

The Problem of "Mass" in the "Tetrahedron Model"

John A. Gowan

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In my own work I have tried to simplify the "mass problem" to its barest bones. To begin with, I make the assumption that all mass is the consequence of [weak force symmetry-breaking during the "Big Bang"](#). Without weak force symmetry-breaking, the universe would have remained in its original state of perfect symmetry, composed only of photons, space, and virtual particle-antiparticle pairs (of leptons, neutrinos, quarks, etc.). Hence the proximate origin of mass is laid (in this view) directly to the "precipitating action" of the weak force asymmetry, the IVBs (Intermediate Vector Bosons), and the Higgs boson which, acting together, "condense" matter from the primordial symmetric state of free electromagnetic energy (high-energy light). "Mass" is a conservation parameter for the raw energy of bound electromagnetic energy (such as immobile atomic particles lacking "intrinsic motion c "); particles of matter are created from photons and their associated virtual particle-antiparticle pairs by the asymmetric action of the weak force during the "Creation Event". So a further question is: why does free electromagnetic energy (light) exist in two forms - photons and virtual particle/antiparticle pairs? I don't think there is any answer to this ultimate question - it's simply a "given" of electromagnetic energy and our universe. Ours is an electromagnetic universe, and electromagnetic energy has this dual nature, without which the cosmos as we know it could not exist. (I like to say that our universe is an electromagnetic subset of the multiverse; however, perhaps we should say that our universe is an "anthropic" subset of an electromagnetic multiverse - at least this is a scenario we can actually imagine.)

We might also say that electromagnetic energy exists in two major phases, one symmetric and free (light), and the other asymmetric and bound (atomic matter). The bound phase is derived from ("condensed" from) the photons and virtual particles of the free phase (via the asymmetric decays of the weak force), and is interchangeable with it. The transition from one phase to another is instantaneous or nearly so (as in the creation/annihilation of particle-antiparticle pairs via the electromagnetic force, or the creation/annihilation of *single* particles via the weak force). Since light is 2-dimensional and matter is 4-dimensional, the phase transition is inter-dimensional, involving most significantly (in the 4-D case) the asymmetric one-way time dimension. This loss of symmetry requires a conservation response: electric charge and the neutrino's spin combine to register the symmetry loss of antimatter. Non-local light (with "intrinsic" (entropic) spatial motion " c ") is converted to local particles with no intrinsic spatial motion, but with a metrically and functionally equivalent "intrinsic" (entropic) temporal motion. The raw energy of the converted photons is conserved as the "mass" of the particles. The symmetry of the photons is conserved via the various conserved charges of matter (as required by "Noether's Theorem - *the charges of matter are symmetry debts of light*"). Herein lies the [conceptual union](#) of the four forces of physics. One of these conserved charges is the "location" charge of gravity, which registers the lost "non-local" spatial distribution symmetry of the light which created the particles. This gravitational "location" charge is dimensionally active, [converting space into time](#). In fact, time is the active principle of the gravitational charge: a "graviton" is a quantum unit of time. Herein lies the conceptual union between gravity and quantum mechanics. (See: "[A Description of Gravity](#)".)

The gravitational conversion of space into time is the conversion of the fundamental spatial entropic

drive of light or free electromagnetic energy (the intrinsic spatial motion of light), into the historical entropic drive of bound electromagnetic energy (the intrinsic temporal motion of matter). Gravity introduces a temporal component into the spatial metric of light, which thereby becomes the composite metric of spacetime, necessary to accommodate the conservation requirements of a universe composed of both free and bound forms of electromagnetic energy. In the extreme case of the "black hole", the gravitational temporal metric of matter completely overtakes and replaces the electromagnetic spatial metric of light.

The conversion of symmetric light to asymmetric matter brings with it as conservation consequences four new asymmetries: time, charge, mass, and gravity, all related and actively involved in the conservation of light's original energy and symmetry, and the return of matter to its original symmetric state (witness our sun, and the ultimate conversion of all mass to light via Hawking's "quantum radiance" of black holes).

The gravitational field produced by mass is an asymmetric metric field (because of its temporal component), which interacts with and distorts the symmetric electromagnetic metric field of space. Recall these fields extend throughout the universe. Forcing the actively distorting gravitational field through the symmetric spatial metric field (as during accelerated motion) produces a natural resistance (since work must be done to distort the symmetric field), and yields the phenomenon of "inertial" mass; inertial mass is equivalent to gravitational "weight", since the accelerated flow of metric spacetime in the two cases is reciprocally equivalent (either we accelerate through spacetime or spacetime accelerates through us). (Note that this "inertial mass via the metric distortion of gravitation" hypothesis provides a universal inertial resistance to any kind of mass or bound energy, in exact proportion, and is not the same mechanism as the "Higgs boson drag" proposed by the "Standard Model", which apparently affects only elementary particles.) (See: "[The Higgs Boson vs the Spacetime Metric](#)".)

This is how I understand mass in the "Tetrahedron Model", considering only the "forest" and not looking at specific "trees", not overly concerning myself with the different kinds of bound energy. The role of the "Higgs boson" in my view is to gauge (scale) the IVB mass, which in turn gauges the mass of the particles they transform, whether quarks or leptons. (See: "[The Higgs Boson and the Weak Force IVBs](#)".)

For more (qualitative) details on my view of the weak force mechanism, see the various papers in the weak force section of my [website](#). But the quantitative detail I gladly (and perforce) leave to the expertise of the mathematically gifted.

To summarize, in this conception I do not try to distinguish between various sources of "mass", but recognize all mass as due to a universal conservation parameter for raw energy triggered by the change of phase from 2-D symmetrically distributed and "non-local" light (with "intrinsic" (entropic) motion in space ("velocity c"), to 4-D asymmetric and "local" (undistributed) matter with "intrinsic" (entropic) motion in time. Time is the alternative and asymmetric (one-way due to causality) entropy drive for bound electromagnetic energy (atomic matter), creating history, the information conservation domain for causal matter. Light, being acausal, requires only space as an entropic domain for energy conservation. Time is derived from the primary and symmetric "all-way" spatial entropy drive of free electromagnetic energy (light's "intrinsic" motion), via the gravitational conversion of space to time,

creating historic spacetime. Historic spacetime is the compound metric and entropic conservation domain of our universe, accommodating (as it must) both free and bounds forms of electromagnetic energy. "Mass" is a property (conserving raw energy) of any energy form which is derived from light, but does not itself move at velocity "c". Any energy form which has a time dimension also has mass and a corresponding gravitational energy (Gm) - which creates the time dimension of mass via the annihilation of space. Spatial annihilation leaves a metrically equivalent temporal residue which has its own "intrinsic" (entropic) motion into history, continuing the self-feeding cycle of the gravitational conversion of space into time, a cycle which ends only with the conversion of mass to light. *A gravitational field is the spatial consequence of the intrinsic motion of time.* (See: "[The Conversion of Space to Time](#)").

The absolute measure of (rest) mass (in terms of electromagnetic energy equivalent) is given by Einstein's $E = mc^2$. Relative or comparative measures of mass are provided by measuring an object's resistance to acceleration or (equivalently) its gravitational "weight". These vary with the degree of acceleration (or the strength of the gravitational field) and rely on additional calibration by an established standard (the international kilogram, for example). This method also assumes acceleration at low (non-relativistic) velocities. An advantage of the method is that we can safely assume that all of the object's mass is included in the measurement - and we don't have to annihilate it. Another absolute measure of mass, but in terms of gravitational rather than electromagnetic energy, is provided by the total energy of an object's gravitational field. This is given as the product of the object's mass multiplied by the universal gravitational constant (Gm). Finally, Newton's gravitational formula allows us to calculate the mass of astronomical objects, including our own earth, if we know the surface acceleration due to gravity, the gravitational constant, and the distance to the center of mass ($F = GMm/rr$). (Google-search "Cavendish experiment" and see the Wiki article for technical details regarding the determination of the gravitational constant (G) and the "weighing" of the Earth.)

Further thoughts on mass and gravity:

- 1) Massless light moving freely in the vacuum of spacetime [does not produce a gravitational field](#). Hence the conversion of mass to light in astrophysical processes such as stellar nucleosynthesis, quasars, supernovas, etc., reduces the total gravitational field of the cosmos - resulting in a universal "acceleration" of the spacetime expansion (recently observed). Hence the mysterious "dark energy" is nothing else but the relaxation of the gravitational grip of the universe as its bound energy content is converted to free energy (light).
- 2) "Dark Matter" is probably composed of a heavy neutrino - specifically, a leptoquark anti-neutrino released during the asymmetric weak force creation of matter during the "Big Bang" - balancing the "baryon number charge" of the matter produced. (See: "[The Higgs Boson and the Weak Force IVBs](#)".)
- 3) The negative energy of gravity exactly balances the positive energy of the "Big Bang" - allowing the cosmos to be born in a symmetric state of no net energy or charge (the latter due to the presence of antimatter). Absolute conservation of energy and charge follow as a natural consequence of this original symmetric condition and "zero sum" charge and energy state. (See: "[Table of the Higgs Cascade](#)".)

CERN Higgs Announcement Citation

See: Discovery Announcement: Science Vol. 337 13 July 2012 pp. 141-143

See (article): The Discovery of the Higgs Boson
Science 21 December 2012: Vol. 338 no. 6114 pp. 1524-1525 DOI: 10.1126/science.338.6114.1524
<http://www.sciencemag.org/content/338/6114/1524.full>

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<http://www.sciencemag.org/content/338/6114/1558.full>

See (article): "Origins of Mass" by Frank Wilczek

<http://arxiv.org/pdf/1206.7114.pdf>

See (book): "Beyond the God Particle" Leon Lederman and Christopher Hill, Prometheus Books, 2013

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Gravitation

[Section II: Introduction to Gravitation](#)

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[A Description of Gravitation](#)

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[The Problem of "Mass"](#)

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[Section VI: Introduction to Information](#)

[Chardin: Prophet of the Information Age](#)

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[The Formation of Matter and the Origin of Information](#)

[Nature's Fractal Pathway](#)

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[The Phases of Matter](#)

Weak Force, Intermediate Vector Bosons ("IVBs"); Strong Force

[Section IV: Introduction to the Weak Force](#)

[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](#)

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[Section XVIII: The Strong Force: Two Expressions](#)

[Section XVI: Introduction to the Higgs Boson \(Part I\)](#)

[The "Higgs" Boson and the Spacetime Metric](#)

[The "Higgs" Boson and the Weak Force IVBs: Part I](#)

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[The Particle Table](#)