

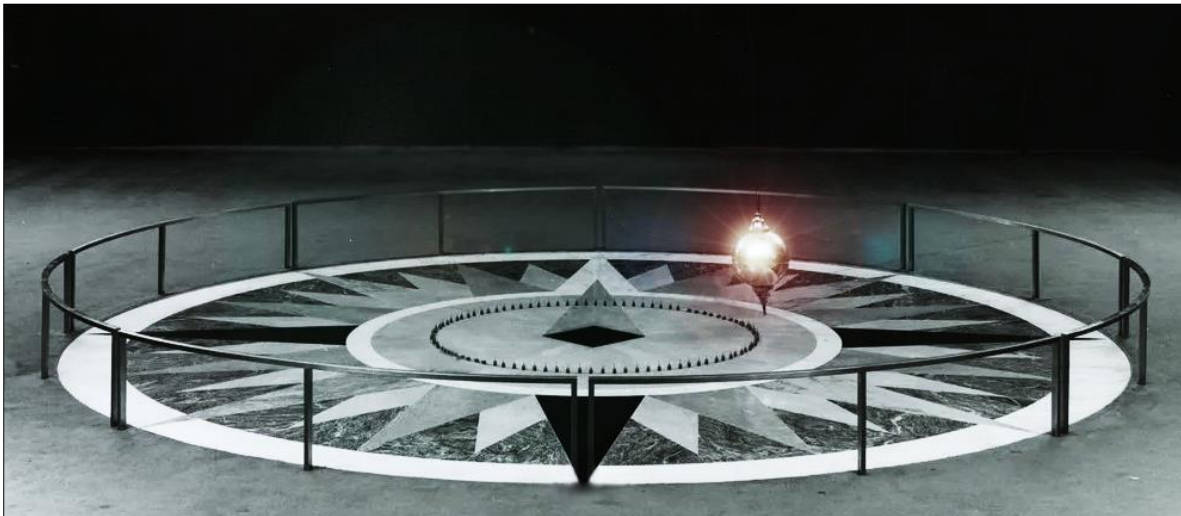
# The Pit in the Pendulum

## On the Nature of Gravity Space and Time

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

While mathematics may be remarkably well suited to modeling physical theory, it represents 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 research directed to unifying the standard-model quantum and gravity field theories, a "quantum gravity" theory, is just such a digression, and propose a way forward.



Imagine the swing of a grand pendulum, that 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 motion, mass, 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, grand 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 visible "vector" extending invisibly inward to the center of Earth's mass, extensible outward in length, its magnitude diminishing with distance but *never* vanishing entirely.<sup>(2)</sup> Next consider the center of the bob's mass—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 Earth's centroid only to find this mass is absent as well—the plumb bob now points toward the Sun! Centers of gravity appear to be 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"<sup>(3)</sup> *within* which massive objects attracted one another via a constant causal "force". Gravitation was apparently a "property" of matter, an invisible, instantaneous,<sup>(4a)</sup> action-at-a-distance across empty space—of a 'nature unknown'.<sup>(5a)</sup> His skeptics were notable.

A better explanation appeared with James Maxwell's theory of light. His electromagnetic "field" was also a dynamic action-at-a-distance and Albert Einstein found that a field-model for gravitation would explain observations unexplained by Newton's force. It also appeared to be instantaneous: In Maxwell's equations light radiated at a constant 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 equations broke down.<sup>(6a)</sup> When these equations "go singular at *c*" a null interval subsumes the metric indicating locality has vanished and a global state of *simultaneity* prevails.<sup>(7a,8a,9)</sup> 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 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 "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"<sup>(6b)</sup> constant—of a 'nature

unknown'. Generations of physicists have continued his ultimate 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 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 rotating galaxies 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 these galaxies—all nature unknowns! Why is it that everything gravitational always appears 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<sup>(10)</sup>

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<sup>(11a)</sup>

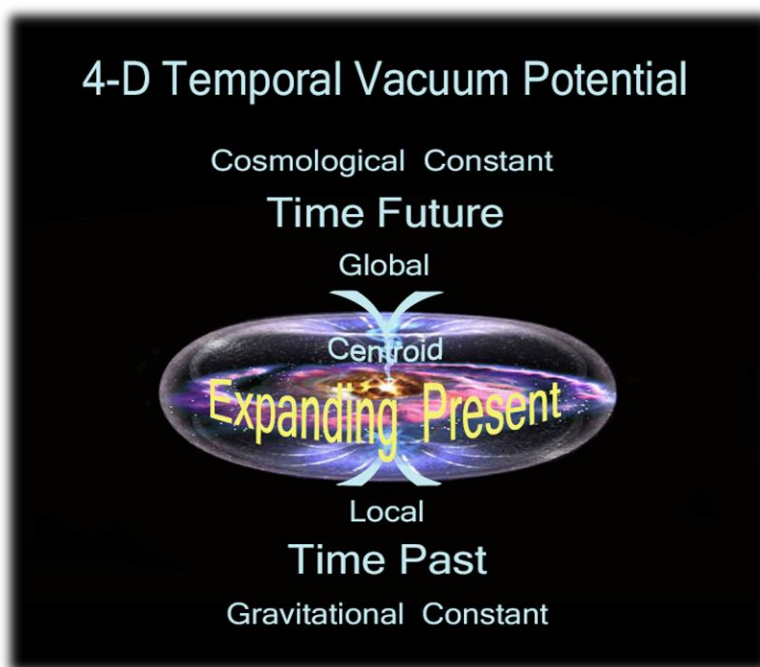
Unification efforts haven't succeeded because the subject energies of the standard quantum and gravity field-theories have absolutely nothing in common. Quantum 'particles' present locally, are discontinuous, and transitory; gravity is global,<sup>(12)</sup> continuous,<sup>(4b)</sup> and constant.<sup>(13)</sup> Matter is the 'nature unknown' in gravity theories: Newton's centers of mass reduce to "mathematical points";<sup>(5b)</sup> Einstein's gravitating masses are representative "field singularities".<sup>(14a)</sup> The quantum field exists in an uncertain state of probability potential, whereas gravity, in field terms, has a certain geometric structure, is elastic but entirely deterministic, and unlike quanta, infinitely contiguous—between "world-points" another always exists.

The systemic problems inherent in the incommensurability of these two theoretical field-models sent unification programs into ever more 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, a spacetime field alternative is prescient in theoretical physics—a scalar "vacuum potential".<sup>(11c,15,16a)</sup>

So here's the proposal: Perhaps everything gravitational appears to be a dark, invisible, vanishing unknown, because there really is absolutely *nothing* there. The positive matter energy is exactly balanced by a negative "vacuum energy"<sup>(17)</sup> *vacancy*. These matter and vacuum energies, moreover, are symmetric counterparts, a universal duality on the grandest of scales. Most notably, this vacuum potential isn't another anomalous unknown. This one we're familiar with.

When the Einstein spacetime equations go singular at  $c$ , and the 3-D spatial coordinates contract to zero,<sup>a)</sup> the 4-D coordinate of *time* dilates to infinity. Stephen Hawking found that by transforming time into the "imaginary" plane it remained continuous.<sup>(18)</sup> Continuous "imaginary time",<sup>(11b)</sup> as such, becomes a universal identity with axiomatic import—a ready candidate for gravity's 'nature unknown'. By attributing to imaginary time a dynamic *negative* vacuum potential, its theoretical action operator, a scalar "vacuum" tensor, would be omni-universal, and therefore, as with Newton's force and Einstein's field, instantaneous.<sup>b)</sup>

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 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, a radiant universal instant, refreshing trillions of times a second, omni-expanding at light-speed, everywhere *now*,<sup>(7b)</sup> *in* time. Hence, from the global 'view' of time-future, the *entire* present has just *one* centroid—its singular Origin.<sup>(16b)</sup> From our local view on the hypersurface of the expanding present, however, this centroid has been apportioned to each and *every* local center of mass. Consequently, the action of gravity-past is rendered everywhere locally, while the action of time-future remains everywhere global.

The global resultant of the future vacuum tensor thus defines the non-local "moment" of inertia.<sup>c)</sup> Scaling out further it defines the inertial offset required to reconcile the missing cosmic 'dark matter'. Ultimately, the vacuum future *is* the cosmological 'dark energy'. Although the inertial future and gravitational past are

dynamically converse—global/local, there's only *one* temporal vacuum 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" forces. Time's potential "reversibility" is a defining feature of the proposed 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 an empirical 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.<sup>(8b)</sup> 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 total energy potential and the temporal vacuum potential are universal counterparts—symmetric, equal, and opposite,<sup>(19)</sup> then a radiant 'inflation' corresponds to a relative 'deflation' of temporal potential.<sup>d)</sup> Therefore, as they encounter ever *less* time, over time, cosmic spectra exhibit dilating frequencies and redshifting wavelengths.<sup>(20)</sup> 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.<sup>e)</sup>

"... 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<sup>(21)</sup>

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

- a) In the final analysis, at the speed of light, space reduces to a conceptual construct. 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 the Einstein "metric" tensor is confined to four dimensions in spacetime, the null-metric vacuum tensor would host an unlimited number of "degrees of freedom" in "Hilbert" space, potentially compatible with the quantum field.
- 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 positive energy potential and the negative vacuum potential 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<sup>(15)</sup>

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"Gravitational energy cannot be localized." No graviton.
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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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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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- 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."
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