Acceleration, Energy, and the Quantum-GR Boundary

Terry Bollinger
2023-01-07.10:30 EST Sat
https://youtu.be/ZdrZf4lQTSg?lc=UgwduykLnqwzi5GpN114AaABAg

A Comment on the Sabine Hossenfelder post:
Special Relativity: This Is Why You Misunderstand It (Jan 7, 2023)
https://youtu.be/ZdrZf4lQTSg?t=18m54s

18:54 "First, acceleration is absolute." Sabine, the correct statement is not that "acceleration" is absolute but that the addition of energy in the form of momentum is absolute. If you do not acknowledge that difference, you cannot correctly calculate incremental time dilation in free-falling systems.

Apart from that qualification, you nailed the Mach silliness nicely. Following Mach's lead was one of Einstein's more significant missteps, as you appear to acknowledge here.

Gyroscopic states are locally created spin pairs that have nothing to do with distant galaxies and everything to do with the acceleration history of gyroscopes.

However, as with linear momentum, the insertion of angular momentum energy creates a gyroscopic state. If the universe consisted solely of two flywheels, it would still require an input of energy to spin them in opposite directions, creating gyroscopic states in both. But once that initial energy input completes, the gyroscopic states are as stable as the time dilation states in linear momentum.

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PDF: https://sarxiv.org/apa.2023-01-07.1030.pdf

[a nicely cogent response]
2023-01-07.11:30 EST Sat

Wrong. Physical acceleration is absolute, i.e., a Lorentz scalar. It has nothing to do with momentum, as the absolute acceleration applies to any world-line constructed relative to the local gravitational field.

TerryBollinger
2023-01-07.13:30 EST Sat

Of course, acceleration is absolute. More specifically, acceleration is quantum wave collapse and, thus, the basis of causality, particularly at the atomic and particle scales. Without accelerations, things stay in quantum states that expand but lack well-defined temporal progression.

My point was that only acceleration events that transfer energy create the linear-momentum Lorentz (time-dilation) states, or the angular-momentum gyroscopic states, seen in the twin and bucket problems. In contrast, planet-surface gravity and the gravity-like effects inside gyroscopes are continuing accelerations requiring no further energy transfers.

The lack of energy transfers during acceleration is the fundamental distinction between gravitational acceleration and linear momentum, elevator-like acceleration. Tracking all energy transfers — the momentum-excitation hierarchy is a more apt description — works in parallel with the Poincaré symmetries. It nicely removes a lot of hand-waving mysticism when pondering those symmetries.

On the negative side, ignoring the momentum excitation hierarchy inevitably leads to losing track of causality. That leads to more hand-waving and paradoxes, which concepts such as block universes lamely attempt to resolve. That kind of infinite deferral of the causality issue doesn't solve anything. Block universes are also deeply ironic since all one needs to do to avoid losing track of causality is keep close tabs on energy transfers.

The topic here is physics, after all, so is keeping track of energy transfer in special relativity that radical of an idea? Especially when doing so cleanly and non-mystically resolves so many silly not-really-paradoxes created by sloppy energy accounting in special relativity and temporal physics in general?

[another nicely cogent response]
2023-01-07.15:30 EST Sat

TerryBollinger, your understanding is all wrong. There is both physical and unphysical acceleration. We don't know that physical acceleration necessarily causes decoherence (wave function collapse), as this could also happen via the gravitational field. Also, energy is itself unphysical as it is a description (a concept we can use under a particular symmetry condition holding).

TerryBollinger
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Thanks! Your second response was so delightfully metaphysical that I could not stop smiling. Unphysical energy… and yet Dominion Power keeps sending me those darned bills!

Picking up on one Penrose-ish point: Sure, resisting gravity collapses wave functions. Following the geodesic perfectly, though, does not, unless it's part of a convergent gravity field (which, I suspect, is the rare but fascinating case on which Penrose has focused).

Geodesic non-collapse is also the junction between GR and quantum theory. There was no need for wildly imaginative and insanely energetic Planck foams to merge the two. The real story is more straightforward and less exotic: Any self-contained, rest-capable unit of

matter traveling purely on its geodesic loses location resolution according to (surprise!) Schrödinger's equation.

That equation was never about the particles. It was always about the lowest levels of resolution of spacetime, which is as quantum as particles and shares the same length scales. More accurately, it's a shared boundary.

The point is that spacetime is a dynamic and comparatively low-energy quantum effect. Over time, it loses resolution at its lower edges, at least in the absence of occasional and potentially very low-energy momentum exchanges.

We don't notice this much at classical levels because the needed momentum exchanges can be so incredibly cheap that, at least for heavy objects, the energy exchanged is almost immeasurably small. However, even such minute momentum exchanges are sufficient to reconnect the object back into its surrounding spacetime environment.

We commonly call such atto-scale (or less) momentum exchanges _information,_ which we obtain by observing (exchanging atto-scale momentum) with an observed object.

Finally, I have sufficient background in social cognition to know this is going to be — and needs to be — a slow process. I don't mind putting information in media like this, but I am also not focused on immediately persuading folks reading this. Your biggest problem is likely that after reading some of these ideas, they may prove remarkably hard to get out of your head in the future. That happens when simple ideas, e.g., momentum excitations causing time dilation, work better than the century-old models emphasizing mysticism.