The Charges of Matter are the Symmetry Debts of Light

Papers:
Symmetry Principles of the Unified Field Theory (a "Theory of Everything") - Part I
Symmetry Principles of the Unified Field Theory (a "Theory of Everything") - Part 2
Symmetry Principles of the Unified Field Theory (a "Theory of Everything") - Part 3 (Summary)

Discovering "Noether's Theorem" and the principle of symmetry conservation was one of the two keys that opened my personal door to the unification theory. The second key was Einstein's statement that the spacetime "Interval" of light was equal to zero.

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 also finds an associated conservation law, and vice versa. I soon came to realize that because matter is created from light, this theorem means that any symmetry of light must somehow be conserved in matter, and that (one of) the real world consequences of Noether's Theorem was *the charges of matter are the symmetry debts of light.* Charge conservation (including "spin") = symmetry conservation, in the case of the electromagnetic field; in the case of the metric field of spacetime, the physical consequence of Noether's theorem is the presence of inertial forces and gravitation. The conservation of "spin" (the quantized spin angular momentum of particles) seems to be a mixture of the charge and inertial force cases. Because the theorem works in two directions, any charge of matter must be associated with a symmetry of light; and further, because charges produce forces, gravity also must be the product of some charge of matter, and therefore gravity presumably represents some symmetry debt of light. In accordance with Noether's Theorem, charges produce forces which act to return the asymmetric material system to its symmetric origin in light. In the case of gravity, we have the example of our Sun, the stars, quasars, and Hawking's "quantum radiance" of black holes, returning bound energy to its original symmetric state, light.

But what broken symmetry of light does gravity represent? What is the nature of the gravitational "charge"? For each of the four forces of physics, there must be an associated charge, and these charges are all (presumably) symmetry debts of light. When light is converted to matter, it loses a lot of symmetry - in fact, according to this line of thought, symmetries of at least 4 different kinds, each of which requires a different kind of conserved charge. The action of the force produced by the charge is therefore understood as the attempt to pay the conserved symmetry debt carried (represented) by the charge, returning the system to its original symmetric state (light), in obedience to Noether's Theorem. The electric charge is prototypical of this effect:

> When light creates particle-antiparticle pairs, the particles are produced with opposite and strictly conserved electric charges, whose whole purpose is to produce a long-range attractive force between the particles with sufficient strength to produce an annihilation reaction within the Heisenberg time limit for "virtual reality", returning the particle pairs to the symmetric state of free energy which created them. Because the photon is the field vector (force carrier) of electric charge, we see light protecting its own symmetry in such annihilations, which occur continuously in the "virtual particle sea", the Heisenberg realm of virtual reality.

A pathway to the conceptual unification of forces therefore presents itself: identify the symmetries of light which the charges and forces of matter represent; all charges, forces, and particles have their origin in light, which becomes the principle of unification. The question becomes: what are the 4 symmetries of light

represented by the 4 charges and forces of physics? This question is pursued (and answered) in the various unification papers, especially: "Symmetry Principles of the Unified Field Theory".

I like to think of Noether's theorem (1918) as the "Truth and Beauty" theorem, as it appears to be nothing less than the mathematical expression of Keat's famous poetic intuition: "Beauty is truth, truth beauty, - that is all ye know on Earth, and all ye need to know" (1819) - where conservation plays the role of truth, and beauty = symmetry. This is an outstanding example of the correspondence between the rational and intuitive powers and sensitivities of the human mind: neither one is to be slighted, much less dismissed.

(See: *Emmy Noether: A Tribute to her Life and Work*. Brewer, J. W. and M. K. Smith, eds. M. Dekker, New York, **1981**

Einstein's "Interval"
The "Interval" of Light = Zero

The second key in my understanding of the unification pathway was Einstein's mathematical statement that the spacetime "Interval" of light = zero. Einstein's "Interval" is an invariant measure of the "quantity" or "interval" of spacetime separating two events. The Interval is so mathematically formulated that it is invariant with regard to the relative motion of observers, and its chief role is to rescue causality from Einstein's shifting relativistic perspectives of space and time in moving frames of reference. Thus moving observers of two events will not agree, in general, on the space and time measurements separating those events, but they will always agree upon the mathematical product of those measurements when combined in Einstein's formulation of the "Interval". The invariance of causality depends upon the invariance of the Interval and the absolute (non-relative) velocity of light.

The zero "interval" of light means light is "non-local", having no time dimension and no spatial "x" dimension corresponding to length or distance - light's "clock is stopped" and meter sticks shrink to nothing in the direction of light's propagation. Light is a 2-dimensional transverse wave. Velocity c, the intrinsic motion of light, is a symmetry condition, drive, or "gauge" for light (free energy) which results in light's "non-local" character. The zero Interval of light is the formal (mathematical) expression of this fundamental symmetry of light, its "non-local" energy state. Several related symmetries flow from light's "non-locality": 1) light has no asymmetric time dimension; 2) light has no asymmetric (local) "rest" mass; 3) light produces no asymmetric gravitational field; 4) being non-local, with an infinite amount of time to go nowhere, in its own reference frame, moving at velocity c, light is everywhere within its conservation domain (spacetime) simultaneously.

The effectively "infinite" velocity of light results in another symmetry - the equitable distribution of light's energy throughout its conservation domain, everywhere, simultaneously - a symmetry of special significance for gravitation and matter's "location" charge. "Non-locality" also allows light, or velocity c, to act as the metric gauge of spacetime, including its inertial symmetry, regardless of the size or motion (expansion, contraction) of the domain. Non-locality has the further consequence of producing a condition of complete unity and connectivity between light and space throughout light's conservation domain of spacetime. It is the (broken) non-local distributional symmetry of light's energy which is the source of the gravitational "location" charge in matter. "Location", a charge whose active principle is time, identifies the spacetime location, quantity, and density of bound energy. Matter is an immobile and hence undistributed lump of concentrated mass or bound electromagnetic energy (E = mcc).

The connection between symmetry and entropy enters our theory with "velocity c", which is the symmetry gauge of free energy, banishing time, distance, mass, charge, and gravitation. "Velocity c" also gauges the entropy drive of free energy (the intrinsic motion of light), causing the expansion and cooling of light's spatial conservation domain - the Cosmos. This double gauge role of "velocity c" is reflected in the

corresponding double conservation role of gravitation: gravitation produces the time dimension of matter, identifying the 4-D spacetime location of mass (light's distributional symmetry debt); the intrinsic motion of time also serves as the historical entropy drive of matter (light's "intrinsic motion" entropy debt). Hence gravity: 1) produces the time dimension of matter via the annihilation of space, conserving the spatial entropy drive of light's intrinsic motion as the historical entropy drive of time's intrinsic motion; and 2) converts bound to free energy (as in stars, quasars, and Hawking's "quantum radiance" of black holes) to conserve the distributional symmetry of light's non-local energy state. Because both light's entropy drive and non-local distributional symmetry are gauged by "velocity c", to conserve either function is to conserve the other by default. This has the significant consequence that gravity's entropy conservation role also falls under the symmetry conservation mantle of Noether's Theorem. Time is a charge with a symmetry conservation role - as demonstrated by gravity's conversion of bound to free energy in the stars. (See: "The Double Conservation Role of Gravity"; see also: "The Conversion of Space to Time".)

The "location" charge of gravitation carries both the entropy debt and the symmetry debt of light's non-local energy state; it is this double role that has made gravity such a difficult force to understand. The active principle of the gravitational charge is time; the one-way spacetime flow of gravitation is the consequence of time's intrinsic one-way motion into the historic domain of spacetime. It is the causal function of time that requires its one-way flow. See: Entropy, Gravitation, and Thermodynamics"; also "A Description of Gravitation".

Symmetry and entropy are connected in light because light occupies its conservation domain completely (space is actually created by the intrinsic motion of light), and the most symmetric dispersion of light within its domain also has the greatest entropy. However, entropy has a further component, temperature, such that while hot or cold light has the same symmetry, cold light has the greater entropy. Hence entropy rather than symmetry actually drives the expansion of space. None of these considerations apply to bound energy (matter), which does not occupy its conservation domain completely (historic spacetime), and does not participate in the expansion of either spacetime or history. It is because of these differing dimensional characteristics that the entropy drives of free and bound energy (the intrinsic motions of light and time as gauged by "velocity c" and "velocity T") are so vastly different in their entropic consequences and metric equivalence, a difference which we perceive as the anomalous weakness of gravitation. Bound electromagnetic energy (matter) is only tangentially connected to its historical conservation domain via the ephemeral "present moment". Gravity produces only enough time to provide the temporal entropy drive for this tangential point of contact between matter and history (actually seen as the area of the "event horizon" of a black hole). (See: "Proton Decay and the 'Heat' Death of the Cosmos".)

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