Feynman and Chaitin on the Paradox of Continuum Computation

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2023-10-15.23:48 EDT Sun
https://youtu.be/ByJe3abjDZo&lc=UgyC3_kTFkqGgvy8goF4AaABAg

A Comment on the Closer To Truth (YouTube) post:
Gregory Chaitin - Is Information Fundamental? (Oct 15, 2023)
https://youtu.be/ByJe3abjDZo?t=5m44s

5:44 GC: *"Feynman put it rather beautifully. He said if you believe in continuity in fields — in everything continuous — [then] if you take a very little cube of space or space-time or whatever, no matter how small, you need an infinite amount of information to say what's going on in there. He said he couldn't believe it."*

Gregory Chaitin, I believe the quote you referenced is from The Character of Physical Law. It's available as a book, but it began as a series of six Cornell Messenger Lectures in 1964 [1].

Thank you for helping me track that down! I've been looking for that quote. Since all known physical examples of binary data storage devices have finite mass or energy, the vacuum density problem is *necessarily* a consequence of assuming a continuum vacuum to be real. The math, not reality, causes this worst prediction in physics.

Here's the relevant quote: At 59 min 44 sec in the online video [1], Feynman says:

"I must say that it is possible — and I've often made the hypothesis — that physics ultimately will not require a mathematical statement, that the machinery ultimately will be revealed: It's just a prejudice, like one of these other prejudices. It always bothers me that, in spite of all this 'local' business, what goes on — in no-matter-how-tiny a region of space, and no-matter-how-tiny a region of time, according to the laws as we understand them today — takes a computing machine an infinite number of logical operations to figure out. Now, how could all that be going on in that tiny space? Why should it take an infinite amount of logic to figure out what one stinky, tiny bit of space-time is going to do? So I made the hypothesis often that the laws are going to turn out to be, in the end, simple like the checkerboard and that all the complexity is from size."

Also, Robert Lawrence Kuhn, regarding one item you mentioned in passing:

4:49 RLK: *"So, [Gregory], are you saying that [the physical world] is … discrete, going down to the Planck length … — that [everything], at the end, is zeros and ones?"*

You are referencing a sincere but badly misinformed speculation by a non-computer person about the nature of bit storage. The unfortunate quote was about event horizons [2] and goes like this:

"One Boolean variable per Planckian surface element should suffice."

That's it. That is the entirety of the thinking that went into redefining the *most* unpredictable, *non*-information-carrying concept in all of physics — Wheeler's "Planck foam" — into an almost infinite supply of *infinitely stable* bit storage devices.

All variants of real-world binary storage devices become *less* reliable as they approach quantum uncertainty, not more. Even the discussion in that article about electron spin states as "bits" disregards that electron spins cannot store information until placed within *classical* — and thus mass-generated — strong magnetic fields.

(Incidentally, this need for classical magnetic fields is also an issue for quantum computing. Many — not all — qubit models naïvely equate particle half-spin *directly* to the classical concept of a bit. However, since an isolated half-spin without a magnetic field is not a valid classical bit-storage device, its states cannot be assumed to be quantum superposable without explicitly addressing the classical magnetic field component.)

Finally, the concept of Planck-scale "foam" in space-time was soundly disproven by a factor of 1800 time back in 2020 [3]. Combine that with the upside-down assumption that infinite uncertainty is identical to perfect classical bit storage, and the message is simple: Planck bits don't exist.

Physics theorists in topics such as holographic universes, superstrings, and loop gravity need to start taking the non-existence of Planck bits into account. Using incorrect axioms blocks progress and wastes a lot of time.

To be fair, lower-resolution multi-scale versions of holography via ordinary quantum mechanical reciprocal (momentum) space are still viable and probably needed. Such second-generation holographic models would first need to clear out the enormous body of "bit storage is free" math clutter, however.

References

[1] R. Feynman, "The Relation of Mathematics and Physics (Lecture 2 of 6 in The Character of Physical Law)," Cornell Messenger Lectures, Nov. 1964, [Online]. Available: https://www.feynmanlectures.caltech.edu/fml.html#2

[2] G. 't Hooft, "Dimensional Reduction in Quantum Gravity," arXiv preprint gr-qc/9310026, 1993, [Online]. Available: https://arxiv.org/abs/gr-qc/9310026. The relevant quote is on page 6: *"One Boolean variable per Planckian surface element should suffice."*

[3] A. Albert et al., "Constraints on Lorentz invariance violation from HAWC observations of gamma rays above 100 TeV," Physical Review Letters, vol. 124, no. 13, p. 131101, 2020, [Online]. Available: https://arxiv.org/abs/1911.08070