Matrix Musings: Why Is Our Universe So Glitchy?

Terry Bollinger
2022-09-14.10:16 EDT Wed

A Patreon Conversation on the Sabine Hossenfelder post:
The Multiverse: Science, Religion, or Pseudoscience?
YouTube https://youtu.be/QHa1vbwVaNU, Patreon https://www.patreon.com/posts/multiverse-or-71591302

2022-09-14.10:16 EDT Wed

Tracey DeLaney on Sat 7:47 PM (2022-09-10.19:47 EDT Sat) said:

>... [amusing tongue-in-cheek prelude] ... "I think I've finally figured it all out ... the measurement problem is clearly the glitch that indicates that the universe is a computer simulation."

After I stopped laughing, my main thought was, "Yeah, except for needing a computer, that's about right. Nobel for Tracey!"

One of the most profound ironies in quantum physics history was its early decision to commit fully to infinitely smooth, infinitely differentiable modeling of the new, profoundly non-smooth phenomenon of quantization. Such methods, by definition, refuse to consider the possibility that the physical universe has a finite resolution — a minimum grain size — that unavoidably generates random outcomes at scales comparable to that grain size.

One of the few notable physicists of that time who pushed against assuming infinite smoothness in physics was Boltzmann, who angered and annoyed important people by promoting his idea that the grubby, material atomicity statistics were fundamental to defining the nature and direction of time. His position came at a high cost. Mach, who advocated infinite smoothness to the point of denying the existence of atoms, hounded Boltzmann relentlessly. In the end, sadly, Boltzmann committed suicide.

If you take a more Boltzmann approach to quantum randomness, quantum collapse could, for example, be nothing more than a subtler, local-only entangled version of something akin to the grainy randomness of Brownian motion. In Brownian motion, randomness arises not from an assigned probability function but from the inability of finite-size atoms to continue the illusion of infinitely smooth pressure when the object they are pushing is small enough to feel the bumping of individual atoms.

You don't need computers to create blobs since, for example, quantum granularity inversely proportional to energy works fine. Stable wave functions such as electron orbitals follow this rule and provide all the graininess needed to generate quantum-Brownian randomness, but only if that possibility is allowed in the math models.

>... "In a real universe, quantum mechanics and general relativity would work properly together at all times on all scales, and bashful electrons would never appear to self-interfere on their passage through slits, whether we watch them or not. Thus, no multiverses would need to be postulated."

True, but the relatively simple point that almost always gets overlooked in such classical continuum "real" universes is this: Every particle has infinite precision, implying infinite information storage capacity and mass-energy.

Cheers,
Terry

Tracey DeLaney, on 2022-09-14.16:20 EDT Wed, said:

>… So, you're letting me down gently, I'm not really in the running for a Nobel Prize. :-)

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Terry Bollinger

Tracey, let's put it this way: The simplest explanation for quantum uncertainty is nothing more than saying the total data storage capacity of the universe is finite and thus a bit ratty at the edges. That is the *only* path out of a paradox that has hamstrung physics for over a century.

You just did that, so in my book and with complete seriousness, the comment you made is worth more than 50 years of superstring math fantasies.

I've noted offline to Sabine (which does not mean she believed me or that you should either!) that I anticipate at least 20 Nobel Prizes to pop out of the impending transition from infinities-are-free, infinite-differentiability math to finite-data emergent-smoothness equivalents and, in some cases, replacements. When the math model changes profoundly, it impacts everything, from advanced theory to most textbooks. That's a lot of work and, more importantly, an enormous opportunity.

So, seriously, please don't underestimate the importance of your Pocahontas County wi-fi deprival-induced insight [1]. It was a deeper and more critical insight than you may realize.

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[1] The lack of radio-anything in the Greenbank vicinity takes some getting used to, doesn't it? And yes, it is a gorgeous area. My friend has excellent stories on how tricky it is to move an antenna that size without accidentally tearing it apart into itty-bitty pieces.

He is a true genius in control algorithm design. Greenbank made good use of his skills, even after he retired. Considering what happened at Arecibo, one should never underestimate the value of top-notch engineering skills and a prescient understanding of potential dangers at facilities using massive, complex instruments.

2022-09-15.00:45 Thu - Addendum:

Using computers in another universe that *is* infinitely precise and classical doesn't work as a strategy for limiting information storage in our (simulated) due to the inability of fully formal, xyzt-class universes to deal with entanglement. The inability to implement entanglement makes such universes incompatible with implementing the quantum behaviors of our universe.

To limit resolution in our universe, you need to create finite information via mechanisms unlike computers, which are hyper-classical devices. What do I mean by that? Start by abandoning xyzt as "fundamental," or, for that matter, even the concept of mathematical orthogonality as a "given." Instead, information has to emerge from something akin to a Poincare symmetry space in which entanglement and special relativity are two sides of the same coin. The universe is... strange... at the bottom.

Feynman was the first to point out the incompatibility of classical computers with the implementation of quantum logic[1][2]. His paper on that is now considered a founding paper of quantum computing, which is ironic since Feynman's main point was not to use quantum effects to compute classical results. Instead, he wanted to emulate the computationally intractable entanglement behavior of one quantum wave function by leveraging the entanglement behavior of another "general purpose" quantum function: a quantum wave emulator. A regular computer then takes care of the ordinary calculations. Folks like Yuri Manin were both a bit earlier than Feynman and, I think, closer in concept to the modern idea of quantum computing [3].

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[1] R. Feynman, Simulating Physics with Computers, International Journal of Theoretical Physics 21, 6 (1982).
https://catonmat.net/ftp/simulating-physics-with-computers-richard-feynman.pdf

[2] A nice feature of Feynman's paper and approach is that he avoided getting sidetracked into the appealing but decidedly counterproductive strategy of strangling quantum behavior down to a slight relaxation of the hyper-classical concept of an infinitely reliable two-state bit. Computers were still a bit new and magical to most folks then, including physicists, and the Frankenstein effect of making something new into magic ("Lightning! It's alive!" or "Radioactive spider! Superpowers!") was very much in play. Manin got off to a promising start but also was responsible for quickly abandoning analog low-power models in favor of "virtualized" computers.

[3] Yuri Manin, Computable and Uncomputable, pp. 14-15. Soviet Radio (1980).
https://sarxiv.org/ref.2020-10-03.2046.pdf

2022-09-14.10.16 EDT Wed
PDF: https://sarxiv.org/apa.2022-09-14.1016.pdf