Einstein Understood Time Until Minkowski Derailed Him

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(Gmail excerpt)

Have you ever heard physicists lament how difficult it's been to reconcile general relativity and quantum theory?

It's not because of some profound mystery in the math. It's because of a dumb math error made about a century ago, one in which an assumption of more truth than exists devastated a century of theoretical physics.

Einstein's special relativity papers were rigorously and vigorously based not on an abstract concept of time but clocks. Einstein was powerfully influenced in his earliest papers by Hume, who believed that all deep understanding of reality began with actual objects doing actual things that a human could then verify and re-verify.

Einstein's 1905 special relativity paper attracted the interest of his former professor Minkowski, who did not like grubby, imprecise material objects. Minkowski preferred the Hilbert formalist view that only infinitely precise math showed reality. So he dumped all the dirty little inaccurate clocks and replaced them with a *perfect* concept of spacetime, one with no flaws, precision limits, or uncertainties. Within this pristine empty universe of pure spacetime, he permitted dirty little material clocks to exist. However, any imprecision was the fault of the *clocks*, not of the beautiful spacetime that Minkowski claimed was the real subject of Einstein's insights.

Einstein, at first, begged to differ, even noting that he had no idea what the mathematicians -- meaning his former mentor -- were doing to his theory. Minkowski even tossed in a bone to help satisfy Einstein's Hume-influenced preference for speaking in terms of material clocks, filling his perfect and self-existent "spacetime" at all points with "substance." These infinitely long strings of substance are now called worldlines.

(It's worth noting that worldlines would have infinite mass under quantum theory and would instantly collapse the universe. They get a pass on this unfortunate feature only because early ideas tend to get grandfathered in, even when they don't work out as initially intended.)

So what has any of this to do with a century of failure to merge relativity and quantum theory?

Simple: Minkowski obliterated the quantum bridge between spacetime and matter by inserting a perfect (and thus perfectly classical) self-existent concept of spacetime. Dirty little clocks get less precise as they get smaller, and in Einstein's original special relativity, that meant *time itself gets less accurate* as you use less and less material. Time becomes a function of quantum matter, particularly the quantum oscillations that also define rest mass, rather than a separate and self-existent concept. Larger spacetime then becomes hierarchies of the smaller, extremely local, and uniquely "personal" units of time.

The continuity of time approaches infinite precision only as the rest mass involved becomes so large that it emulates a continuum.

Had Einstein continued using *only* material clocks for time, and *only* material rulers for distance, the opportunity for a divergence of relativity and quantum theory would never have emerged. Small clocks and small rulers are inherently quantum, so the very foundations of this clock-and-ruler version of spacetime would have remained quantum.

No amount of effort can make Minkowski's perfect spacetime quantum. That is due to Minkowski's initial non-physical assumption of the classical perfection and independent existence of spacetime. Much silliness has ensued since non-physical assumptions of infinite perfection generate infinite noise when applied to the finite real world. The most glaring example is multiverses, which emerge directly from the Fourier transforms of infinitely precise wavefunctions as their harmonics. These make for excellent science fiction, but there's not enough mass and energy to create them with clock-ruler-generated spacetime.