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Hi Sabine: Here's my best understanding, so far, of this video:

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(1) "Superdeterminism" is more a brand name than a mathematical description.

That is, regardless of its historical origins, "superdeterminism" has become a quick way of referring to the Hossenfelder interpretation of quantum mechanics.

The distinction is important since, as best I can tell, you are proposing a suite of ideas that is far more subtle and complicated than simply asserting the pre-existence of a block universe with sufficient pre-defined and essentially arbitrary correlations across vast reaches of spacetime to resolve Bell inequality results before they happen. This "hyperblock" universe would resolve Bell inequality results by predetermining how experimenters behave in exquisite and unforgiving detail.

That, I suspect, is the interpretation that gets folks upset and screaming about superdeterminism being anti-science. In many folks' minds, only an omnipotent deity could create such an impossibly interconnected artifact, so they interpret your label as invoking such a deity.

You are instead proposing something far more subtle and far more compatible -- even supportive -- of both a self-evolving universe and what most folks think of as "free will."

For this reason, I would say that your name for your interpretation is a bit unfortunate. Just as an example, after seeing your video and reading up a bit (still working on that), I think if someone asked me for a label for your interpretation of quantum mechanics, I'd call your interpretation more like "bottom-up time construction" -- a very different spin.

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(2) I think you may, perhaps inadvertently, be generalizing Feynman's assertion that to a photon, emission and reception happen *simultaneously*.

I mean that you and your co-authors of the Hossenfelder Interpretation seem to be framing quantum events as events that *do not see classical time*. That is, a fully quantum system -- it can be multi-particles such as entangled photons -- *does not care* if some of its measurements occur now or in a billion years, just as a Feynman photon does not care -- and in fact *does not even see* -- that in classical time it was emitted at the close of the cosmic Dark Ages and received by an antenna on earth yesterday. To the photon, both happen at the same time.

Similarly, but with more complexity and an intriguing bottom-up hierarchy of temporal complexity, I *think* you are saying that more complex particles and systems also do not see time, even when they are complex enough to have their *own* elaborate internal time systems. Recent work [1] shows that even 2000-carbon-atoms-big organic molecules can double-slit interfere just like photons. If such large, internally complex, state-filled molecules can double-slit interfere, the unforgiving space-and-time interchangeability requirements of special relativity also require them to exhibit delayed-choice entanglement.

A Feynman photon sees nothing happening over a billion years, but *we* see it as traveling distances of billions of light-years over spans of billions of years. Similarly but more subtly, that 2000 carbon-atom organic molecule -- which at that level of internal state complexity might as well have an embedded stopwatch and a very well-developed internal concept of time -- doesn't "see" the same past and future we do, provided that it stays "out of touch" (not easy!) with the rest of the universe as it travels.

That is… remarkable. Something I got from your video that I hadn't seen in your earlier papers is the idea that humans are not "predetermined" by any of this because they are already far too large and far too "classical time-synchronized" with the rest of the universe. Yes, there is some bizarre stuff going on at the *quantum particle* level, stuff in which time, as we see it, becomes irrelevant and even non-sensical. But at the *human* level, it doesn't make quite as much difference as we might think. We, as classical beings, see quantum systems make choices.

Notably, the dependence of quantum choices on measurement events in *both* the past and the future would seem to expand and hugely complicate the range of options for "free will" rather than restrict them. The chaotic domains of positive feedback amplifiers come to mind, for example.

To say that "superdeterminism" doesn't carry quite the same connotation as a bottom-up, positive-feedback, past-and-future-dependent quantum collapse in which the outcome becomes even harder to predict would be a bit of an understatement. Thus, I prefer the Hoffstedder Interpretation or bottom-up time construction for a more descriptive label.

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(3) You are predicting that quantum collapse is not purely random. You are right.

The faith assertion -- and by that phrase, I mean any unexamined but deeply held critical axiom -- that quantum collapse is Perfectly Random is just that: a faith assertion. And it's a pretty brain-dead stupid one, despite being loved by so many physicists for so many decades, emphatically including folks like Feynman.

The Perfectly Random Collapse thesis is stupid because quantum collapse bears an uncanny resemblance to ordinary thermal collapse. That begs for someone to figure out how thermal complexity is sneaking into the collapse process and how to test for it, rather than relying on inspiring Perfectly Random Angels to push quantum events around.

One way to get cryptic thermal noise in is by sampling a much broader spectrum of spacetime than classical events. Nothing randomizes as nicely as being able to sample thermal (classical) data points from the entirety of the history of the universe, does it?

I gather this is what Sabine is proposing by suggesting cold experiments. She and her co-authors are correct. Experimentalists who want a Nobel prize really should be getting on board with Sabine and her co-authors on this issue -- the sooner, the better.

I would mention that I was a bit surprised when Sabine mentioned "cold and small," though I eventually got her point and strongly agree. My musings on this idea always leaned towards the megascale, such as statistical observations on trans-universe photons emitted early in the universe's history or influences on local quantum events. After all, if you launch a well-collimated and thus slow-spreading beam of Feynman-Wheeler laser photons (the Maxwell "retarded" solution) out into the cosmos, you are nominally sampling the advanced-photon recoil impacts [2] of advanced photons from eons in the future. If you point the beam at an exceptionally empty region of space -- a cosmic void -- one could postulate that the *lack* of future reception targets might have a measurable recoil or suppression effect back in the laser itself, and thus an impact on nominally "random" quantum emissions by the laser.

So there's another possible line of non-random quantum collapse experimental thought for folks who like giant telescopes more than tiny refrigerators.

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[1] Y. Y. Fein, P. Geyer, P. Zwick, F. Kiałka, S. Pedalino, M. Mayor, S. Gerlich, and M. Arndt, Quantum Superposition of Molecules Beyond 25 kDa, Nature Physics 15, 12 (2019).

[2] J. A. Wheeler and R. P. Feynman, Interaction with the Absorber as the Mechanism of Radiation, Reviews of Modern Physics 17, 2–3 (1945).