The Devastatingly Simple Math Error Behind Everett's Multiverse

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2023-05-09.23:25 EDT Wed
Email Excerpt

Sent: 2023-05-09.23:25 EDT Wed
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I've been sincerely baffled by [the widespread view that the Everett interpretation of quantum mechanics is] "nothing more" than accepting Schrodinger wave evolution at face value. His thesis is far more than that, of course, dealing primarily with creating his orthonormal relative states. Thus I ended up diving deeper into his maths.

The problem is duh-simple: Everett used the Hilbert space representation of his new states, which skips over the physical process of how such relative states formed. If he had looked instead at the 3-space Schrodinger equation, he might have noticed the speed of light limit in the spread of information needed to instantiate a true relative relation with the entire universe. It's a gorgeous example of how wrong assumptions can creep into maths-only physics strategies.

2023-05-10 Additional Notes:

(1) For folks not familiar with it, the Hilbert space representation is a handy data structure that represents unique, non-overlapping quantum states such as electron spin-up and spin-down as "orthonormal" (meaning, essentially, "at right angles to each other") axes of a space with as many axes as there are unique states. Electron spin has only two, but the number of unique axes can be indefinitely large. Everett assumed the creation of new states (universe splitting) every time someone looked at a quantum wave function.

(2) The Hilbert space approach works great when the individual orthogonal states are well-defined. The electron spin-up and spin-down states are a slam-dunk for Hilbert space representation since those states are fundamental to the fabric of the universe.

(3) The issue Everett overlooked is that *new* quantum states are subject to speed-of-light constraints. This limit doesn't show up if you *assume* the states to exist, regardless of the constraints of the physical world. However, it is impossible to set up a Schrödinger wave without *starting* at some well-defined location in the classical world, such as a pinhole from which a single photon is emitted. This classical start means that no matter how you represent the function mathematically, *information* in the wave cannot expand and impact the rest of the universe faster than the outbound wavefront of the Schrödinger wave, which cannot exceed light speed. Only 3D Schrödinger waves capture this constraint.

(4) For a description of just how disastrous this math omission is, see *Everett's Many Worlds Are Nothing Like Radio Channels*, https://sarxiv.org/apa.2023-05-07.2345.pdf

(5) I suspect the resurgence of interest in many-worlds-based quantum computing in recent years also traces back to Everett's Hilbert space error. That would qualify as a significant "oops" since all the noise arises *because there is no signal underneath.*