to "ground state" proton, electron, and photon with emission of leptonic antineutrinos. Leptons, mesons, and neutrinos serve as alternative charge carriers for the decays of hyperons and heavy leptons, avoiding antimatter annihilation reactions. *(Creation of leptons, neutrinos, mesons - alternative charge carriers; creation of leptonic "singlets". Creation of elements: Stars)*

Chemical Era: "Ground State"

Chemical Era. "Ground State" cold atomic era. Large spatial and temporal dimensions. Historic spacetime, bosons, leptons, hadrons - E/M unity (Electromagnetic Unification). History: currently 13.7 billion years after the "Big Bang"; temperature 2.7 K. Separate leptons, neutrinos, mesons, and baryons. Spacetime, light, and gravity remain unified, electric and magnetic fields remain unified. Virtual vacuum particle "sea". Photon separates from "W" IVBs, creates and energizes space; gravity creates time from space, time creates history. Spacetime metric and photon are the ground state (dimensional) analogs of the Higgs and IVB "particle metric". Era of atomic matter, chemistry, information, life, light, gravity, and historic spacetime. *(Creation of space, historic spacetime, and atomic matter. Evolution of chemical information systems and biological life forms. Planets.)*

The "Ground State Vacuum" also hosts virtual particle-antiparticle pairs, which are essential for maintaining an active connection between the electromagnetic ground state and higher energy electroweak transformations, (for example, the transmutation of atomic nuclei in "radioactive" decays and element-building in stars). Both processes (fission and fusion) directly and continuously interact with the electromagnetic ground state, whereas interactions at the GUT and TOE energy levels are typically of one-time historic significance (creation of Universe, creation of matter). The "nucleon" is a remnant of the electroweak unification era that persists into the ground state of atomic matter due to strong force binding via the exchange of a virtual meson

field. Neutrino "flavor" oscillations may be another example of a remnant union from a more symmetric era.

Symmetry Restoration or "Rebound" Era

Ground State "Rebound" Information, life, and consciousness era, including symbolic information, technology, and humanity. Driven by symmetry conservation, negentropic gravity, and biological evolutionary forces. Rebound begins with planets (ground state); continues through sun-like stars, supernovas, and neutron stars (level H1); galaxies (including quasars and black holes) (level H2); and cosmic collapse or "Big Crunch" (level H3). *Creation of planets, stars, black holes, the "Big Crunch", heavy elements, molecules, chemistry, life, conscious experience, symbolic information, technology, humanity, novel forms of creativity and beauty.* (See: "Nature's Fractal Pathway".)

We have previously (and correctly) understood the gravitational rationale from the point of view of: 1) energy, entropy, and causality conservation (the gravitational creation of time from space, providing the temporal entropy drive and causal linkages of bound energy); 2) the point of view of symmetry conservation (the gravitational conversion of bound to free energy, as in stars); 3) the source of negative energy (balancing positive electromagnetic energy) in the "Big Bang". (See: "Entropy, Gravitation, and Thermodynamics"). The gravitational recapitulation of force unification and symmetry states (culminating in the "Big Crunch") allows us to understand the gravitational rationale from a new, fourth perspective embracing only the reunification of the four forces.

References

Gross, Politzer, Wilczek: *Science:* 15 October **2004** vol. 306 page 400: "Laurels to Three Who Tamed Equations of Quark Theory."

Links:

Unified Field Theory

Symmetry Principles of the Unified Field Theory (a "Theory of Everything") - Part I
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
Light and Matter: A Synopsis
Global-Local Gauge Symmetries and the "Tetrahedron Model"
Global-Local Gauge Symmetries: Material Effects of Local Gauge Symmetries
The "Tetrahedron Model" vs the "Standard Model" of Physics: A Comparison

Weak Force, Intermediate Vector Bosons ("IVBs")

Section IV: Introduction to the Weak Force
Section XVI: Introduction to the Higgs Boson
The "W" Intermediate Vector Boson and the Weak Force Mechanism (pdf file)
The "W" IVB and the Weak Force Mechanism (html file)
Global-Local Gauge Symmetries of the Weak Force
The Weak Force: Identity or Number Charge

home page