The Unified Field Theory - Synopsis of a Personal Quest

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The Charges of Matter are the Symmetry Debts of Light

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See also:
NY Times article on Emmy Noether 26 Mar 2012
Neuenschwander, D. E. *Emmy Noether's Wonderful Theorem*. 2011. Johns Hopkins University Press.

Part I: History

When I turned 40 (about 35 years ago), I started to build my personal version of the Unified Field Theory. I did so as a faithful disciple of Einstein, attempting to help the scientific hero of my youth reach his unfulfilled goal. At that time the strong and weak forces were just becoming understood, gravity remained where Einstein had left it (with some more recent help from Hawking, Wheeler, and Bekenstein concerning black holes), and the electromagnetic force had long been solved by a parade of many geniuses, beginning with Faraday and Maxwell, and culminating with Feynman, Schwinger, and Tomonaga ("quantum electrodynamics"- QED). Because of limitations of time, intellect, and energy, I decided not to work on those parts of the theory that others had already solved - so far as I could tell - satisfactorily. Accordingly, I accepted most of what had been done with the electromagnetic and strong forces (the Gell-Mann/Zweig colored-quark model for the latter: "quantum chromodynamics" - QCD). I also accepted (most of) quantum theory and (most of) Einstein's Special and General Relativity theories, remaining willing not only to learn from these theories but to modify (or extend) them if I thought it necessary to complete a self-consistent picture of all four forces.

For example, in the long-range "spacetime" forces, I found that, contra Einstein, light in free flight cannot produce a gravitational field. I also recognized the electromagnetic constant "velocity c" as the gauge of: 1) the "non-local" distributional symmetry of light's energy; 2) the metric symmetry of light's energy (including banishing time); 3) the symmetric spatial entropy drive of light (creating, expanding, and cooling space). I also recognized the "intrinsic" dimensional motions of light, time, and gravitation as extensions of (and foundations for) the classical concept of entropy. In the strong force I saw quark confinement by the gluon field as necessary protection for whole-quantum units of charge - since quantized charges are the primary means whereby Nature creates exactly reproducible and balancing symmetry debts. In the short-range "particle" forces, I recognized the weak force IVBs (Intermediate Vector Bosons) as actual examples of the electroweak unified-force symmetric energy state (hence their great mass and mysterious composition). Leptoquarks and proton decay (both hypothetical to date) are phenomena of an even higher unified-force symmetric energy state joining the leptons and hadrons, and the electroweak and strong forces (the energy level of the "GUT" or Grand Unified Theory of Georgi and Glashow).

Most of my effort has been expended on bringing gravitation into the fold with the other forces, and on the details of the weak force mechanism. I think I have been successful in both these areas. However, I only claim a conceptual qualitative unification, not a mathematical quantitative unification. I have tried to understand unification from the perspective of the most general physical conservation laws and inclusive principles (I have especially used General Systems ideas regarding fractal patterns in nature).

Part II: Conservation Laws

I identify four basic conservation laws: Energy, Symmetry, Entropy, and Causality. Included in Energy Conservation is "rest mass", linear and angular momentum, and the usual thermodynamic parameters (kinetic and potential energy, etc.); included in Symmetry Conservation (Noether's Theorem) is charge/spin conservation (particles) and inertial/gravitational/metric forces (dimensions); included in Entropy are the dimensional "intrinsic motions" of light, time, and gravity (as well as classical thermodynamic principles); included in Causality is "information", historical "karma", Einstein's "Interval", Lorentz Invariance, etc. The role of information - in its primordial form of charge - is to provide a lawful, conserved ("straight and narrow") pathway for the asymmetric material system to return to its symmetric origins in light. (See also: "Introduction to Information".) All these laws, principles and their corollaries are interconnected in the "Tetrahedron Model" (diagram) (and see text: "Synopsis of the Tetrahedron Model").

These are the minimal concepts and theories that we need for a basic-level non-mathematical conceptual unification comprehensible to most people of ordinary education and intelligence. After Energy Conservation, the most important of these principles for unification is Noether's Theorem, which I will paraphrase as: "The charges of matter are the symmetry debts of light". (Noether proved mathematically (1918) that conservation laws are associated with symmetries and vice versa). In bound forms of electromagnetic energy (matter/atoms), light's symmetry debts take the form of charge/spin; light's energy debt takes the form of mass/momentum; light's entropy debt takes the form of time/gravity. "One-way" causality is due to one-way time. Non-local light has no time dimension, hence light is acausal. Breaking light's spatial "non-local" symmetric energy state (as when massless light is converted to massive particles) is the cause of (gives rise to the symmetry debts/charges of) both the electric and gravitational forces (the two long-range forces).

Because the conservation of light's various symmetries takes the form of charge/spin conservation in the atomic realm (and inertial/gravitational/metric forces in the dimensional realm), the issue of *charge invariance* in a world of relative (rather than absolute) motion and entropic expansion/contraction of the spacetime metric becomes of major consequence. (Symmetry and charge conservation would fail if the magnitude of conserved charges should vary through time or space under the influence of external factors.) Field vectors (force carriers) of the four forces are uniquely equipped to address such issues of "local gauge symmetry" by compensatory actions involving magnetism (electromagnetic force), quark confinement via "sticky" gluons (strong force), massive Intermediate Vector Bosons (weak force), and co-varying time and space parameters (gravitational/inertial/metric forces including "Lorentz Invariance").

The unifying concept in the "Tetrahedron Model" is that everything begins as light (during the "Big Bang"), and eventually returns to light. Since light is the most symmetric of all energy forms, this is a symmetry-conserving/restoring cycle. The symmetry of light is conserved no less than the energy of light. The major mechanism for this cosmic-scale symmetry conservation cycle is charge conservation. Light's symmetries are converted to charge/spin when light is converted to matter during the "Big Bang"; these charges are held invariant through time until the symmetry debts they represent can be redeemed/repaid by their return to light, via matter-antimatter annihilation reactions, particle and proton decay, or gravitationally driven astrophysical processes (stars, quasars, Hawking's "quantum radiance" of black holes, etc.). Charges produce forces which universally and spontaneously act to return asymmetric material systems to or toward their symmetric origins, light. This is what the stars are busy doing, creating the heavy elements as by-products of their primary gravitationally-driven symmetry-restoration/conservation activity - converting nuclear mass to massless radiation.

Part III: Unification

The unification program consists of identifying the symmetry debts of light associated with (giving rise to)

the charges of each of the four forces (including gravity). This makes for a very simple and tight conceptual system, firmly grounded upon physical conservation law, with consequences readily identifiable (in most cases), such as inertial/gravitational/metric forces, charge conservation, and the symmetry-restoration activity of the sun and stars overhead. The notion of symmetry conservation furthermore provides a consistent rationale for color charge and the gluon field of the strong force ("quark confinement", maintaining whole quantum-unit charge values); likewise, for the massive weak force IVBs and the "identity" charges of the neutrinos (gauging, creating, and transforming mass-invariant *single* elementary particles by using the large IVB mass to access the electroweak unified-force symmetric energy state). Likewise also for the invariance of "velocity c" - gauging and maintaining (among other essential parameters) the invariance of electric charge, the invariance of light's "non-local" symmetric energy state and entropy drive (including the metric symmetry of space in which time is banished), the energetic relation between free and bound forms of electromagnetic energy (hv = mcc), and the invariance of Einstein's "Interval" and causality. Finally, the unification program includes gravity with the other forces of nature as yet another example of light's symmetry debts with its own unique charge: "location".

The reality of the spacetime metric as well as of the Heisenberg/Dirac virtual particles in the spacetime "vacuum" is assumed throughout. The spacetime metric is the foundation of energy conservation; time is not only real, time is the entropy drive of matter, history, and the dynamical source of gravitation. "Gravitons" are actually time "charges", pulling space after them into history. Space self-annihilates at the center of mass (since it cannot follow time into history); space in its self-destruction creates more time, the exact metric equivalent of the annihilated space. Thus gravity and time induce each other endlessly, much like the electric and magnetic components of a light wave. *A gravitational field is the spatial consequence of the intrinsic motion of time*. (See: "A Description of Gravitation".)

The electromagnetic constant "c" is the spatial symmetry/entropy gauge of light's intrinsic motion; the gravitational constant "G" gauges the conversion of space to time, or the conversion of light's symmetric "all-way" spatial entropy drive to matter's asymmetric "one-way" historical entropy drive. (See: "The Conversion of Space to Time".)

Part IV: Gravity

The "location" charge of gravitation has a double origin, arising as both a symmetry and an entropy debt of light consequent upon:
1) the breaking of the "non-local" symmetric spatial distribution of light's energy by the conversion of massless, free forms of electromagnetic energy (photons) to massive, bound forms of electromagnetic energy (atoms). Atomic matter consists of immobile (and hence undistributed) lumps of concentrated mass-energy with no (net) intrinsic spatial motion;
2) the loss of light's symmetric "all-way" intrinsic (entropic) spatial motion when massless light is converted to massive forms of energy (as in 1) above). Light's symmetric spatial entropy drive is converted to matter's asymmetric "one-way" temporal entropy drive, causing the expansion/dilution of history rather than space (an entropic component of space is converted to time when light is converted to matter). These gravitational symmetry and entropy debts are linked, in that both arise (simultaneously) as consequences of the loss of light's intrinsic, symmetric spatial motion (gauged by the electromagnetic constant "velocity c"), when free electromagnetic energy (light) is transformed to bound electromagnetic energy (mass/matter/momentum), during the "Big Bang" or subsequently, as via the absorption of a photon by the electron shell of an atom, etc. This linkage manifests through the gravitational creation of time via the annihilation of space, identifying in asymmetric 4-D metric/inertial terms (= "warped" gravitational spacetime) the symmetry-breaking specific spacetime "location" of matter (as distinct from the "non-local" 3-D symmetric space-only distribution of light). Time is the active principle of gravity's "location" charge. A "graviton" is a unit of negative spatial entropy, causing the contraction and heating of space rather than spatial expansion and cooling - an anomaly caused by the active presence of time moving from space into history, dragging space along with it to the

local center of mass.

The special position of gravity in physics is due to its relation to time: gravity creates time from space. Hence gravity, like light (which creates, expands, and cools space), is a dimension-creating and entropy-generating force. The spacetime metric and entropy are the foundations of energy conservation, which in turn is the foundation of physical law. We have seen that the charges of matter are actually symmetry debts held invariant through time until payment is demanded (for example) by antimatter. By contrast, raw energy debts must be paid immediately (as in accelerating an automobile, for example). Symmetry conservation (through charge conservation) makes the historical existence of the material universe possible. Gravity, itself arising as one of the symmetry debts of light, provides an extended dimensional arena for charge conservation by creating time from space. The intrinsic (entropic) motion of time carries on to create history, matter's causal (and conserved) information field. At low field energy (such as on planet earth), gravity simply "pays the interest" on matter's symmetry debt by creating the time dimension in which the debt is held or deferred (the creation of time has a cost - the negative energy of gravitation). This is gravity's entropy-conservation role/mode. At high field energy (such as on our sun), gravity begins (in addition) to assert its symmetry-conservation role by actually "paying down the principle" of matter's symmetry debt, converting mass back to light. (See: "Gravity, Entropy, and Thermodynamics".)

The "black hole" theories of Hawking/Bekenstein/Wheeler confirm the notion of gravity as a dimensional force which converts space to time: the "event horizon" of a black hole is thought to be a time/entropy "surface" (see: *Scientific American* Aug. 2003, pp. 58-65). We see the asymmetric neg-entropic gravitational/time metric of matter gradually taking over the symmetric pos-entropic electromagnetic/spatial metric of light as undistributed lumps of concentrated mass energy (on the astrophysical scale) become larger and denser (planets -> stars -> white dwarfs -> neutron stars), until finally only time, gravity, and bound energy remain as a "black hole" - the spatial metric of free electromagnetic energy having been completely replaced by the temporal metric of bound electromagnetic energy ($g = c$). Yet even here, as Hawking has shown, symmetry conservation eventually triumphs through the phenomenon of "quantum radiance", the total conversion of the black hole's mass to light, completely repaying the gravitational symmetry debt and hence canceling the hole's gravitational field (since the reconstituted light does not itself produce a gravitational field in free flight). Hawking's "quantum radiance" of black holes is the ultimate triumph of Noether's Theorem and symmetry conservation, conserving even the symmetry of light's spatial entropy drive, and confirming the symmetry-conserving role of gravitation.

The loss of negative gravitational energy on the cosmic scale by the astrophysical conversion of mass to light is the cause of the recently observed "acceleration" of the expansion of spacetime, and constitutes the observational evidence that light in free flight does not produce a gravitational field. (See: "A Spacetime Map of the Universe".)

Symmetry principles as applied to the strong force are discussed (among other places) in the paper: "The Strong Force: Two Expressions". For a comparison between the unification scenarios of the "Tetrahedron Model" and the "Standard Model" of "establishment" physics, see: "The 'Tetrahedron Model' vs the 'Standard Model' - a Comparison". For an explanation of technical terms and particle names, see: "The Particle Table".

Part V: Weak Force

My first efforts on the weak force were directed toward uncovering the mechanism behind the "black box" that was the standard model "W" IVB. I found I could explain all the published (CRC Handbook of Chemistry and Physics) weak force decays by a simple model involving the exchange of virtual particle-antiparticle pairs between the particle-to be-transformed and the Dirac-Heisenberg "vacuum" of spacetime - a transaction mediated by the "W" IVB. This exchange amounted to a typical "local gauge symmetry current" flowing between the decaying particle, the IVB, and virtual particle-antiparticle pairs in the "vacuum". (See:

") The weak force is the only force which can either create or destroy a *single* elementary particle (absent antimatter). The weak force is therefore uniquely responsible for bringing our material universe of matter-only atoms into existence.

The task the weak force must accomplish is daunting: every elementary particle created today must be exactly the same as those (of its type) created in the "Big Bang", or at any subsequent time or place. For reasons of energy, charge, and symmetry conservation, any elementary particle must be able to "swap places" with any other of its kind without the exchange being noticed. I realized that the weak force assures the invariance of elementary particles (within type) by recreating the original environmental conditions in which they were first created. This is why the great mass of the IVB is needed to create even a humble (single) electron - the IVB must recreate the original energy-density of the electroweak unified-force era of the early micro-moments of the "Big Bang" in order to exactly reproduce all the conserved parameters of charge, mass, and spin of every lepton or quark it creates/transforms. Accessing the electroweak (EW) unified-force energy state allows the "W" IVB to transform any quark to any other quark, or any lepton to any other lepton, as these "generic" quark or lepton symmetry states are precisely what defines the electroweak force-unity symmetric energy level. The Higgs boson gauges the unified-force symmetric energy state levels, of which there are apparently 3, one for each unified-force level: the electroweak (EW); the Grand Unified Theory (GUT) incorporating EW plus the strong force; and the Theory of Everything (TOE) or Planck Era unity state (incorporating gravity with the GUT). (See: "Table of the Higgs Cascade".)

In our ordinary, cold, electromagnetic (EM) "ground state", all species of leptons and quarks are separate and distinct. Photons and gravitons are part of extended and expanded spacetime, which they have combined to create for reasons of (their own) energy conservation. In the high energy, hot and dense EW unified-force symmetric energy state (the "genus" level of symmetry/unity for leptons and quarks), all lepton "flavors" are equivalent and can be transformed one into another; likewise the quark flavors, but leptons cannot be transformed into quarks. In the GUT unified-force symmetric energy state (the "family" level of symmetry/unity for fermions), all leptons and quarks (= all fermions) can be transformed one into another, leading to the possibility of proton decay and the production of single matter-only baryons from electrically neutral leptoquark precursors (due to the activity of the "X" class of IVBs). In the GUT however, fermions and bosons remain separate. At the TOE unified-force symmetric energy level (the "order" level of symmetry/unity for electromagnetic energy), in which gravity is combined with the other forces, all fermions and bosons are united, and free electromagnetic energy is transformed into bound electromagnetic energy, resulting in the production of particle-antiparticle pairs of leptoquarks, both electrically charged and electrically neutral (the latter due to the activity of the "Y" class of IVBs).

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".)

Other aspects of the weak force I have investigated include the "Big Bang" Origin of Matter and Information. In the "Origin" study I surmise that high energy, massive leptoquark neutrinos are likely candidates for the

"dark matter" of the Cosmos. Regarding the mysterious neutrinos and the essential weak force "identity" charges they carry: "identity" charges (and the neutrinos which carry them in alternative, explicit form), allow a (single) elementary particle to be created because they make it possible for that particle to be known and recognized, exactly reproduced multiple times, or annihilated by an exactly equivalent antiparticle (in either case making charge/symmetry conservation possible) (see: "Identity or Number Charge of the Weak Force").

Part VI: Cosmology and General Systems

Cosmology is another aspect of the Unified Field Theory which early-on claimed my interest. See the paper: "A Spacetime Map of the Universe", which addresses several vexing questions in cosmology, including "inflation" (an early rapid expansion of spacetime - Guth, Linde); "dark energy" (the "accelerating" universe); and "dark matter" (the "missing mass" of the universe). The "Spacetime Map" paper, which was originally produced independently of my other work, was eventually found to have great relevance, especially for the unitary or causally-connected aspects of the theory.

Finally, there is the General Systems aspect of the work, which was my original point of departure and chosen method of attack on the Unified Field problem (see: "Introduction to General Systems"). Although the "scientific" sections of the theory are my own responsibility, in the General Systems portions of the theory, especially in relation to our human experience, I have been materially and ably assisted by my colleague August "Gus" Jaccaci, and by the work of my late father, Dr. John Curtis Gowan. (See: "Introduction to Fractals"; see also: "Nature's Fractal Pathway"; see also: "Trance, Art, Creativity" (one of several books on the memorial website for Prof. John Curtis Gowan").

Links:

Introduction to the Papers

Section I: Unification
Section II: Gravitation
Section IV: Introduction to the Weak Force
Section VII: Entropy
Section VIII: General Systems, Complex Systems
Section IX: Symmetry: Noether`s Theorem and Einstein's "Interval"
Section XIII: The Solar Archetype
Section XVI: Introduction to the Higgs Boson

Weak Force Papers:

The "W" Intermediate Vector Boson and the Weak Force Mechanism (pdf file)
The "W" IVB and the Weak Force Mechanism (html file)
The Weak Force: Identity or Number Charge
The Weak Force "W" Particle as the Bridge Between Symmetric (2-D) and Asymmetric (4-D) Reality
The Strong and Weak Short-Range Particle Forces
The "Higgs" Boson and the Spacetime Metric
The "Higgs" Boson and the Weak Force IVBs: Part I
The "Higgs" Boson and the Weak Force IVBs: Parts II, III, IV
"Dark Matter" and the Weak Force

The "Tetrahedron Model" in the Context of "Global and Local Gauge Symmetries":

Global-Local Gauge Symmetries and the "Tetrahedron Model"
Global-Local Gauge Symmetries: Material Effects of Local Gauge Symmetries

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