

# General Systems and the Unified Field Theory

(Part II)  
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## **Abstract: (from part 1)**

The conceptual basis of the Unified Field Theory, as presented in these pages, can be briefly sketched as follows:

"Noether's Theorem" states that in a multicomponent field such as the electromagnetic field (or the metric field of spacetime), where one finds a symmetry one finds an associated conservation law, and vice versa. In matter, light's symmetries are conserved by charge and spin; in spacetime, by inertial and gravitational forces. All forms of energy, including the conservation/entropy domain of spacetime, originate as light. During the "Big Bang", the asymmetric interaction of primordial, high energy light with the metric structure of spacetime produces matter; matter carries charges which are the symmetry (and entropy) debts of the light

which created it. Charges produce forces which act to return the material system to its original symmetric state (light), paying matter's symmetry/entropy debts. Repayment is exemplified by matter-antimatter annihilation reactions, particle and proton decay, the nucleosynthetic pathway of stars, and Hawking's "quantum radiance" of black holes. Identifying the broken symmetries of light associated with each of the 4 forces (and charges) of physics is the first step toward a conceptual unification of those forces.

## Row 3 - Charges: The Symmetry Debts of Light

### Symmetry

Symmetry in its most general terms means the quality of sameness, balance, equality. Light has the most symmetry of any energy form, which is why we designate light as the primordial energy from which all others are derived and to which they all return. We see this directly in the production and annihilation of matter-antimatter particle pairs. Light itself carries no charges of any kind, neither electric, gravitational, strong, nor weak. Light's intrinsic motion  $c$  is its most fundamental symmetry condition, which as Einstein discovered, even allows light to escape the dimensional asymmetry of time: light's "clock" is stopped. Bearing no charges itself, light can only produce charges in balancing pairs which cancel each other, the equal but opposite charges of matter-antimatter pairs. It is the function of these opposite charges to allow, facilitate, and indeed compel the particle pairs to annihilate each other, returning the particle pairs to the light which made them. The creation and annihilation of particle-antiparticle pairs is the ongoing conservation of light's symmetry in its most immediate and obvious form.

Whereas in [row 1 of our matrix](#) we saw the production of particles from light by the still-mysterious process of symmetry-breaking (during the "Big Bang"), and in row 2 we saw the conservation of the raw energy of light through the mass and momentum of particles, in row 3 we consider the conservation of the symmetry of light - the conservation of light's quality rather than its quantity - as manifest in the conservation of charge and spin, and in the inertial and gravitational forces of the spacetime metric - all in obedience to "Noether's Theorem".

### Electric Charge

This is the row of particle charges, charges carried by matter produced when the weak force breaks the symmetry of particle-antiparticle pairs at the conclusion of row 1. Charges are conservation effects, in particular the conservation of symmetry in its material and temporal form. *The charges of matter are the symmetry debts of light.* Charge (and spin) conservation is a temporal form of symmetry conservation; the forces generated by these charges are the demand for payment of the symmetry debt. "Noether's Theorem" is the formal (mathematical) theory addressing the conservation of the symmetry of free electromagnetic energy (radiation, light). Time is a transformation of light's entropy drive; mass is a transformation of light's raw energy; charge is a transformation of light's symmetry. These three conservation transformations (mass, charge, time) allow (but do not cause) the conversion of light to matter. (See: "[The Tetrahedron Model](#)".)

Because of its symmetry conservation role, the invariance of the magnitude of charge becomes a crucial issue, considering the potentially enervating effects of entropy, time, the expansion of the cosmos, and relative motion. Charge quantization and the separation of matter from its entropic, expanding, causal conservation domain of information ([historic spacetime](#)), both function to protect charge invariance. In the case of electric charge, local magnetic forces associated with relative motion perform an analogous protective conservation service - magnetic forces fluctuate, while electric charge remains invariant. (See: "[Global vs Local Gauge Symmetry and the Tetrahedron Model](#)".)

Charges arise naturally from the process of symmetry-breaking. When particle-antiparticle pairs are created from light, each member of the pair carries various charges which function to ensure instant and successful annihilation, reconstituting the light from which they were created. Since light itself carries no charges, it can only create particle pairs whose charges balance, summing to zero. The electric charge is prototypical of this effect.

Initially, all massive elementary particles are created in particle-antiparticle pairs with equal but opposite electric charges summing to zero. These opposite charges attract each other powerfully, allowing the particles to find each other in space and recombine, producing the annihilation reaction which returns their energy to light, conserving the symmetry state of the free energy which created them. Since photons, or light quanta, are the field vectors (force carriers) of electric charge, we see light actively protecting its own symmetry in annihilation reactions through the forces generated by electric charge.

When one member of a particle-antiparticle pair is isolated, as by the asymmetric decay of matter-antimatter pairs during symmetry-breaking in the Big Bang, the charges of the remaining pair member, which were intended to motivate and facilitate an annihilation reaction with its antimatter partner, are simply "hung" in time. The remaining particle is one-half of a symmetric particle-antiparticle pair, one-half of light's symmetric particle form, and its charges can therefore be fairly characterized as the "debts" of light's broken symmetry.

We do not ordinarily realize that the symmetry of energy is conserved as well as its total amount, but it has been known for a long time that this must be true. In a famous theorem, Emmy Noether (1918) proved mathematically that in a multicomponent field, such as the electromagnetic field (or the metric field of spacetime), wherever there is a symmetry one also finds an associated conservation law, and vice versa. Charge (and spin) conservation and the inertial forces of the spacetime metric (including gravitation) are consequences of Noether's Theorem as enforced in common experience. This great theorem has become the mathematical basis (through "group theory") for modern efforts to unify the forces. In the model presented here, I trace the unity of all the forces back to their origins as the conserved debts of light's broken symmetry. (See: [Emmy Noether: A Tribute to her Life and Work](#)).

The program of unification pursued here is to identify a specific (broken) symmetry of light for each of the 4 charges and forces of physics. We begin with electric charge.

While electric charge is always associated with mass, it is independent of the quantity of mass; the three leptonic particles (electron, muon, and tau), for example, have vastly different masses but carry the same electric charge. Electric charge is not associated with particles which have intrinsic motion  $c$ , such as the gluons, photons, gravitons, and possibly the neutrinos. There is definitely a major, general asymmetry associated with the loss of light's intrinsic motion which electric charge is powerfully guarding against, and we would like to distinguish it from the asymmetry associated with the gravitational charge, which is obviously also generally related to mass and its lack of intrinsic motion.

The asymmetry I single out as the cause of electric charge is dimensional - light is 2-dimensional, mass is 4-dimensional. Light lacks the  $x, t$  dimensions of bound energy, as Einstein discovered. The jump from 2 to 4 dimensions in the conversion of light to particles is a general loss of symmetry, since the 4th dimension inevitably includes time, which is an asymmetric, one-way dimension. It is this particular asymmetry, time, which electric charge protects against. Electric charge, through matter-antimatter annihilations, protects light's dimensional symmetry by preventing light from devolving into mass, charge, gravitation, and the asymmetric time dimension which is matter's historical entropy drive.

Because the intrinsic motions of light and time are also the entropy drives of free and bound energy, we can furthermore say that electric charge is guarding against the devolution of symmetric spatial entropy into

asymmetric temporal entropy. But this is essentially just another way of saying that electric charge protects light against the metric warpage of time and gravitation. The close association of the symmetry debts of electric charge and gravitation - both involving time - can be distinguished by observing that electric charge is centered on the dimensional, metric asymmetry without regard to mass, whereas the gravitational effect is centered upon the mass itself, its location, quantity, and concentration. Because both forces involve the phenomenon of time, electric charge functioning before the fact to prevent time's explicit appearance, gravity functioning after the fact to both create and destroy time, an imperfect analogy (see below) exists between these two long-range forces, which was of great interest to Einstein, who sought for many years to unify them.

As magnetism is the invisible, "intrinsic", projective ("electro-motive") electrical force of the loadstone, so gravity is the invisible, "intrinsic", projective ("inertio-motive") dimensional force of the ordinary rock. In the case of magnetism, we trace the force back to the moving (and ordered) electric charges of the atoms in the loadstone; in the case of gravity, we trace the force back to the moving (and one-way) temporal charges of the bound energy in the rock. A moving electric charge creates a magnetic field; a moving temporal charge creates a gravitational field. In both cases the field is produced at right angles to the current. The relation is reciprocal as well: moving magnetic or spatial (gravitational) fields create electric or temporal currents. This is the intuitive analogy between electromagnetism and gravitation which so intrigued Einstein. Finally, time and gravity induce each other in an endless cycle, as do the electric and magnetic components of light. (See: "[A Description of Gravitation](#)".)

## Gravitational Charge

Gravitation is a "spacetime" charge, at once the most common and familiar, but perhaps the most mysterious and intractable to explain. Yet some of gravity's role seems clear enough: gravitation reduces the expansion rate of spacetime in response to the loss of free energy producing that expansion, as when light is converted to particles, or any other form of bound energy. Light has intrinsic motion in space, which produces the expansion of space; indeed the intrinsic motion of light produces space and the spatial metric. Particles (or bound energy generally) have no intrinsic spatial motion. Bound energy cannot produce space much less cause its expansion. Instead, the time dimension of bound energy has intrinsic motion. Earlier we saw that gravity decelerated the expansion of spacetime by the actual annihilation of space and the production of time. Thus the time dimension of matter and the expansion of history is funded by the gravitational deceleration of the spatial expansion of the Cosmos. Space and the drive of spatial entropy (the intrinsic motion of light) (S), is gravitationally transformed to time and the drive of historical entropy (the intrinsic motion of time) (T):

$$\begin{aligned} -Gm(S) &= (T)m \\ -Gm(S) - (T)m &= 0 \end{aligned}$$

The symmetry debt associated with gravitation is "location". When light is converted to mass, light loses its intrinsic motion and hence its essential distributional symmetry in space, "non-locality". Whereas light is everywhere simultaneously within its conservation domain (light's "Interval" = 0), mass has "intrinsic rest" and acquires a positive "Interval". The distributional symmetry of light's energy within spacetime is broken; immobile mass is a concentrated lump of energy with a specific location in spacetime; the location, density, and quantity of bound energy is actually identified in energetic terms by the warped metric produced by the gravitational field of mass. Whereas light is 2-dimensional, mass is 4-dimensional; the acquisition of the extra dimensions, especially T (time), identifies the spacetime coordinates and specific location of mass. (See: "[The Conversion of Space to Time](#)".)

But the gravitational charge is unusual in that it is more than just a symmetry debt. Unlike electric charge,

color, or number, "location" charge also carries the entropy debt of light, the conserved form of light's entropy drive, or intrinsic motion. The gravitational force creates the time dimension which mass requires for its historical entropy drive, converting space to its metric equivalent, time. Gravity and time are the primordial expressions of matter's entropy drive.  $-Gm$  = the temporal entropy drive of mass, the entropy-energy required to produce time and the historical dimension of matter. The complexity of gravitation is due to the fact that its conservation function simultaneously addresses both the first and second laws of thermodynamics, through time and entropy, as well as symmetry conservation, through the "location" charge and the positive "Interval" of bound energy. It is the "location" charge which brings gravity under the symmetry conservation umbrella of "Noether's Theorem". (See: "[The Double Conservation Role of Gravitation](#)".)

Simple causality - the causal nature of local matter - is perhaps the ultimate of several rationales for gravitation (which also include the creation of matter's entropy drive and the conservation of light's non-local symmetric energy state, among others). Gravity ultimately pays both the symmetry and the entropy debt of light (as carried by mass - "location" and time) through the conversion of bound to free energy in stars, and via Hawking's "quantum radiance" of black holes ([light is "non-local" and timeless](#)). (See: "[The Sun Archetype](#)".)

The active principle of the gravitational "location" charge is time. The gravitational flow of space is the consequence of the intrinsic motion of time. For a more complete discussion of the gravitational charge and its mechanism, see: "[Entropy, Gravitation, and Thermodynamics](#)"; "[A Description of Gravitation](#)"; "[The Double Conservation Role of Gravitation](#)"; "[The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos](#)".

## **The Strong Force Color Charge**

Quarks are sub-elementary particles, as we know from their fractional electric charges, which are either  $1/3$  or  $2/3$  of the unit charge carried by elementary particles such as the electron. "Allowed" quark combinations always sum to zero or unit leptonic values of electric charge: the proton is  $+1$ , the neutron  $0$ , mesons are  $0$ ,  $+1$  or  $-1$ . The symmetry which the strong force is protecting is this quantum unit of charge, electric or otherwise. If quarks were not confined as they are, there would be no way to annihilate or even neutralize their partial electric charges, or other partial charges they may carry (color, identity). Symmetry could not be restored and conserved in such a case. The strong force protects symmetry by confining these sub-elementary particles and charges into quantum packages of whole charge units which can be neutralized and annihilated via the usual quantum mechanical pathways involving whole leptonic elementary charge units, mesons, other antiparticles, or alternative charge carriers.

If one were to fracture an elementary particle into 3 parts, but require that when it became "real in time" it must retain its "virtual" leptonic character in terms of charge, one would require a confining force with exactly the characteristics of the strong force as produced by the color charge. Furthermore, the gluon field, which has been compared to "sticky light", has the appearance of a "fractured" photon, as if the field vector of the leptonic electric charge had also been fractured along with the elementary leptonic particle.

The two "particle forces", the strong and weak forces (the "short range" forces), form a symmetric-asymmetric force pair which are essential to the creation of matter. In this regard, they are curiously similar to the two "spacetime" forces, electromagnetism and gravitation (the "long range" forces), and to the spatial and temporal dimensions themselves. These similarities constitute further evidence that particles originate as a union of light's energy with the structural metric of spacetime.

## **Strong Force Binding in Compound Atomic Nuclei**

There are two types or structural levels of strong force, one involving binding the individual quarks inside baryons via "color charge" and the exchange of gluons (discovered by Murray Gell-Mann and George Zweig (1964)), and the other involving binding "nucleons" (protons and neutrons) in compound atomic nuclei via quark "flavor" charges and the exchange of mesons (discovered by Hideki Yukawa (1935)). These are very different processes, even though both involve nuclear material, and they have very different consequences: quarks are permanently confined, and can never escape the binding force of the gluon field; nucleons are tightly held, but given sufficient energy, can and do escape the grasp of the meson field (as in radioactive decay).

What is the conservation basis of the meson binding force of the compound atomic nucleus? It is evidently the simple fact that when nucleons are herded together in sufficiently close aggregations, they are able to exist in a lower energy state than when they exist singly. Just like poor college students, they find that living in groups is cheaper than living alone. And any condition or state that reduces bound energy and releases free energy is favored by the conservation laws, especially by symmetry conservation.

So what is it about the communal state of heavy nuclei that is so energetically favorable? It apparently has to do with the clouds of virtual particles which surround any real particle, and which constitute a normal part of the bound energy state or endowment of real particles.

The quark composition of a neutron is  $udd$ , that of a proton is  $uud$ . The only difference between them is a single  $u$  or  $d$  quark, and these are very nearly the same in mass. In virtual reality, it is a relatively simple matter for a  $\underline{u}d$  meson to change a neutron into a proton, and for a  $\underline{u}d$  meson to change a proton into a neutron (antiparticles underlined). Note how the  $\underline{u}d$  and  $\underline{u}d$  mesons make a neat particle-antiparticle meson pair. Protons and neutrons, if they are sufficiently close together, will find themselves constantly being transformed into one another simply by the exchange of these mesons in their surrounding virtual particle fields. In fact, they can get rid of some of these virtual pions if they are close enough to share them, and share also the energetic cost of their production and maintenance. Hence sharing these (very similar) virtual particle fields is a means of reducing their bound energy content, if these nucleons can come together closely enough and in suitable combinations. The (individually and collectively) reduced mass energy of the nucleons then becomes a binding principle or "glue" - any lost energy must be replaced if the nucleon is to be made whole again and become free.

The most energy-efficient nucleon combinations are called alpha particles, or helium nuclei, consisting of 2 protons and 2 neutrons. I point out elsewhere that this is a "classic" 4x3 General Systems resonance or fractal combination - 4 nucleons each consisting of 3 quarks. (See: ["Nature's Fractal Pathway"](#).) The alpha particle is for some reason an especially stable nuclear configuration, and becomes the "brick" or standard building block of the stellar nucleosynthetic pathway. (See: ["The Fractal Organization of Nature"](#).)

As the compound atomic nucleus grows in size, there is a diminishing energetic return (in terms of the release of binding energy) with the addition of each new nucleon. This is because the shared field of virtual particles eventually becomes saturated - all the advantages and possibilities for sharing the burden of virtual particles have already been explored and exhausted. There's just no more room at the commune. Furthermore, the collective long-range electrical repulsive forces of the protons finally increase beyond the strength of the short-range binding energy of any individual new proton trying to join the party.

After the nucleus has grown to iron 26, fusion nucleosynthesis becomes endothermic - as much energy must be expended to break through the "front wall" of nuclear electrical resistance as is gained by the release of strong force binding energy. However, given an external source of energy to surmount the initial barrier (such as gravitational acceleration), enough nuclear binding potential energy remains available to grow compound nuclei (in nature) up to uranium 92. Humans have created several dozen more transuranic heavy nuclei in accelerators, of which plutonium is the best known. Most are extremely short-lived.

## The Weak Force: Lepton "Number" or "Identity" Charge

The leptonic or weak force charge is known as "number" charge. I prefer to call it "identity" charge, a name which better reflects its reason for existence. Photons (individual light quanta) are indistinguishable and anonymous. They are all alike, and hence form a symmetry of identity ("anonymity" symmetry). Particles, on the other hand, are not all alike; they are distinguishable as to type.

We know of three distinguishable heavy elementary particles, the leptonic spectrum or series: electron, muon, and tau, differing in their masses, which increase from electron through muon to tau. Each has a specific neutrino associated with it, a (nearly) massless particle traveling at (nearly) velocity  $c$ , which carries lepton number ("identity") charge in an explicit or "bare" form. The heavy leptons carry identity charge in an implicit, or hidden form. (See also: ["The Weak Force: Identity or Number Charge"](#)).

The leptonic series has the appearance of a mass quantum series - that is, these elementary particles are always created with a specific, discreet mass and no other; there are no elementary massive particles in the gaps between their mass units, much like the discreet gaps between energy levels of atomic electron shells (or the spaces between the rungs of a ladder). The neutrino that is associated with each is evidently the hallmark of the truly elementary particle (the sub-elementary quarks have no associated neutrinos).

It seems likely, however, that there is an undiscovered neutrino associated with the ancestral particle which gave rise to the baryons, which I assume to be the heaviest member of the leptonic series, the so-called "leptoquark". If we ever see proton decay, we would expect to see a leptoquark neutrino produced in the process.

The lepton "number" or "identity" charge evidently facilitates the annihilation process, identifying the proper annihilation partners for the several types of elementary particles, and by the handedness of neutrino spin neatly distinguishing matter particles from their antimatter counterparts: all neutrinos have left-handed spin, all antineutrinos have right-handed spin. Neutrinos also comprise a type of accounting system, recording the number and identity of elementary particles (or antiparticles) contained within the conservation domain of spacetime. Neutrinos, and especially the (hypothetical) leptoquark neutrino, may be responsible for much of the mysterious "dark matter" of the Cosmos.

"Identity" or "number" charge plays a special role in the creation of the material universe. We can characterize the light universe, before the creation of matter, with just 2 numbers representing its symmetric dimensional and charge state: Interval = 0, and Number = 0 (no time, no particles). After the creation of matter, both symmetries are broken and become positive: Interval > 0, and Number > 0 (time and particles exist). (Electric charge is zero both before and after the creation of matter, while color charge is an internal property of baryons, also summing to zero). The positive Interval represents gravitation and time, the positive number charge represents the weak force and particles. The metric Universe, the Universe of the entropic dimensional conservation domains, responds to the positive "number" asymmetry by providing an asymmetric temporal (causal) conservation domain for particles (historical spacetime) through the gravitational conversion of space to its metric equivalent, time.

The universe manifests through the identity charge and its alternative charge carrier, the neutrino. "Identity" provides a conservation basis for the interaction between the symmetric quark field and the asymmetric field of the leptons and IVBs. It is through the identity charge that the leptonic and IVB field recognizes, conserves, and distinguishes leptoquark and antileptoquark, and sets them upon separate and asymmetric decay pathways. Just as "location" is the essential metric asymmetry and charge associated with gravitation, so "identity" is the essential information asymmetry and charge associated with particles (conserving respectively the "non-local" and "anonymity" symmetry of light). There must be a conserved alternative charge carrier for identity charge (the neutrino), if particles are to escape the matter-antimatter annihilation

cycle and manifest in real time. It is for these reasons that I feel the leptokuark neutrino must exist. For a more complete discussion, see: "[The Formation of Matter and the Origin of Information](#)". (For a further discussion of the weak force in its full energy spectrum, see: "[The Higgs Boson and the Weak Force IVBs](#)".)

### Summary of Row 3

In summary, we have identified the transformed symmetries of light which are carried by massive particles as conserved charges. Charge (and spin) conservation = symmetry conservation. *The charges of matter are the symmetry debts of light.* Charges create force fields which demand payment of the symmetry debt; forces act to pay off these symmetry debts, returning the material system to light. Noether's Theorem is the key to force unification. The symmetry of light - even including the symmetry of light's entropy drive (the intrinsic motion of light) - is conserved no less than light's raw energy. Charges are quantized and matter is isolated in the "present moment" to help protect charge values from inflation or deflation by entropy, age, the expansion of the universe, or relative motion in spacetime; otherwise, charge conservation would have little meaning. Charge invariance (including the mass and charge invariance of elementary particles) is the key to the local activity of the forces and their field vectors. The magnetic component of electric charge in relative motion, the mass of the weak force IVBs and Higgs boson, the confining principle of the strong force gluon field, and the time dimension of gravitation, are all local effects of the field vectors ("local symmetry currents") which specifically address the issue of charge invariance in a material, relative world with a temporal metric (including the "Lorentz Invariance" of Special Relativity which protects the invariance of the "Interval", causality, and "velocity c"). (See: [Effects of Global vs Local Symmetries in the Tetrahedron Model](#)".)

The symmetry debt of electric charge is dimensional; light does not "want" to become 4-dimensional in its particle form because of the asymmetric one-way time dimension. The symmetry debt of gravitational "location" charge is with respect to the non-local distribution of light's energy; light is distributed symmetrically throughout spacetime, bound energy is not. But gravitation carries two debts; it is also the entropy debt of light; gravitation creates matter's time dimension by the annihilation of space (time and gravity actually induce each other). The symmetry debt of color charge and the strong force is quantum mechanical - the partial charges of the quarks must be permanently confined so they may be neutralized by the standard "gauge" of the elementary (leptonic) charge units. Finally, the symmetry debt of the weak force is informational in character; photons have no distinguishable "identity", elementary particles do. (See: "[The 'Tetrahedron Model' vs the 'Standard Model' of Physics: A Comparison](#)".)

The material Universe in no accident. The asymmetry which produces matter is built into the quantized weak force mechanism and the IVBs (including the Higgs boson) which package light into particles. Asymmetry is the principle of manifestation: the Universe "intends" to take a manifest, particle form. But it does so with great care; it does not allow its "particles of light" to become lost to their original conservation domain, space. Instead, a 4th dimension (time) is added to the Universe for our accommodation, paid for by gravitation. Each massive elementary particle is tagged with a neutrino as it enters the 4th dimension. This neutrino informs spacetime of the identity of every elementary particle and their total numbers. Further, the gravitational force locates their position, mass, and density in spacetime through a structural warpage of the entire domain around each particle, the parental embrace of the conservation domain. Finally, the time dimension places each particle on a metrically equivalent footing with light: the intrinsic motion of time is the metric (and entropic) equivalent of velocity c. Information is completely conserved as matter's causal "matrix" or network in the temporal historic domain at "right angles" to space. We are all immortal in history; indeed, there are no lost sheep in this flock, and "not a sparrow falls but the Father knows". (See: "[A Spacetime Map of the Universe](#)".)

The inexorable forces of symmetry conservation will eventually return all particles to their light form, via

proton decay or Hawking's "quantum radiance" of black holes. In the meantime, the Universe will become conscious and experience itself in individual material form. It has been said that humans believe they are physical beings having a spiritual experience, whereas in fact they are spiritual beings having a physical experience. The fractal extension of this notion is that the Universe itself is a spiritual being having a physical experience. The conservation of this physical experience for spiritual enrichment (self-knowledge, experience, information, creative growth) is the only conceivable reason to have it. (For a further discussion of these issues, see: ["Chardin: Prophet of the Information Age"](#); and: ["The Information Pathway"](#) and: ["Trance. Art. Creativity"](#) (a book by Prof. J. C. Gowan Sr.).)

## **Row 4 - Field Vectors: The Force Carriers as Symmetry Payments**

### **Photons - The Electromagnetic Force**

The electrical symmetry debt can be repaid partially by neutralization, or wholly by annihilation, since unlike gravitation, electric charge is not entropic, and is bipolar rather than monopolar. Whereas the gravitational symmetry debt can only be repaid by the total conversion of mass to light, electric charge can be neutralized by its opposite matter charge, as well as annihilated by its antimatter charge. Electric charge acts to prevent the formation of bound energy (as in the annihilation of particle-antiparticle pairs); if it fails in this, electric charge seems to have little further ability to restore symmetry, other than an eternal readiness to motivate an antimatter annihilation if the opportunity arises. Instead, electric charge contents itself with neutralizing opposite matter charges, and confining them to small regions of spacetime, which "pays down" its symmetry debt as far as it can. Gravitation does not act to prevent the formation of bound energy, but once matter is formed, seems to have a real "plan" for its ultimate destruction - not "divide and conquer", but "collect and conquer". In its insatiable appetite to accumulate matter we discern the entropic character of gravitation, in marked contrast to any other symmetry debt.

The field vector of electric charge is the photon, the quantum unit of light and the electromagnetic force. In the annihilation of matter-antimatter particle pairs, we see the photon protecting its own symmetry. Electric charge is bipolar, consisting of opposite charges which attract each other powerfully over an infinite range of spacetime. The strength of this arrangement is that it permits matter-antimatter pairs to find each other, no matter how far they may be separated. The weakness of this arrangement is that electric charges can neutralize as well as annihilate each other. It is therefore possible for a composite particle like the baryon to arrange the partial charges of its quarks to a neutral electric configuration, as in the neutron. It is just this possibility that is exploited by the weak force to produce the asymmetric decays of neutral leptoquarks and produce an excess of matter in the Big Bang. Electrical neutrality is the fundamental reason why a composite particle (such as the baryon) is necessary to extract matter from the primordial symmetric energy state (the particle-antiparticle pairs) of the Cosmos. (See: ["The Origin of Matter and Information"](#).)

Once matter is formed, electric charge (in the absence of antimatter) can do little to restore the symmetric state of energy because its force is quenched by its ability to neutralize itself. The net electric charge of the Cosmos is zero, both before and after the creation of matter. In chemical reactions, electric charge will drive toward the lowest bound energy state, but chemical releases of energy are insignificant compared with the total energy content of matter.

Electric charge, however, in the form of the electron shell of atoms and the interplay of electrical and magnetic forces, is instrumental in building a negentropic "Information Pathway" which culminates in biological systems and the rise of consciousness. Through biology, electric charge seems to be attempting to reconstruct the original connectivity of light, even if it cannot reconstruct light's symmetry. The primordial system of light was not only a wholly symmetric, but also a wholly connected entity. Electric charge, whose field vector is the photon, can perhaps be thought of not only as a debt of light's symmetry, but also as a

debt of light's connectivity, the holistic ("holy") character of the primordial energy state. Similarly, "beauty" in all its forms, natural and man-made, can be thought of as a conserved element of symmetry in the electromagnetic force, emergent in the complex products of the "Information Pathway". Hence electric charge seems to function as a "memory" of a preexisting state of connectivity and unity as well as of symmetry. (This is another way in which the long-range forces of electromagnetism and gravitation display a similarity of action, as it is typically gravitation which we identify as preeminently the connective force of matter.) Like symmetry, the original connectivity and unity of the Universe may be a conserved attribute of light, or at least a corollary of symmetry conservation.

For example, biology is nothing if not a web of interconnections, and through the evolution of conscious information systems, humans have not only become aware of the essential connectivity of the Cosmos, both intuitively ("spiritually") and rationally, but are now engaged in the process of extending this physical web of connection between the planets of our solar system, and on into the galaxy. "Spirit" resides, if anywhere, in the connectivity of the Universe. Biological information networks may be another example of the electromagnetic force "paying down" a symmetry debt as far as it can - in this case the debt of the photon's (broken) connectivity. Human intuitive powers may be a further example. For a more detailed examination of the evolution of this network, see: "[The Information Pathway](#)"; and "[Chardin: Prophet of the Information Age](#)".

## Gravitons - Gravitation

If we are to believe Einstein, gravitons, the field vectors of gravitation, must connect directly with the dimensional structure of spacetime. This connection is attractive only, without a repulsive counterpart, as in electricity. The consequence is to "warp" or "bend" spacetime, in effect reducing the local gauge of the metric - but without reducing the magnitude of the electromagnetic constant "c". Time and space are affected in metrically equivalent terms, producing a "local gauge symmetry current" which avoids affecting the local value of c, causality, or the "Interval" (the "Lorentz Invariance" of Special and General Relativity). Instead of noticing a lower value of c, outside observers of a gravitational metric will notice a slower clock rate and shorter meter sticks, and a gravitational Doppler shift. It may be difficult to imagine how anything could connect to something so intangible as a dimension, yet this is certainly the best explanation we have. And the dimensions are not so intangible when we encounter them through inertial forces (forces felt during acceleration); the intrinsic motion of time, the intrinsic motion of light, and gravitation itself can also be considered inertial forces in that they are all *dimensional* expressions of entropy, energy, and metric symmetry conservation.

A dynamic view of gravitational action is allowed by Einstein's equations, via his "Equivalence Principle". We are free to view a reference frame as either at rest in a static gravitational potential (as on the surface of the Earth) or as accelerated in spacetime by an equivalent positive force (as in a "rocket ship"). Hence we can view gravitation as the accelerated motion of spacetime itself, rather than as a static, "warped", metric field. It seems to me this dynamic view, first developed by Einstein, offers a physically simpler way to visualize gravitational action, and is more heuristically fruitful.

The "Equivalence Principle" follows from the notion that we cannot distinguish between moving ourselves through spacetime (acceleration) and spacetime moving itself through us (gravitation). In the dynamic view, all objects fall with the same acceleration not because the static gravitational potential is the same but because they are carried along in the same accelerated flow of spacetime. Similarly, the local metric is changed simply by the subtractive effect of the physical flow of spacetime; co-movers with the flow are of course unaware of its motion - all the ordinary gravitational effects are as readily explained by one view as by the other. If I have added anything to Einstein's Equivalence Principle, it is the notion that the actual motion of spacetime is caused by the intrinsic motion of time marching into the historical domain and pulling space along behind it. Space self-annihilates at the center of mass, exposing a metrically equivalent

temporal residue which repeats the endless, entropic cycle. *A gravitational field is the spatial consequence of the intrinsic motion of time.*

For example, the gravitational contraction of the Universe comes about simply through the shifting balance between the quantity of inward vs outward flows of spacetime (gravitational annihilation of space vs the creation of space by the intrinsic motion of light). Mechanically, the symmetrically opposing flows of spacetime toward a gravitational center of mass simply cancel themselves out: +x in one direction cancels -x in the other direction, where they meet at the center of mass, and so forth with y and z. The energy content they carry with them is simply left behind, deposited on the surface, say, of an accreting planet, or raising the temperature of the remaining volume of space. This furthermore explains why (in addition to considerations of energy conservation), gravitation must be a spherically symmetric force, since the dimensions will not otherwise cancel each other (and because time connects equivalently to all three spatial dimensions). The acceleration of gravitation is due to the constant application of a force - the unceasing intrinsic motion of time. (See: "[The Conversion of Space to Time](#)".)

When the spatial component of spacetime is annihilated, the temporal component must remain as a metrically equivalent residue. T, being one-way by causality and the conservation of energy, does not cancel; there is no -t as there is -x, -y, and -z. The universal gravitational constant G thus precisely links the drives of temporal and spatial entropy, because G extracts T from its metric equivalent, space. As noted before, the magnitude of G is determined by the small energy difference between the symmetric spatial entropy drive of free energy (the intrinsic motion of light) (S), and the asymmetric historical entropy drive of bound energy (the intrinsic motion of time) (T):

$$S - T = -G.$$

This is equivalent to the energetic difference between implicit and explicit time. For a discussion of the weakness of gravity, see: "[The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos](#)".)

Simply stated, gravity is necessitated by and creates temporal causality, as expressed through its creation of matter's time dimension, the temporal entropy drive of bound energy, and through our unbreakable connection to the causal web of the ever expanding historic conservation domain of information. This might be expressed more succinctly in the intuitive terms of Eastern metaphysics by saying that gravity creates the karmic chains of time. Hence the necessity for the long range, dimensional character of the gravitational force which connects us and our present moment to the entire Universe of historic spacetime in an unbroken causal matrix extending backward and outward in spacetime to the "Creation Event" or "Big Bang" itself. The gravitational deceleration of cosmic spatial expansion provides the energy to create matter's time and historic dimension. Matter's temporal entropy drive (T) and the historic expansion of the Universe are therefore funded by light's spatial entropy drive (S) and the spatial expansion of the Universe:

$$\begin{aligned} -Gm(S) &= (T)m \\ -Gm(S) - (T)m &= 0 \end{aligned}$$

The primary role of gravity is to create an energy-conserving metric for matter, by the translation of the metric of light and space (as gauged by the electromagnetic constant c), to the metric of matter and time (as gauged by the gravitational constant G). This gravity accomplishes by the conversion of space to metrically equivalent time. This conversion satisfies the demands of the 1st and 2nd laws of thermodynamics, and constitutes our experience of gravity on planet Earth. But Noether's Theorem actually demands a second gravitational role, which biological life forms cannot experience: the conservation of light's symmetric energy state. This gravity accomplishes also, by the conversion of mass to energetically equivalent light in stars, and via Hawking's "quantum radiance" of black holes.

## Quantum Radiance

In addition to the entropy debt of light's lost intrinsic motion, gravitation, like the other charges, also has a symmetry debt to pay (the restoration of light's "non-local" distributional symmetry), and like the other charges, if gravitation cannot pay off the debt completely, it will always move in that direction by at least "paying it down" as much as possible. Since an atom or a planet can have the same center of mass, or coordinate position, the gravitational concentration of massive particles reduces the scatter of individual location charges, confining them to as small a volume and effective number as physically possible (the relentless entropic function of gravitation will accomplish this accumulation in any case). When enough mass is accumulated, the fusion reactions of the nucleosynthetic pathway are initiated, converting a portion of the bound energy to light, a direct payment of matter's symmetry/entropy debt. But this process can only go so far, as baryon number conservation prevents the great bulk of any stellar mass from converting to light. But gravitation drives on, collapsing the electron shells of atoms in white dwarfs, and finally driving this "electron sea" into the protons, forming neutron stars, essentially gigantic atomic nuclei held together by gravitational forces. Still unsatisfied, if enough mass is present, gravitation collapses even nuclear matter to the singularity of a black hole, surely the most bizarre and fearsome object in the universe.

Black holes can convert much more of the bound energy of atoms to radiation than nucleosynthesis, including extracting energy from the rotational energy of the hole, from the gravitational potential energy of highly accelerated particles (including any relativistic increase in mass), and even from the binding energy of nuclear particles, which the intense gravitational field of the hole replaces. A significant percentage of the rest mass energy of a particle can be converted to free energy as it falls through the event horizon, explaining the huge luminosity of quasars. But even this is only a beginning.

In the creation of a black hole, gravitation finally reaches its goal, for as Stephen Hawking has shown, through the principle of "quantum radiance" the total mass of a black hole will eventually be converted to light. The defining feature of a black hole is that the gravitational acceleration of spacetime reaches  $c$ . As in the venerable saying, "the extremes meet": matter began as light with intrinsic motion  $c$ ; matter ends by itself achieving intrinsic motion  $c$  through the gravitational acceleration of spacetime, a total reversal of the roles of intrinsic motion. But this full circle regenerates matter as light again, both inside the black hole (via proton decay), and outside (via "quantum radiance"). The backhanded symmetry solution of gravitation pays positive dividends in the end, an amazing story of purposeful and relentless symmetry conservation which no one would believe if Einstein's and Hawking's mathematics were not there to prove it. Because the spatial entropy of free energy has greater symmetry than the temporal entropy of bound energy (because it is "all-way" rather than "one-way"), the "evaporation" of black holes demonstrates that even the symmetry of light's entropy drive is conserved, the ultimate expression of Noether's theorem. If a rock is a massive, asymmetric form of light's energy "brought to rest", a black hole is a temporal, asymmetric form of light's entropy "brought to rest".

In thermodynamic terms, the conservation of light's spatial entropy drive (light's intrinsic motion), via the gravitational conversion of light's intrinsic motion to time's intrinsic motion, reaches a limiting case in the black hole. Because at the Schwarzschild radius (the "event horizon") the inflow of space is already at velocity  $c$ , it is not physically possible to simply continue increasing the strength of the gravitational field if more matter is added to the hole. Therefore, the only conservation accommodation possible for further mass inputs is to increase the size of the surface over which this maximum spatial flow is realized, resulting in the Hawking-Bekenstein theorem relating the entropy of a black hole to its surface area. Since gravity is creating the time dimension for the mass of the hole, the constraint on the entropy expression also applies to time and mass. Hence the surface area of a black hole should be directly proportional not only to its entropy, but to its time dimension, its mass, and its total gravitational energy as well. The black hole is the physical proof and demonstration that gravity converts space and the spatial entropy drive of light to time and the temporal entropy drive of matter. Time "stands still" at the event horizon (where " $g$ " = " $c$ ") because

the gravitational inflow of space at velocity  $c$  is replacing time as fast as time moves away into history.

If, as seems likely, proton decay is commonplace in the interior of black holes, a black hole may be nothing less than a gravitationally bound state of light - an actual case of light "transformed to rest", a "light crystal". This possibility would remove the difficulty of the infinite compression of matter at the central singularity, since there is no limitation imposed upon the superposition of photons. (See: "[Entropy, Gravitation, and Thermodynamics](#)").

## **Gluons - The Strong Force**

In addition to its important role in confining quarks to elementary whole-quantum charge units, the strong force contains a crucial internal symmetry. The "color" charge of the strong force is divided into three parts, called (for convenience of reference only) red, green, and blue; the summation of these colors yields a whole "white" unit of color charge. Each quark carries one of the partial color charges, which it swaps with its neighbors in a ceaseless round-robin exchange by means of an internal field of "gluons". Gluons are massless particles, moving at velocity  $c$ , the bosons, field vectors, or force carriers of the color charge and strong force. They have been compared to "sticky light". Each gluon is composed of a color-anticolor charge, in every possible combination, hence there should be nine of them, except one is doubly neutral ("green-antigreen"), leaving eight effective charge carriers. Because the gluon field is composed of color-anticolor charges, it sums overall to zero color (not the same as "white" color, which refers to the whole unit color charge, as distinct from its partial color components. With "white" color a whole unit color charge is present, with "zero" color there is no color charge at all). The gluon field is internally confined to baryons and mesons, the class of particles ("hadrons") containing quarks.

In a baryon, physically squeezing the quarks together has the effect of summing up the gluon field, so that as quarks crowd together, the strong force relaxes and the quarks move more easily with respect to each other. This effect is known as "asymptotic freedom" (Wilczek, Politzer, Gross, 1973) - (2004 Nobel Prize in Physics. See: *Science*: vol. 306 15 Oct. 2004 page 400). In the limit, if the quarks are fully compressed (perhaps to "leptonic size"?), the color charge sums to zero and vanishes. This is the configuration of the leptoquark, and is the condition of perfect "color symmetry" (color = 0) which is necessary for proton or leptoquark decay. Quarks repel each other electrically and through other quantum mechanical forces (Pauli's "exclusion principle"); as quarks spread apart, the color force becomes explicit, limiting their expansion. Because the color charge is conserved, the weak force cannot cause baryon decay while the color charge is explicit (neutrinos do not carry color charge). But if for some reason the color charge should self-annihilate (as in the extreme pressures of the Big Bang, a black hole, or via the "X" IVB), the leptonic decay of a baryon can go forward ("proton decay"). It is this same effect that allows weak force decays of neutral leptoquark-antileptoquark pairs during the Big Bang. Again, the "summing to zero" of the color charge is exactly what we would expect of a quark-confining field arising from the fracturing of an elementary particle which initially contained no color charge at all - in other words, a fractured, heavy, primordial lepton. Likewise, the similarly fractured field vector or photon of the leptonic electric charge has been transformed into the gluon field of "sticky light".

"In the limit" the color charge vanishes. This limit probably translates physically to "leptonic size"; in this condition, with no color charge present, a baryon is indistinguishable from a heavy lepton, reverting to its ancestral form, the "leptoquark". This particle is useful for energy storage or "packaging" at high energy densities, since the quarks can store extra energy like an internal set of compressible springs (but also see below). When the quarks are fully compressed, the leptoquark is a lepton and the color charge is implicit; when the pressure is relieved, the quarks expand and the color charge becomes evident or explicit, and the leptoquark becomes a baryon. As a lepton, it must have an associated neutrino, but as a baryon, this neutrino cannot cancel the explicit color charge. Thus the baryon is stable against ordinary leptonic decays in its normal (expanded, colored) state. Only when the quarks are fully compressed, vanishing the color

charge, does the baryon return full circle to its leptonic ancestral state, and proton decay becomes possible via the "X" IVB and with the emission of a leptoquark neutrino. (See: "[The Particle Table](#)".)

Achieving a condition of electrical neutrality is the fundamental reason why the elementary mass-carrier must be a composite particle whose constituent parts (the quarks) can assume an electrically neutral configuration (as in the neutron). This requirement in turn demands the creation of the gluon field and color charges to permanently control and confine these partial charges in combinations that sum to whole unit (leptonic, electromagnetic) quantum numbers. The simplest way to create all these particles and fields is simply to split an elementary heavy lepton into three parts, and the gluon and color field will follow of necessity. The assumption is that there is a natural mass-size limit beyond which the self-interaction of an electric charge will cause an elementary particle to fracture. The leptoquark represents that mass-size limit, terminating the leptonic series.

Presumably, all baryons have one and the same (species of) number charge ("leptoquark number"), as all baryons stem from the same leptoquark ancestor, and all must revert to this same high-energy form to decay, resulting in the extraordinary stability of the proton. It seems likely that in the current Universe only the gravitational pressures of a black hole can provide sufficient symmetrically applied force to routinely cause proton decay. If this is so, then the interior of black holes may consist of nothing but gravitationally trapped light, a condition strangely reminiscent of the gluons or "sticky light" trapped within a baryon. If a neutron star is a gigantic gravitationally bound compound atomic nucleus, then a black hole may represent the next level of simplicity, a gigantic gravitationally bound single baryon.

The primary strong force (color field, within baryons) acts to protect light's symmetry by confining quarks to whole quantum unit charge combinations, and restores light's symmetry through self-annihilation and proton decay. The secondary strong force (meson field, between baryons) initiates nuclear fusion, resulting in the creation of heavy elements in the nucleosynthetic pathway of stars, and the conversion of nuclear binding energy to light. This pathway, however, is relatively short and ineffective, as only a small fraction of the energy stored in baryons can be released through nuclear fusion. Proton decay completely converts nuclear mass to light, but the process is so rare that the proton, in human terms, is virtually eternal. We owe the stability of matter to the color charge of the strong force, the weakness of gravity, and the huge mass-energy barrier of the "W" and "X" IVBs. But the seeds of its own destruction are contained within the baryon, through the principle of "asymptotic freedom" and the potential self-annihilation of the color charge. (See: "[The Half-Life of Proton Decay and the 'Heat Death' of the Universe](#)".)

## **The Weak Force IVBs: Fission, Identity Charge**

(For a discussion of the role of the weak force IVBs, including why they are so massive, see: "[Global vs local Gauge Symmetry and the Weak Force](#)"; see also: "[The Higgs Boson and the Weak Force IVBs](#)".)

Because it is the weak force which breaks the symmetric state of energy in the "Big Bang" and brings the material Universe into existence, we might not expect this force to be particularly active in returning the material system to symmetry. Yet, the force that creates matter can also destroy matter, and it does so in several ways - through the decay of heavy particles to their ground state, through the fission of heavy compound nuclei ("radioactivity"), through contributions to fusion in the nucleosynthetic pathway of stars, and through the process of proton decay, for which it provides the "X" IVB and an alternative charge carrier for the identity charge (the leptoquark neutrino).

When we consider an elementary particle, such as the electron (e<sup>-</sup>), we often forget that this particle carries two charges, electric charge and identity (or "number") charge. The electric charge is indicated by the negative sign, the identity charge is indicated by the "e". We say that identity charge is "hidden", or carried in implicit form, by the massive electron, but is revealed in its explicit, nearly massless form as the electron

neutrino. (Whether or not the neutrino is actually massless has little to do with its symmetry debt of "identity". Most symmetry debts are in fact carried as charges by massive particles). Usually the "identity" charge is simply called lepton or baryon "number" charge, which obscures the true meaning of this charge. If lepton "number charge" adequately described its function, then the number charge of the electron would also serve as the number charge of the muon and tau; but as we have learned, there is a specific and distinct neutrino associated with each member of the elementary leptonic spectrum (plus another set of distinct antineutrinos for their antiparticles), so the charge is more accurately described as "identity". Moreover, we can readily assign "identity" as the plausible symmetry debt of light's anonymity, with a sensible function to perform in annihilation reactions (facilitating the timely choice of the correct antimatter annihilation partner), arguments and contact with Noether's Theorem which we cannot make for the generalized "number" charge.

It is at first only a curious fact, and then after reflection, an obvious one, that the "identity" charge is the key to manifestation. It is identity that brings matter into existence, as the principle or "cardinal" symmetry debt of information. But then, how could it be otherwise? Identity is the essence of asymmetry, the key ingredient of information that must be isolated from the symmetric field of energy if manifestation is to occur. "In the beginning was the Word"; the Word carried information, and the information was "identity". Do we not spend our entire lives discovering the personal meaning of this word? (See also: "[The Weak Force "W" Particle as the Bridge Between Symmetric \(2-D\) and Asymmetric \(4-D\) Reality](#)".)

The leptonic field of elementary particles functions as alternative charge carriers, both for the symmetric, composite field of the quarks and hadrons, and for other leptons. The massive leptons function as alternative carriers of electric charge, the (nearly) massless neutrinos function as alternative carriers of identity charge (mesons also serve as alternative carriers of electric charge, and of quark "flavors", "colors", and partial electric charges); mesons are especially useful in baryon transformations and decays (see: "[The Particle Table](#)"). Without alternative charge carriers, the symmetric quark field could not manifest, since in the absence of leptons, quarks could only balance their charges with antiquarks, and they would remain forever locked in mutually annihilating particle-antiparticle pairs. Without neutrinos, the massive leptons would likewise remain locked in their particle-antiparticle pairs, themselves lacking an alternative carrier of identity. Hence it is that the neutrino, the least of all particles, becomes the "mouse which nibbles the lion's net", providing an alternative, conserved, carrier of identity charge, unleashing the information potential of the Cosmos. (See: "[The Weak Force: Identity or Number Charge](#)".)

Just as we see the information pathway of the electromagnetic force evolving to reestablish the primordial connective unity of light throughout material systems, so we see through the rise of consciousness and the emergence of organisms with definite individuality and personality, the reemergence and exploration of "identity" in the biological realm. Our concept of the "soul" as the essential element of personal identity, hidden in the body but functioning as a conserved, alternative "charge carrier" which both underlies and permits the manifest human experience, is a particularly striking example of the convergence of human intuitive awareness with the fundamental workings of natural law, including, in this case, the uttermost element of our cosmic origin. We look to the phenomenon of fractal resonance for the explanation. (See: "[Chardin: Prophet of the Information Age](#)".) (See: "[The 'W' IVB and the Weak Force Mechanism \(pdf\)](#)" - also available in [HTML format](#).)

## General Systems Properties of the Table

*Note to readers: The author views certain religious, mythological, astrological, and occult "World Systems" or cosmologies as examples of ancient, intuitive General Systems which display relevant features of the universal 4x3 fractal algorithm, a pattern also seen in today's "scientific" or "rational" cosmologies. These intuitive systems are examined in the context of their General Systems properties only, without endorsement*

*in any other sense.*

Nowadays we are equally plagued by scientific (rational) and religious (intuitive) "fundamentalism" - people who are convinced they alone are in possession of the "One Truth". Scientists have become as bigoted and blind as the Church that martyred Bruno and persecuted Galileo - and even those people are still with us, except lately they have fastened upon Darwin and "Intelligent Design", rather than upon Copernicus, Kepler, and the heliocentric model of the Solar System.

While the scientific and rational mind may scoff at religious and occult systems of thought, few scientists would care to deny the value of the arts, which are also peculiarly human and non-rational perceptions of reality. The fact is, as science itself has forced us to realize, that our human-scale perception of "reality" is at once specialized, relative, personal, subjective, and limited. There is no greater fool than the man who thinks there is only one "right" way to see the world. Nobody knows what an atom "really" is; but apparently atoms make human beings to try to answer that very question: humans are (apparently) a collection of atoms in search of themselves.

General Systems is just another way to get at the "truth underlying reality", whatever that phrase may mean. We pile up circumstantial evidence of a certain sort (the 4x3 fractal algorithm, for example) and hope it points us toward a general understanding of our situation, toward the general principles which underlie our existence and that of the World. As a social rather than a personal effort, it is perhaps the best methodology we have at present.

A central purpose of this paper is to discover and share a glimpse of how the physical Universe works in terms of the general principles governing energy and its conservation. But because this [table](#) of our rational, scientific cosmology is arranged in accordance with the pattern and dynamics of a universal General System, or fractal algorithm of the Cosmos, we are in a position to get more than just scientific information from it. We can compare it to other historic and traditional intuitive cosmic systems, religious and occult, which to one degree or another share this same pattern and dynamic. By this comparative means, we can actually extract some "human meaning" from all this "scientific" data.

"As above, so below" is an intuitive realization of the fractal nature of the Universe. But while it presumably works in both directions, we must realize that emergent properties of size and complexity will always prevent us from making exact analogies and transfers of logic between levels. We can expect to find general patterns, but also unpredicted surprises - quantum mechanics and black holes are good examples at opposite ends of the scale of size. "Inflation", the "multiverse", "strings" and "wormholes" may be others. We don't know what we don't know, so above all, we must keep an open mind. General Systems is an invaluable tool and guide, but it must always be supplemented by experimental scientific data and rationality, as well as by the arts and our intuitive and aesthetic faculties. Understanding the universe (in a scientific sense) is a "whole brain", open mind, social effort. Establishing a personal relationship with the universe (in a spiritual sense) is entirely a subjective and intuitive matter for each individual.

The intuitive mind is just as clever as the rational mind in discovering the underlying order of the Universe, and it has been busy at this task for a much longer time. The "Einsteins" of the intuitive mind have figured out this order in generalized, abstract terms long ago; the rational mind is only now catching up. We live in a fortunate time - even 50 years ago we could not have filled out the rational table; it would not have been possible, due to lack of scientific data, to make the comparisons we are now able to consider.

## **Religious Systems**

The first comparison I want to make is between the cosmological story told by this scientific model and that

told by the Old and New Testament of the Bible. In their larger features these stories are virtually identical. The Universe in both cases begins as light, followed by a short period of grace or symmetry, which is spoiled by a descent or "fall" into a chaotic, disharmonious state of manifestation and asymmetry. In the rational model, the weak force plays the role of Satan, the fallen angel, a principle of manifestation, a duality apparently built into the system from the beginning.

But God does not abandon his "spoiled" creation; the principle of conservation, the salvation of souls, promises an eventual redemption, a return to the original condition of "grace", the analog of the return to symmetry, unity, connectivity, and light which we have mapped in the physical model. "Heaven" is but the conservation domain (or "dimension") of spirit. Spirit itself resides in the connections of the Cosmos, and in the physical laws and principles which govern its existence, interactions, and evolution. In the rational model, "God" is embodied as the "Multiverse" - all-symmetric and all-creative, the Source and First Cause of all reality and energy.

As material beings, humans are especially aware of and disturbed by the fact that bound energy as a class is curiously separated from its conservation domain, historic spacetime. We experience instead an "Eternal Now", which is largely the causal effect of matter's historic information matrix. (See: "[The Time Train](#)".) We need to understand that this separation, while necessary and purposeful, is temporary and to some extent illusory, as the Universe is in fact a wholly connected unity in time and space, and is constantly evolving toward a more perfect realization of that central fact. We are all immortal in history.

We live in the separate, manifest world of the weak force, the temporal "hell" of the physical realm, but we remember with longing an earlier time of unity, when we were but a potential for experience in the womb of the Universe. It is to this condition of unity ("enlightenment") we hope to return, not as infants, but as adults, creative in our own right, illumined by spiritual awareness, and with a more complete understanding of reality.

The interaction of two energy states or two conservation domains is a fundamental and recurring theme in Nature and our model (space vs time, strong force vs weak force, light vs matter). The intersection of a symmetric with an asymmetric conservation domain is necessary to bring any system into manifestation. The interaction or intersection of the symmetric spiritual domain with the asymmetric physical domain is the fundamental symbolism of the Christian Cross. Such an interaction is possible only if the conservation rules of both domains are respected. Hence the death of Christ on the cross symbolizes a necessary obedience by spirit to the rules of the physical domain; the Resurrection follows as a compensating obedience to the rules of the spiritual domain. Christ's physical mortality, like our own, is the price spirit must pay to interact with the physical world. Whether or not you believe this story in its literal and religious sense, it is symbolically correct, rationally and intuitively, which is why it has endured. (See: "[A Religious Interpretation of the Tetrahedron Model](#)".)

## Astrological Systems

Next I want to look at the correspondence of this [physical matrix](#) to the astrological world model, as astrology is also an ancient, western, intuitive 4x3 cosmological model, but one I would characterize as occult, rather than religious, at least as we view it today.

Astrology is a [General Systems model](#) of the human condition. What is unusual about astrology is that it models humanity in terms of a cosmological (astronomical) system. Astrology makes a fractal or General Systems statement about the relationship of humanity to the Universe: if we understand one, we understand the other; at the least, they are iterations of the same 4x3 fractal algorithm.

The constellations, stars, and planets visible to the naked eye (in essence, the Milky Way galaxy), were the full extent of the Universe known at the time astrology originated, at least 4,000 years ago. In terms of its historical origins, Astrology is a mixture of a rational and an intuitive model (as it is based on astronomical observations) and was just as universal in its intended scope as our present day Unified Field Theory. The ancients wanted more from their rational model than simply the ability to predict planetary positions, eclipses, and seasonal changes; they wanted human meaning from it as well. I am asking the same from our modern Unified Field model: what is the meaning of our modern cosmological system for humanity? What does it say about our fundamental questions? What can we learn from it about ourselves and the "human condition"?

The ancients essentially compared humanity to our galaxy, which was their observable Universe; we are extending this comparison to the limits of the Universe as we know it today (in terms of fundamental physical principles as well as cosmological observations). If Man, galaxy, and Universe are all iterations of the same fractal, the comparison should remain valid.

A test of this hypothesis is provided by mapping the ancient system on top of the modern, and seeing if there is a significant convergence of meaning. In this way we compare the thought of two kinds of genius - the intuitive genius of the ancients, and the rational genius of the modern world. The "heavy lifting" in both camps has already been done. Our contribution must be that of aligning the two systems correctly and interpreting the results with skill and sensitivity.

The astrological system can be represented as a 4x3 matrix of 3 "Qualities" vertically mapped against 4 horizontal "Elements". Again we see a symmetric, general, or spiritual domain (the 3 Qualities: Cardinal, Fixed, Mutable) intersecting or interacting with a more asymmetric, specific, physical domain (the 4 Elements: Fire, Water, Earth, Air). (Seen also as [global vs local gauge symmetry](#).)

As the modeler, I have to decide how to assign the astrological attributes to the physical matrix, that is, what are the appropriate correspondences between the two systems.

On the vertical axis I pair "Mutable" with Energy, since energy is changeable but conserved, taking many forms; "Cardinal" corresponds to symmetry and charge conservation, the principle which translates Law (symmetry conservation) into matter (charge conservation); "Fixed" corresponds to manifestation, therefore to particles and matter. Astrology does not give us a 4th quality to fill out our 4x4 table, so I have had to invent one which I call "Motive", conveying the idea of directional action, intent, or evolution to correspond with the "agenda" or "drive" of the force fields (field vectors) in paying matter's symmetry and entropy debts, and converting bound energy to free energy.

For the horizontal axis of the elements of the physical world, I choose Fire for the electromagnetic force, Water for the gravitational force, Earth for the strong force, and Air for the weak force. Those who know astrology can now fill in the "Sun Signs" corresponding to the cells of the matrix and see if they like the fit between the traditionally described attributes of the Sun Signs and the physical characteristics of their rational counterparts. (See: ["Table of the Sun Signs"](#) and ["Combined Table of Astrology and Physics"](#).) I think in every case they will find the fit remarkably good, and fraught with meaning both old and new. Unfortunately, it is rare to find a person who is versed in both physics and astrology, so the beauty of the correspondence between the two systems may not be readily apparent to the uninitiated. I try to make them so in some of the astrological papers cited below.

In the terms of Norbert Wiener's cybernetics, the Qualities are the "inputs", the Elements are the "thruputs", and the Sun Signs are the system "outputs", a dynamic which applies equally well to the rational system.

The correspondence between the astrological and rational cosmic systems is also shown in the ["Hourglass"](#)

or "[Grail](#)" diagrams (see also: "[The Particle Grail Diagram](#)" and "[The Spacetime Grail Diagram](#)"). The interpretation of the human condition as revealed by these convergent systems is shown in the "[Personal](#)" and "[Civil](#)" Grail diagrams. These diagrams are discussed in detail in two papers, the "Physical Correlates of the Astrological Sun Signs", [The "Sun Signs" of Astrology: Part One](#) and [The "Sun Signs" of Astrology: Part Two](#). (See also the "[Overview of the Astrological System of the Grail Diagrams](#)" for a synoptic and general discussion.)

## Summary

Here, and in the papers, diagrams, and tables cited above, we have seen how the astrological system maps upon the modern rational system with exquisite meaning and precision. The Chinese classic "I Ching" (Book of Changes) is an Eastern example, independently derived, of an ancient, intuitive, occult system which is also based on a perfect 4x3 metric: 4 male trigrams joined to 4 female trigrams, producing 4 hexagrams. Its basic dynamic and structure are perfectly in accord with the General System features of our other cosmological systems, but I do not know enough about its elaborated form to discuss it further.

All these systems of human thought are examples of how the mind, in both its intuitive and rational mode, has grasped the fundamental pattern and order of the fractal Universe. Since we ourselves, including our brains, are part and parcel of the same fractal order, these correspondences of thought are the natural outcome of the patient process and evolution of truth-seeking. (See: "[Table of Natural Organization](#)" and "[The Fractal Organization of Nature](#)".)

The Universe values symmetry, for that is the conservation principle which upholds us all (charge conservation, charge invariance). Our natural perception of symmetry is beauty, hence we are naturally led by our delight in beauty toward enlightenment. We should look very carefully at this issue of symmetry and beauty, for in this aesthetic principle is our natural path to salvation (in every sense). Einstein's strict adherence to the principles of aesthetics led him to truth in his equations, and the discovery of the symmetry conditions of light and spacetime.

We also seem to have a natural perception of symmetry in our native sense of social justice. The "Golden Rule": "do unto others as you would have them do unto you", is the fundamental and universal symmetry principle of social behavior. "Liberty, equality, fraternity"; "all men are created equal"; "one man, one vote"; "all men are equal before the law": these are all symmetry statements regarding the civil and political status of humanity. "All men are equal before God" is the equivalent expression of spiritual symmetry.

Spiritual awareness is the awareness of connection - of our connections to the fractal nature of the Universe, all the way back to its beginnings in the "Multiverse" as unmanifest Principle. Our spiritual awareness is the self-awareness of the fractal Universe: "Man created in the image and likeness of God". We are each a quantum unit of this fractal self-awareness. We cannot escape it, it is in our DNA as a genetic heritage bestowed through evolution upon our species. Let us learn to use it well, remembering that symmetry in all its meanings is our true and natural guide - Noether's Theorem is the "Golden Rule" of natural law. "Beauty is truth, truth beauty - that is all ye know on Earth and all ye need to know" (Keats - *Ode on a Grecian Urn* - 1819). And similarly, from Socrates in Plato's *Symposium*: "This is the life which man should lead above all others in the contemplation of Beauty absolute ... Dwelling in that realm alone, he will bring forth not images of beauty, but Beauty itself, and so would become immortal and be the friend of God." (c. 370 B.C.) (See: [The Tetrahedron Conservation Model and Plato's "Symposium"](#).)

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