

ABOUT GRAVITY

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Note to Readers Concerning "Entropy":

See: [Spatial vs Temporal Entropy](#)

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Abstract

Gravity plays a double conservation role in nature, conserving both: 1) the intrinsic motion of light (by converting it to the intrinsic motion of time - via the annihilation of space and the extraction of a metrically equivalent temporal residue (entropy conservation role); and 2) the non-local distributional symmetry of light's energy (by converting bound to free energy in stars, and via Hawking's "quantum radiance" of black holes (symmetry conservation role). These two conservation roles derive from the double gauge role of "velocity c ", which regulates both light's intrinsic motion c (the entropy drive of free electromagnetic energy), and light's non-local distributional symmetry (vanishing time and distance in the direction of propagation). When gravity conserves light's non-local, distributional symmetry (in obedience to "Noether's Theorem"), via gravity's "location" charge, gravity also conserves light's entropy drive by default, since time itself is the active principle of the "location" charge.

In the course of thinking and writing about gravity for nearly 30 years, the following are some of the conclusions I have drawn regarding this remarkable and enigmatic force. (See: ["Introduction to Gravitation"](#).)

1) Gravity plays a double conservation role in nature, conserving:

A) The spatial entropy drive of free electromagnetic energy (light's intrinsic motion), converting it to the historical entropy drive of bound electromagnetic energy (time's intrinsic motion). This gravity accomplishes by the annihilation of space, which reveals a temporal residue, the metric equivalent of the collapsed space. Because entropy is a corollary of energy conservation, this is gravity's major energy conservation role, seen from elementary particles to galaxies and cosmological spacetime.

B) The non-local distributional symmetry of light's energy - as required by "Noether's Theorem". This gravity accomplishes by the conversion of bound electromagnetic energy (mass) to free electromagnetic

energy (light), in stars, supernovas, quasars, etc., and ultimately and completely, by Hawking's "quantum radiance" of black holes.

The two conservation roles of gravity are a consequence of the double regulating role of "velocity c ", the electromagnetic constant, which gauges both the entropy drive of free energy (light's intrinsic motion), and the "non-local" distributional symmetry of light's energy. The "intrinsic" (entropic) motion of light creates, expands, and cools the spatial cosmos; "velocity c " also vanishes the time dimension and a single spatial dimension (in the direction of propagation): clocks stop and meter sticks shrink to nothing at the speed of light. Light therefore acquires an "infinite" velocity in its own reference frame, having forever to go nowhere. Light is a 2-dimensional transverse wave whose intrinsic motion "sweeps out" a third spatial dimension. When gravity conserves either gauge function of "velocity" c (in accordance with Noether's Theorem and the requirements of energy and/or symmetry conservation), it conserves the other by default.

2) Like the other four forces of physics, gravity is the consequence of a charge which arises as a symmetry debt of light. "Noether's Theorem" requires that the symmetry of light, no less than the energy of light, be conserved. *The charges of matter are the symmetry debts of light.* Identifying the (broken) symmetries of light from which the charges and their associated forces arise, provides a simple conceptual basis for a Unified Field Theory: all forces trace to a common origin as symmetry debts of light - just as all matter traces the origin of its energy back to light. Matter is an asymmetric, bound form of light whose symmetries are conserved as charge and spin, whose energy is conserved as mass and momentum, and whose entropy drive or intrinsic motion is conserved as time and gravity. All matter's inherent charges and forces work spontaneously and incessantly to return matter to its primordial symmetric form - as our Sun bears daily witness.

In the case of gravity, the charge (carried by all forms of bound energy in amount Gm) is the "location" charge, whose active principle is time. "Location" charge identifies the 4-dimensional spacetime location of bound energy, which as we have seen above, breaks the non-local distributional symmetry of light's free energy as gauged by "velocity c " (because mass has no intrinsic spatial motion), and results in the eventual return of bound to free energy, as we should expect (in stars, for example). (See: ["The Double Conservation Role of Gravity"](#).)

3) *Gravity is the spatial consequence of the intrinsic motion of time.* Time is the active principle of the gravitational "location" charge. Time has "intrinsic" (entropic) motion which causes the expansion and aging of history, the temporal analog of space. The dimensions of space and history are conservation domains created by the entropic drives of light and matter, the "intrinsic" motions of free and bound electromagnetic energy. Gravity connects and conjoins these two entropic conservation domains, actually converting either into the other, creating the compound conservation domain of spacetime, wherein both free and bound forms of electromagnetic energy can find their conservation needs satisfied. (See: ["The Conversion of Space to Time"](#).)

4) Gravity pays the entropy-interest on the symmetry debts of matter by creating the time dimension for bound energy, through which charge conservation can have an extended significance - as a means whereby a symmetry debt can be contracted and held as a "promissory note" (a "conserved charge"), which may be redeemed at some future time, as guaranteed by the invariant principle of charge conservation (and the existence of a temporal or historical dimension as created by gravity). Our universe functions in a historical or "karmic" (causal) mode through charge conservation in which symmetry debts, held as temporal charges, allow matter to "buy now and pay later", while gravity pays the entropy-interest through the creation of time. Gravity funds the expansion of the historical cosmos by subtracting energy from the expansion of the spatial cosmos - via the direct conversion of space to time. As matter's symmetry debt is paid off (by the conversion of bound to free energy in stars, for example), the cosmic gravitational field is reduced and the suppressed expansion of the spatial universe begins to resume, resulting in the recently perceived

"acceleration" of the cosmic expansion. (See: ["Dark Energy: Does Light Produce a Gravitational Field?"](#).)

Massless light is "non-local", atemporal, and acausal, with intrinsic (entropic) motion "c", and produces no gravitational field. Massive matter is local, temporal, and causal with intrinsic (entropic) motion "T", and produces a gravitational field.

5) The conversion of space to time is accomplished by the gravitational annihilation of space, which reveals a hidden, latent, or implicit component of time, the metric equivalent of the annihilated space. Einstein has taught us that space is not "just" space but spacetime: destroy space and you have a metrically equivalent temporal component remaining. This temporal component is in fact the hidden entropic principle that also causes the spatial expansion of the cosmos (the "Hubble expansion" of cosmology). Freed of its spatial envelope, in which it was implicit, time becomes explicit and creates, expands, and ages history by its own "naked" intrinsic and entropic motion.

6) The entropic, expansive motion of space and history is necessary for reasons of energy, symmetry, and causality conservation. The dimensions of spacetime are conservation domains created by entropy which must have intrinsic (entropic) drives of light, time, and gravity in order to conserve energy, symmetry and causality via the "infinite" and/or one-way velocity of light, time, and gravitation. (See: ["Entropy, Gravity, and Thermodynamics"](#).)

7) The incredible weakness of gravity has been a perennial puzzle. However, from the viewpoint of gravity as a conservation force that converts the spatial entropy drive of free energy (light's intrinsic motion) to the historical entropy drive of bound energy (time's intrinsic motion), we can finally begin to see a plausible explanation for gravity's weakness.

The first thing to note is that the weakness of gravity means that (in the context of the theory espoused here) on a per mass unit basis, gravity needs to annihilate only a small amount of space to extract a sufficient amount of time to serve as the entropy drive for matter. Matter doesn't seem to require much time to energize its historical entropy drive. Why should this be? Thinking along these lines, a rather obvious explanation comes readily to mind: massive objects such as ourselves (which are the only energy forms or states which require a historical causal dimension and its associated temporal entropy drive) are only tangentially connected to their historical entropy/conservation domain. We live only in the "now", not in the historical and causal past. Contrast this with the energy state of free energy or light, which is coextensive with its entropy domain (space). (Due to its effectively "infinite" velocity, light, in its own reference frame, is everywhere simultaneously within its spatial conservation domain.) The "now" is a tangent point on the surface of historical spacetime. P. A. M. Dirac pointed out that the ratio between the strength of gravity and the strength of the electromagnetic force was very similar to the ratio between the size of an electron and the size of the Cosmos - which quantitatively is essentially the same comparison that I am making between the tangential "now" and historic spacetime. Our conclusion is that gravity produces only enough temporal entropy to service matter's point-like connection to its historical entropy domain. (See: ["Proton Decay and the 'Heat Death' of the Cosmos"](#).)

8) Black Holes are the most extreme expression of gravitational force - the "limiting case" - and they have much to teach us. A black hole is a region of spacetime in which the gravitational field is so powerful that its local field strength "g" is equal to the velocity of light "c". Consequently, no light can escape from a black hole - or at least not much. Stephen Hawking has calculated that a quantum mechanical effect due to the extreme shear forces at or near the "event horizon" or "surface" of a black hole actually converts the gravitational energy of the hole into a form of radiation which will eventually, over immense stretches of time, cause the total conversion of the mass or bound energy of the black hole into radiation, completely fulfilling Noether's Theorem with respect to the gravitationally held entropy and symmetry debt.

Jacob Bekenstein and Stephen Hawking have also produced a theorem which relates the surface area of the event horizon of a black hole to its entropy. In the theory advanced here (see the ["Tetrahedron Model"](#)), this surface of the black hole must be a time surface and so the entropy in question must be temporal (historical) entropy. The logic is that once the limiting case of increasing field strength is reached ($g = c$), the only way to accommodate the temporal entropy requirements of any further mass inputs to the hole is to increase the effective surface area through which space can be sucked in and converted to time, so the Bekenstein-Hawking theorem makes perfect sense with regard to the notion that gravity converts space to time - just as Hawking radiation is a sensible resolution to the question of the final and complete payment of the gravitational symmetry debt. (See: *Scientific American* August 2003, page 58)

According to Einstein, in a gravitational field, meter sticks shrink and clocks run slow, and at the black hole's event horizon meter sticks shrink to nothing and clocks stop. The local gravitational metric as gauged by "g", which is superimposed upon the global electromagnetic metric as gauged by "c", completely overwhelms the latter. A gravitational metric of time and matter replaces the electromagnetic metric of space and light. Just as gravity overwhelms and replaces the atomic and nuclear binding forces in the white dwarf and the neutron star, so in the black hole gravity also overwhelms and replaces the regulatory function of the electromagnetic spacetime metric. Time stands still at the event horizon because it is being replaced as fast as it moves away into history; meter sticks vanish because space is completely replaced by time. The event horizon represents the end point of temporal entropy, the triumph of time and gravity over space and light, and yet Hawking radiation tells us that this triumph of darkness and matter is incomplete, ephemeral, and cannot last. We should have known, even without Hawking's brilliant deduction: Noether's Theorem requires the conservation of symmetry, and the all-way spatial entropy drive of light's intrinsic motion has more symmetry than the one-way historical entropy drive of time's intrinsic motion.

At the event horizon, gravity and temporal entropy return immobile matter to an intrinsic spatial motion equal to velocity c - revealing their hidden agenda of symmetry conservation, which is nevertheless fulfilled only through Hawking's "quantum radiance". While outside the black hole symmetry conservation is proceeding via Hawking radiation, it is likely that inside the black hole symmetry conservation is proceeding via proton decay. The extreme gravitational pressures at the central singularity squeeze the quarks of baryons back to their primordial leptonic configuration (the "leptoquark"), vanishing the color charge in the limit of "asymptotic freedom", and proton decay proceeds via the weak force "X" IVB with the emission of a leptoquark neutrino. (See: ["The Origin of Matter and Information"](#).) The inside of a black hole is therefore full of nothing but light, solving the problem of the infinite compression of matter at the central singularity. A black hole is apparently a gravitationally bound state of light, somewhat similar to a gigantic baryon, the next stage of simplification beyond the neutron star, which is a gravitationally bound atomic nucleus.

9) Finally, although I have no talent in mathematics (as my family is fond of reminding me), I have nevertheless attempted to formulate a "concept equation" representing the gravitational conversion of space to time. Obviously I accept Einstein's gravitational field equations as essentially correct (without the "cosmological constant"), except for the caveat expressed in: ["Dark Energy: Does Light Produce a Gravitational Field?"](#).

In my "concept equation" (S) represents the spatial volume annihilated or collapsed by gravity "-G" in order to produce the historical entropy drive (T) or time dimension of matter for any given mass "m".

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

It is to be understood that the temporal component is the metric equivalent of the annihilated space (as gauged by the electromagnetic constant "c"), and is "hidden" in ordinary space as "spacetime", elucidated by Einstein. Since every massive elementary particle, atom, or other form of bound energy produces its own

gravitational field $-Gm$, every mass produces its own time dimension $(T)m$, as gauged by the universal gravitational constant "G". The gravitational constant is negative because it requires energy to annihilate space and to convert a symmetric spatial entropy drive (the intrinsic motion of light) to an asymmetric historical entropy drive (the intrinsic motion of time). Furthermore, it is this same temporal component (at work in the electromagnetic wave through "frequency") that is also ultimately responsible for the spatial entropy drive of light's intrinsic motion. The symmetric, spatial component of light's entropy drive ("wavelength") must "flee" the embedded asymmetric temporal component ("frequency") to maintain light's non-local symmetric energy state and suppress the asymmetric time dimension, which, like the proverbial "bur under the saddle", is an intrinsic feature of light's own nature.

Energy plus symmetry conservation, spurred by the implicit presence of time, is the cause of light's intrinsic motion. Implicit in "frequency", time is the universal entropy element embedded in every form of energy: frequency multiplied by wavelength = c ; $E = hv$; $hv = mcc$. Time is the entropic motivator of cosmic expansion, whether implicit in the intrinsic motion of light and the expansion of space, or explicit in the intrinsic motion of gravity and the expansion of history. (See: ["A Description of Gravitation"](#).)

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