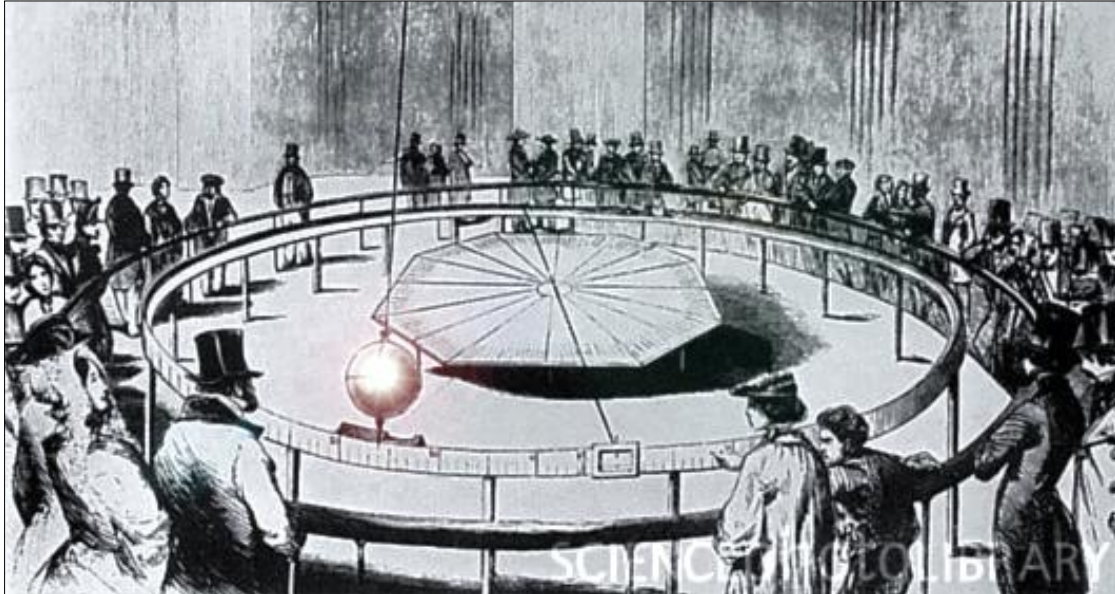


The Pit in the Pendulum

Tom Ransom

"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 may be remarkably well suited to modeling physical theory, at large it remains an abstract domain of infinite possibility; applicable formulations will likely always be found. 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 that further research directed toward a unification of the quantum and gravity field theories 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 regarding 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 "vector" extending invisibly inward to its source—the Earth's centroid, extensible in length, its magnitude diminishing over distance but never vanishing entirely.⁽²⁾ Next consider the center of mass tensing the cord—the 'pit', for if the 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 center 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? 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 contextual reference; aethereal "vortices" were causing their orbital attractions. 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) The skeptics were notable.

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 force. But it too was apparently 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 in the equations of motion the coordinates of space and time were velocity variant. But then, at the speed of light, the spatial coordinates 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 global state of *simultaneity* prevails.^(7a,8a,9) Therefore, because Einstein's proposed gravity waves propagated at lightspeed, the gravitational field, as was Newton's force, theoretically instantaneous. Again there were notable skeptics. It took a while for time-honored Newtonian mechanics to give way to Einstein's "relativistic" field.

Though both theories were derived geometrically, whereas Newton's force was a product of classical geometry, Einstein's field was a contemporary geodesic stretch: The tensor curvature, of a matter conformal, "spacetime" continuum, over *four* dimensions. Gravitation wasn't a property of matter, it was contextual, a dynamic 'force' *within* spacetime 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 have faithfully continued his ultimate pursuit of a unified quantum-gravity 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 apparently expanding—ever faster, induced by a vacuous, cosmic-scale, "dark energy" unseen, in effect Einstein's cosmological constant, but still of an unknown nature. Around stellar clusters observations began to implicate an invisible prevalence of gravitating "dark matter", and then, photometric data began pointing to vanishing "black holes" at the centroid of spiral galaxies—all nature unknowns! 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⁾

No wonder most of the most informed confess uncertainty. Of all the numerous field unification machineries of "quantum-gravity", with their host of non-existent phenomena, none has ever succeeded in securing any unified explanation. Why?

"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)

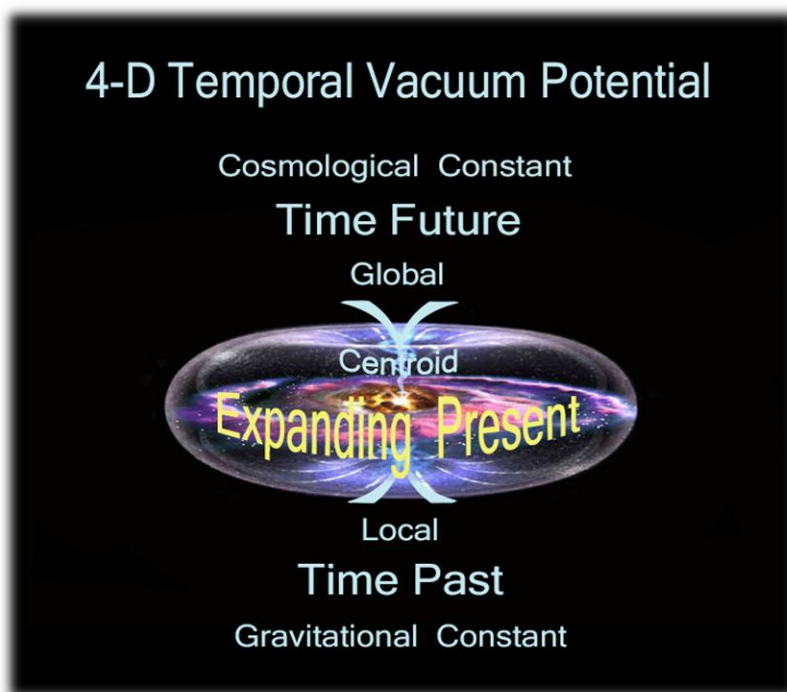
Unification efforts didn't succeed because the subject energies of the quantum and gravity field-theories have absolutely nothing in common. Quantum 'particles' present locally, are discontinuous, and transitory; gravity is global,⁽¹²⁾ continuous,^(4b) and constant.⁽¹³⁾ Matter is the 'nature unknown' 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 "world-points" another always exists.

The systemic problems inherent in the incommensurability of these two theories sent unification programs into ever more abstract digressions. A way forward is required, an explanation of gravity compatible with contemporary quantum theory, able to not only reciprocate an expanding Universe, but also reconcile its related 'nature unknowns'. Fortunately, an apposite field alternative is prescient in theoretical physics—a scalar "vacuum potential".^(11c,15,16a)

So here's the proposal: Perhaps everything gravitational appears to be a dark, invisible, vanishing unknown, because there really is *nothing* there. The positive matter energy is exactly balanced by a negative "vacuum energy"⁽¹⁷⁾ vacancy. Moreover, these matter and vacuum energies are entropic counterparts, a universal duality on the grandest of scales. Most notably, this vacuum potential isn't an 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 "imaginary" coordinate of *time* remains continuous.⁽¹⁸⁾ This means in the *final* analysis, space was just a conceptual construct, and time the fundamental dimension.^{a)} As such, "imaginary time"^(11b) is a universal identity with axiomatic import—a ready candidate for gravity's 'nature unknown'. By attributing to imaginary time a dynamic vacuum potential, its theoretical action operator, a scalar-field vacuum tensor,^{b)} would be singularly universal, and therefore, as with Newton's force and Einstein's field, instantaneous.

In this proposal the "present" is a cosmic-scale, radiant energy expansion, *within* a dynamic 4th dimension of "temporal vacuum potential". 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 only 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*,^(7b) *in* time. Hence, from the universal 4-D 'view' of time, the *entire* Universe always has just *one* centroid—its singular Origin.^(16b) From our 3-D view on the hypersurface of the expanding present, however, this centroid has been apportioned to each and *every* local center of mass. So the action of gravity-past converges everywhere locally, while the action of time-future appears to globally diverge.

The global resultant of the future vacuum tensor thus defines the non-local "moment" of inertia.^{c)} It also defines the 'gravitating' offset required to reconcile the missing cosmic 'dark matter'. Although the inertial future and gravitational past are conversely conformal—global / local, there's only *one* temporal tensor,

so their resultants are equivalent: The causal basis of Newton's first and third laws, Einstein's "equivalence principle", and the centripetal and centrifugal "pseudo" force. Time's theoretical "reversible" nature 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. Velocity "time dilation" is prerequisite to event simultaneity at the speed of light.

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 evolute 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' of Origin.^(8b) No wonder the theoretical action attribute of gravitation has always been instantaneous.

Finally, this proposal informs questions regarding the "arrow of time", cosmogenesis, and destiny, for if the matter energy density and the temporal vacuum density are a universal, entropic duality^{d)}—separate, equal, and opposite,⁽¹⁹⁾ then a radiant 'inflation' corresponds to a relative 'deflation' of temporal potential. Therefore, as they encounter ever *less* time, over time, cosmic spectra exhibit dilating frequencies and redshifting wavelengths.⁽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.^{e)}

"... 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) Whereas Einstein's "metric" tensor is confined to four dimensions in spacetime, the null-metric vacuum tensor hosts an unlimited number of "degrees of freedom" in "Hilbert" space, compatible with the infinities of quantum field superposition.
- c) "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
- d) The present matter energy and the temporal vacuum energy are mutually exclusive. At present—at *c*—there is *no* time, and the temporal vacuum is all the expanding present *isn't*. This "entropic" differential drives the evolution of the Universe.
- e) Big inflection? As the energy entropy approaches its maximum—zero frequency/infinite wavelength, and the vacuum entropy nears its minimum, the centroid conserved in time-past causes a cyclic Universe to return 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⁾

References

- 1) Einstein, A; Infeld, L *The Evolution of Physics* (Simon & Schuster: 1966) 277
- 2) Bergmann, Peter *The Riddle of Gravitation* (Dover Pub: 1992) 82-3
- 3) Newton, Isaac *The Principia* (Prometheus Books: 1995) 14-15
- 4) Hesse, Mary *Forces and Fields* (Philosophical Library: 1961) a:137 b:260
- 5) Newton, Isaac *Philosophical Writings* (Cambridge U.Press: 2004) a:137 b:xxi, 124
- 6) Einstein, Albert *Relativity* (Crown Publishing: 1961) a:41-2 b:152
- 7) Schrodinger, Erwin *Space-Time Structure* (Cambridge U.Press: 1950) a:80
My View of the World (Ox Bow Press: 1961/1983) b:22
b: "For eternally and always there is only *now*, one and the same now; the present is the only thing that has no end."
- 8) Rucker, Rudolf *Geometry, Relativity and the Fourth Dimension* (Dover: 1977) a:93 b:113-14
a: "For someone going at the speed of light, every event... happens at the same time—and in the same place!"
- 9) Redhead, Michael *From Physics to Metaphysics* (Cambridge U.Press: 1996) 74
- 10) Feynman, Richard *Six Easy Pieces* (Addison-Wesley: 1995) 109
- 11) Hawking, Stephen *The Universe in a Nutshell* (Bantam: 2001) a:91 b:59-63 c:96
b: "A mathematical model involving imaginary time predicts not only effects we have already observed but also effects we have not been able to measure."
- 12) Dirac, P.A.M. *General Theory of Relativity* (Princeton U. Press: 1996) 62
"Gravitational energy cannot be localized." Gravity 'waves' everywhere at once.
- 13) Fuller, Buckminster *Synergetics* (Macmillan: 1975) 306
"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."
- 14) Einstein, Albert *Ideas and Opinions* (Crown Publishers: 1954) a:351-2 b:348
- 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."
- 17) Moffat, John *Reinventing Gravity* (HarperCollins: 2008) 201,209
- 18) Hawking, Stephen *A Brief History of Time* (Bantam: 1998) 144
"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."
- 19) <https://briankoberlein.com/2016/09/13/the-constant-of-time/>
"The vacuum energy density (as determined by the Hubble constant) and the matter energy density are about equal, known as the coincidence 'problem'."
- 20) Powell, Corey *God in the Equation* (Free Press: 2002) The "de Sitter universe": 84
- 21) From *Philosophy, Mathematics and Modern Physics* (Springer-Verlag: 1994) 111

Versions of this work were submitted to the [Gravity Research Foundation](#) 2010 and 2018 essay competitions.

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