# Quantum Geodesics, Conic Simultaneity, and Pure-Math Indeterminacy

Terry Bollinger
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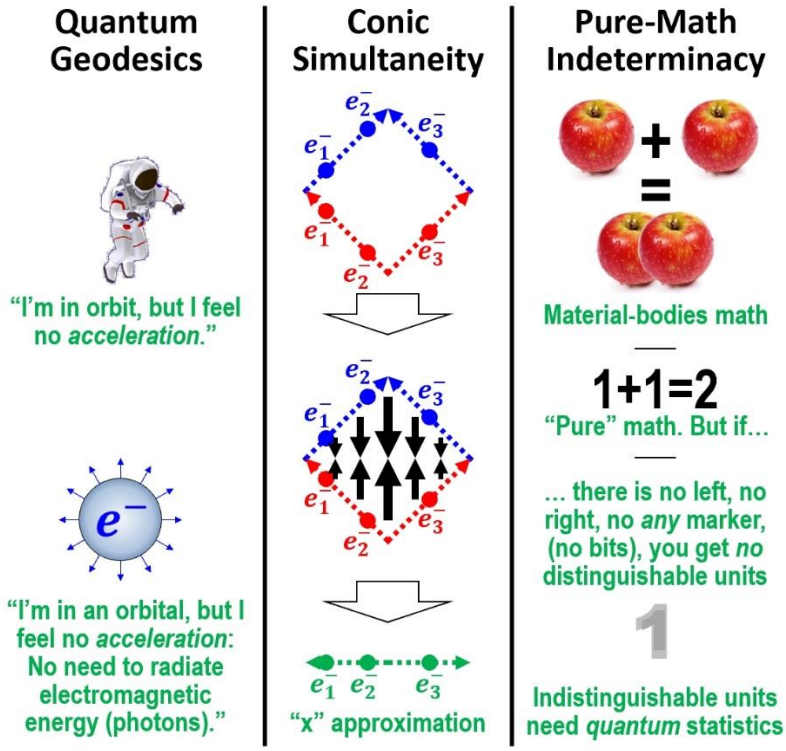


**Figure 1**. *Three Physics Crossover Ideas: Quantum Geodesics, Conic Simultaneity, and Pure-Math Indeterminacy*

Extraneous assumptions in physics, such as universal time and fixed lengths, are typically so "obvious" that questioning them never comes up and is quickly abandoned if it does. This Medium.com discussion looks at three options that arise if one stops assuming space and time are fundamental.

In an interesting *Starts With A Bang* article, Ethan Siegel said [1]: *Physicists just can't leave an incomplete theory alone; they try and repair it. When nature is kind, it can lead to the next major breakthrough.*

## Quantum Geodesics

*Comment by Terry Bollinger* [2]: Unexpected crossovers sometimes help, e.g., gravity equals acceleration. Another potential acceleration connection is this: In both quantum orbitals and gravitational orbits — geodesics — moving bodies feel no acceleration.

*sycamore* [3]: I didn't get it. How do quantum orbitals feel no acceleration?

*Terry* [4]: They are charged yet do not radiate electromagnetic radiation. Physicists usually accept this as an axiom of quantum orbital mechanics. What I am suggesting is that we need to look closer at this axiom.

*sycamore* [5]: But orbitals are not particles; there is no (classical) movement along closed orbits/trajectories.

*Terry* [6]: To understand how the non-acceleration of an electron in an orbital is like the non-acceleration of an astronaut in an orbit, you have to rethink what spacetime is. It is… messier and vastly more local?… than the cleanly simple, orthogonal-by-definition matrix equations of physics math suggest.

The problem is that the existence of such equations depends far more on the properties of spacetime than you might suspect. This tautological loop-around creates an illusion of simplicity for an incredibly complex mechanism that pulls in every aspect of the physics we know, including the particles of the Standard Model.

*Terry* [7]: I cannot emphasize this enough: The century-long global failure to unite GR and quantum theory stems mostly from using old math that accepts various axioms and definitions (e.g., points) from millennia ago as no-cost givens.

In physics, these concepts are anything but given. They arise from some of the most complicated and remarkable machinery in the physical universe. Points, continuity, orthogonality, and even counting are examples of the complex, powerful, and often highly context-dependent "loaners" math gets from the physical universe.

Accepting such ideas as mathematical axioms results in theories that cannot explain the universe because they assume as givens concepts such as points — or, more precisely, asymptotically point-like regions of non-zero energy — that one must first clarify at the physics level.

Euclidean definitions and axioms work great if you stay close to the classical approximation. GR/QM unification does not have that luxury and must tear apart the definitions and axioms that mathematics assumes as inexplicable givens.

Electrons fail to "see" acceleration not because they are tiny hard balls in xyz-like orbits around nuclei but because the concept of a local xyzt space breaks down at that level.

*sycamore* [8]: You seem to be implying that spacetime is emergent and complex; I always liked such an idea.

Also, how might the "new" mathematics (you seem to allude to) be extracted from physics? Experiments in colliders appear to have hit a wall.

It looks like there is no acceleration, just the effects of "pivots to divert" from free falling/flowing in the Universe's resultant curved spacetime, i.e., gravitational fields. This gravitation "force" appears quite different from all the rest.

*Terry* [9]: Thank you, sycamore. Those are thoughtful and well-stated points.

My analysis of such issues is ongoing, so I post new items as quickly as possible at Apabistia Press, mostly under Notes.

**Conic Simultaneity**

Rather than saying spacetime is emergent, a better analytical might be to say spacetime is an oversimplification that works reliably only after meeting certain enabling conditions. The most critical of these enablers is the presence of stable half-spin fermions, either simple or composite, with rest mass: Electrons, protons, and (stable if bound) neutrons.

Such stable fermions are critical because there are two versions of space-like simultaneity, not one: the past lightcone version and the future lightcone version. (This is new; I must add it to Apabistia Notes.) Such stubbornly persistent Higgs-mechanism fermions have the critical property of staying "mostly" invariant across outgoing and incoming definitions of simultaneity

Think of radar or lidar: The outbound light detection of a proton indicates a proton location that is mostly unchanged after the return inbound return reflection. Increase the rest mass — build a heavier self-bound object with more

chemically protons, neutrons, and electrons — and the stability of this detection increases, eventually reaching the classical limit if an "object" with a "location" in "space."

However, on closer examination, this flat "space" metric is a simplified collapse of two light ones, one outgoing and one incoming. The collapse simplification only works in the presence of the Higgs (massive fermion) property.

Even then, the dual-cone collapse — the approximate gluing or identification of the forward and return definitions of simultaneity — gets ratty for small masses, giving quantum spatial uncertainty.

For large enough rest masses, cone collapsing allows us to pretend that two clocks in two locations have the "same" time and, thus, the same "location" in a new, simpler collapsed-cone metric we call "space."

The space simplification works well until you encounter quantum entanglement. At that point, you must fall back to the messier but always lightspeed-respecting dual-cone representation of simultaneity to avoid using non-physical phrases such as "instantaneous wave collapse."

**Pure-Math Indeterminacy**

Regarding your math comment, here's a Ron-Green-style start on probing the quantum infrastructure of math. Think about what is meant by "pure" mathematics, that is, math that has no physical entities attached to it.

The pure equation 1+1=2 is a good example. The goal is that each 1 is unattached to any physical object.

Here's the problem: If you strip each 1 of all physical distinctions, they become the same entity. You can no longer say "the left 1" or "the right 1" because those descriptions attach physical locations to each 1, contradicting the goal of full isolation from physical matter.

The founders of quantum mechanics thought hard about such issues when deciphering fermions and bosons. These issues don't stop with matter since subtle issues of indistinguishability lie hidden in plain sight in even the simplest of pure-math equations.

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**References**

[1] E. Siegel, *Why "incompleteness" matters in theoretical physics*, Medium.com **2024** (3), 26 [Mar. 26] (2024). https://medium.com/starts-with-a-bang/why-incompleteness-matters-in-theoretical-physics-0b7692274690.

[2] Terry Bollinger on Medium.com, 2024-03-26.11:04 EDT Tue: https://medium.com/@terrybollinger/unexpected-crossovers-sometimes-help-e-g-081e1f00027b

[3] sycamore on Medium.com, 2024-03-27.09:16 EDT Wed: https://medium.com/@yavorva/didnt-get-it-how-quantum-orbitals-feel-no-acceleration-d11fdcdc06b8

[4] Terry Bollinger on Medium.com, 2024-03-27.12:31 EDT Wed: https://medium.com/@terrybollinger/they-are-charged-yet-they-do-not-radiate-electromagnetic-radiation-3c328cbee62c

[5] sycamore on Medium.com, 2024-03-27.14:04 EDT Wed: https://medium.com/@yavorva/but-orbitals-are-not-particles-there-is-no-classical-movement-along-closed-orbits-trajectories-18936283c82c

[6] Terry Bollinger on Medium.com, 2024-03-30.18:59 EDT Sat: https://medium.com/@terrybollinger/also-to-understand-how-the-non-acceleration-of-an-electron-in-an-orbital-is-like-the-3931b473a708

[7] Terry Bollinger on Medium.com, 2024-03-30.23:35 EDT Sat: https://medium.com/@terrybollinger/see-my-other-reply-today-to-your-first-cimment-one-level-up-3dbf4f787a74

[8] sycamore on Medium.com, 2024-04-02.16:18 EDT Tue: https://medium.com/@yavorva/you-seem-to-be-implying-that-spacetime-is-emergent-and-complex-i-always-liked-such-an-idea-898600f15352

[9] Terry Bollinger on Medium.com, 2024-04-03.08:25 EDT Wed: https://medium.com/@terrybollinger/thank-you-sycamore-those-are-thoughtful-and-well-stated-points-c8b1b7d3e80d