

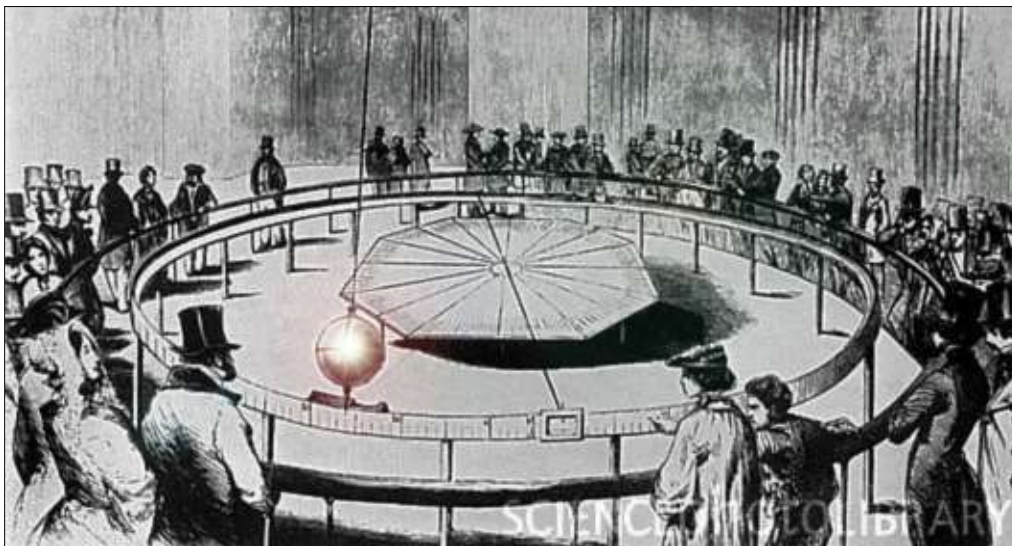
The Pit in the Pendulum

Tom Ransom 2010...

Abstract *

"Books on physics are full of complicated mathematical formulae. But thought and ideas, not formulae, are the beginning of every physical theory." Einstein/Infeld⁽¹⁾

While mathematics, selectively applied, may be remarkably well suited to modeling physical theory, at large it remains an abstract domain with an infinite host of objects, operators, and solutions, and thus, lends itself to endless possibility; applicable formulations will likely be found forever. But science, ever assiduous, seeks those solutions bringing us closer to the "final" theories, and when theoretical correspondence with physical reality is lost, any intended convergence has digressed. I submit why research directed toward a quantum-gravity "unified field theory" is just such a digression and propose a way forward.



Imagine the swing of a giant pendulum, that grand, sweeping, silent arc through space, determined, continuous. With each accelerated pass is visibly marked a vanishing moment of time. Is it any wonder such a phenomenal thing was instrumental in the development of our scientific theories regarding mass, motion, and gravitation—for if left to its own devices, the swinging pendulum is one day found profoundly motionless, stationed directly over the Earth's "center of gravity".

Though more than six thousand kilometers deep within, giant pendulums are not necessary to locate the Earth's gravitational center—its "centroid". With perfect precision any dumb plumb bob will forever point the way. So for millennia we've known for certain where the local source of gravity resides, and for centuries have calculated what it does, but as for identifying the nature of what it really *is*, most of the most informed, even to this day, confess uncertainty.

Consider the cord of our stationary pendulum, a "geometric vector" drawn taut to the center of the Earth, not only invisible, but endlessly extensible, its magnitude diminishing with extension but *never* vanishing entirely.⁽²⁾ Next consider the nature of the "geometric origin"—the 'pit', the center of mass tensing the cord, for if the pendulum bob is a hollow sphere, this 'mass' is resident in *empty* space. Now imagine following our invisible vector all the way down to the Earth's centroid only to find this mass is absent as well—the plumb bob now points toward the Sun! Centers of gravity are apparently nothing more than vanishing proxy in a magnitude continuum of mass attraction: pendulums to planets to stars to galaxies to... what exactly? How, and why?

Much of science has been directed to answering these questions, and those familiar with this quest know that along with mass, the subjects of space and time have been in the mix the entire way. Isaac Newton was critical of how his contemporaries positioned celestial bodies relative to one another independent of any comprehensive context; ethereal "vortices" caused them to gravitate toward one another. He proposed instead an "immovable space" and an "absolute time"⁽³⁾ *within* which massive objects attracted one another via a constant causal "force". Gravitation was most likely a "property" of matter, an invisible, instantaneous,^(4a) "action at a distance" across empty space—of a 'nature unknown'.^(5a)

A better explanation appeared with James Maxwell's theory of light. His electromagnetic "field" was a dynamic potential similar to gravity—causal yet invisible, and Albert Einstein found that a field-model for gravitation would explain observations unexplained by Newton's theory. It also appeared instantaneous: In Maxwell's equations light radiated at an invariant absolute velocity(c), and Einstein had discovered this would be the case for all observers only if variance was reintroduced into the equations of motion by making the coordinates of space and time subject to velocity. But then, at the speed of light, the spatial values turned "imaginary"^(6a) and the equations faltered. When these transformation equations "go singular at c " a null interval subsumes the metric indicating locality has vanished and a state of global *simultaneity* prevails.^(7a,8a,9) Therefore, because Einstein's proposed gravity waves propagated at lightspeed, the gravitational field, as was Newton's force, apparently instantaneous.

Though both theories were derived geometrically, whereas Newton's force was a product of classical Euclidian geometry, Einstein's field was a contemporary geodesic stretch: the *four* dimensional, tensor curvature, of an energy conformal, "spacetime" continuum. Gravitation wasn't a property of matter, it was contextual, a dynamic 'force' *within* surrounding space itself. Having no evidence that the entirety of the Universe was other than static—neither expanding nor contracting,

Einstein balanced the universally convergent gravitational constant, with a divergent "cosmological"^(6b) constant—of a 'nature unknown'. Physicists, to this day, continue his pursuit of a quantum-gravity, unified field theory, mediated by a proposed massless "graviton", intensively searched for but so far unfounded.

As astronomy extended and improved, cosmologists determined that the observable Universe was evidently expanding—ever faster, due to a vacuous, cosmic-scale, "dark energy" unseen, in effect a cosmological constant, but still of an unknown nature. Around stellar clusters observations began to implicate invisible halos of gravitating "dark matter", and then, photometric data began pointing to vanishing "black holes" at the centroid of spiral galaxies—all natures unknown! Why does everything gravitational always appear to be a dark, invisible, anomalous unknown, in the act of vanishing?

"No machinery has ever been invented that 'explains' gravity without also predicting some other phenomenon that does *not* exist."

Richard Feynman⁽¹⁰⁾

I submit that the machineries of quantum-gravity, with their host of non-existent phenomena, have failed to ever secure *any* explanation, and it's time to move on.

"As the universe expands... the positive matter energy is exactly balanced by the negative gravitational energy, so the total energy is zero."

Stephen Hawking^(11a)

If the subject energies of the quantum and gravity field-theories, are indeed, diametrically opposed, then it's no wonder unification efforts have failed. Quanta and gravitation have absolutely nothing in common: Quantum 'particles' present locally, are discontinuous, and transitory; gravity is global,⁽¹²⁾ continuous,^(4b) and constant.⁽¹³⁾ Matter is the 'nature unknown' in gravity theories: Newton's centers of mass reduce to "mathematical points";^(5b) Einstein's gravitating masses are representative "field singularities".^(14a) The quantum field exists in an uncertain state of probability potential, whereas gravity, in field terms, has a certain geometric structure, is conformal but entirely deterministic, and unlike quanta, infinitely contiguous—between adjacent "world-points" another always exists.

The systemic problems inherent in the incommensurability of these two theories sent unification programs into evermore abstract digressions. A way forward is required, an explanation of gravity separate from, but compatible with, quantum theory, able to not only reciprocate an expanding Universe, but also reconcile its related 'nature unknowns'. Fortunately, an apposite field-analogue is already prescient in theoretical physics: a scalar *vacuum* potential.^(11c,15,16a) Perhaps everything gravitational appears to be a dark, invisible, vanishing unknown, because there really is *nothing* there. The radiant expansion of the "Big Bang", and an *empty* reciprocal counterpart, may be a dynamic duality on the grandest of scales.

So here's the proposal: The radiant Universe is expanding *within* a contra-conformal "vacuum energy"⁽¹⁷⁾ *vacancy*, moreover, this dynamic vacancy provides the entropic differential driving its evolution. This vacuum energy potential, however, isn't another anomalous unknown. This one we're all familiar with.

When Einstein's spacetime equations go singular at c , and the 3-D spatial coordinates vanish, the 4-D "complex" coordinate of *time* remains continuous.⁽¹⁸⁾ This means in the *final* analysis, space was just a conceptual construct, and time the actual ontologic dimension.^{a)} "Imaginary time",^(11b) as such, is a universal identity with axiomatic import—a ready candidate for gravity's 'nature unknown'. By substituting a vacuum energy potential for imaginary time, its standard action operator, a scalar-field stress-energy tensor,^{b)} is singularly global, and therefore, as with Newton's force and Einstein's field, instantaneous.^{c)}

In this proposal the "present" is a cosmic-scale, radiant energy expansion, within a dynamic 4th dimension of temporal vacuum potential.^{d)}^(16b) Advancing this expansion is the cosmological constant 'dark energy' of the temporal "future". The action of the temporal "past", by which the present is vacuum tensioned, is that of the gravitational constant. These seemingly opposed vacancies of past and future, however, are really one and the *same* temporal continuum. Their actions appear proportionally opposed because the cosmological future presents *globally* while the gravitational past is present everywhere *locally*.



The present, omni-expanding at lightspeed, simultaneously, everywhere *now*, in time.^(7b) Hence, from the overall 4-D 'view' of time, the Universe is forever always emergent upon *one* centroid—its singular Origin. From our 3-D view on the hypersurface of the expanding present, however, this centroid is now apportioned to *every* center of mass, so while the gravitational action of time-past is thus everywhere local, global time-future is everywhere else. Time future is the 'gravitating' offset required to reconcile most, if not all, of the missing cosmic 'dark matter'.^{e)} Time's theoretical "reversibility" is a defining feature of the proposed "block" temporal continuum. The scalar nature of its vacuum potential means any perceived "flow" must reference the motion of the expanding present.

In the Einstein field-model, because the omni-expanding Universe has shaped conformal spacetime continuously ever since its Origin, a common 'evolute' is conserved at the locus of every gravitational geodesic. In terms of vacuum potential this Origin is the vanishing 'black hole' at the centroid of every center of mass. Either way, by spacetime or temporal vacuum, in both these continua of the 4th dimension, the 'pit' of every centroid is a proximity proxy for every other because they're all one and the *same* 'point'.^(8b) No wonder the theoretical action attribute of gravitation has always been instantaneous.

Finally, this proposal informs considerations regarding the "arrow of time", cosmogenesis and destiny, for if the radiant energy density and the temporal vacuum density are entropic reciprocals and conversely conformal,⁽¹⁹⁾ then a radiant 'inflation' corresponds to a relative 'deflation' of temporal potential. Therefore, as they encounter ever *less* time, cosmic spectra exhibit dilating frequencies and red-shifting wavelengths related to *time* distant.⁽²⁰⁾ This means rather than the spatial universe expanding ever faster, its complementary inverse is in evidence: The expanding Universe is slowly running out of time.^{f)}

"... it is necessary, in the interest of science, to call the fundamental concepts again and again into question so that we are not governed by them without realizing it." Albert Einstein⁽²¹⁾

"Everything is atoms and the void." Democritus [400 BC]

- a) "... the concept of space detached of any physical content does not exist." A. Einstein^(14b)
The standard measure of the spatial dimensions is now officially defined as the *time* it takes for light to travel a one "meter" length. The space between objects is time.
- b) A stress-energy tensor likewise determines the curvature of Einstein's field. Whereas this "metric" tensor is confined to four dimensions in spacetime, the temporal vacuum tensor hosts an unlimited number of "degrees of freedom" in "Hilbert" space, potentially compatible with the superpositional infinities of the quantum field.
- c) A pendulum clock actually *is* marking the measure of time!
- d) The present energy expansion and the temporal dimension are mutually exclusive: At present—at *c*—there is *no* time, and the temporal vacuum is everything the expanding present *isn't*. The manifold inertial energy—in a universal "Machian" sense, and the temporal vacuum potential are symmetrically reciprocal, equal and opposite. This is the basis of Newton's first and third laws, Einstein's equivalence principle, and the centripetal and centrifugal "pseudo" forces.
"Cosmology somehow enters the local laws of physics, as in the law of inertia, or a common agent affects both cosmology and local physics so as to leave the same mark on both of them." M. Milgrom: *Sci.American* (Aug.2002) 52
- e) The time future / dark matter offset amounts to the 'inverse integral' of the gravitational force.
- f) Big inflection anyone? When the total energy entropy is at its maximum, just prior to zero frequency / infinite wavelength, and the entropy of the vacuum potential is at its minimum, the centroid conformally conserved in time-past returns a cyclic Universe to its singular Origin—and subsequent Big Bang.

"The [vacuum state] allows for the conservation of energy and is the driving force behind the exponential expansion." A. Guth⁽¹⁵⁾

* Versions of this essay were submitted to the Gravity Research Foundation 2010 and 2018 essay competitions.

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"Gravity... is never partial, but always whole. Radiation is always packaged. Gravity is the inside-outness of energy-as-matter... the sum of all the no-points embracing all the points."
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- 15) Guth, Alan *Inflationary Universe* *The Physical Review D* 23, 347 (1981)
- 16) Prigogine, Ilya *The End of Certainty* (Free Press: 1997) a:178 b:6
b: "The big bang was an event... *within* the medium that produced our universe. It marked the start of our universe but not the start of time. Although our universe has an age... this medium has none. Time has no beginning and probably no end."
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"In real time, the universe has a beginning and an end at singularities that form a boundary to space-time and at which the laws of science break down. But in imaginary time, there are no singularities or boundaries. So maybe what we call imaginary time is really more basic."
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