Answers to Several Questions About Finite Emergent Spacetime

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https://www.youtube.com/watch?v=ll0LWR8gR5s&lc=Ugw3MXRq3YjfpPKj0TF4AaABAg.9ph1v1y810X9t0jbqhfAaz

A Comment on the Parth G YouTube post:
The 2005 Nobel Prize Controversy: The Indian-American Physicist Who Should Have Won It Instead (Apr 25, 2023)
https://youtu.be/ll0LWR8gR5s

Terry Bollinger on 2023-08-03.17:26 EDT Thu:

First, here is my short answer to any question about well-defined objects seeming to travel by multiple paths at once: Spacetime is not a "fabric" or "substance" but a set of relationships within and between instances of matter and energy. It is never correct to assume that all relationships in physics can be mapped into our personal xyzt model.

At the neural circuitry level, our brains want to interpret these relationships as "space" and "time," but they no more form a singular, mathematically perfect fabric than would the pairs of names and places in an extensive address book.

Until one accepts this oddly simple idea, there is no self-consistent path to resolving a wide range of quantum and relativistic paradoxes, most of which stem directly from assuming the complexity of 3+1 spacetime to be self-evident and thus fundamental.

Here are my answers to @slowdown7276's 2023-08-03 questions on my ten axioms:

(1) In your set of ten axioms, what did you mean by "time-like structures"?

First, a bit of background: You need to visualize trees. Axiom 1, pair production, asserts that the universe we see and its understructure, the deep universe, collectively form an unstable binary tree in which pairs of "opposites" form at the end of an existing branch and then (usually) collapse back together into that same end. An excellent way to visualize this universe is as an ordinary-looking tree with branches forming in pairs. The catch is that this is a super-timid tree in which each new pair of branches tends to collapse quickly back into the branch end where it formed. The virtual particle pairs seen in particle physics, such as the virtual electron-positron pairs [1] that blur the positive charges of atomic nuclei, are terminal branches of this tree.

With that dynamic tree image in mind, a *time-like structure* is a tree branch whose canceling branch keeps getting damaged or removed in a way that delays the remerger of the two. If the tip of the branch was a ball, one time-like scenario is to cut the ball in half and then shatter one of the halves into pieces that, while never disappearing completely, fall so far away that the odds of reforming the "zero" ball drop almost to zero.

The critical part is what happens next: The lone branch keeps trying to heal itself in a way that succumbs again to whatever is creating the delay. Picture this frustrated branch shooting off into infinity as it tries, almost always in vain (think Groundhog's Day), to branch in a way that brings it back to zero. It is this obsessive-compulsive attempt to achieve a closure that creates the basics of a time-like structure: A sort of persistent, repetitive "forward" motion. Entropy plays a role since the more mixed up the missing partner becomes, the more persistent this forward-branching behavior becomes.

To make that more concrete, the proton in a hydrogen atom is a badly shattered version of a positron. Its electron keeps attempting to cancel the positive charge and return the branch into pure energy, but the stupid proton has all this debris called quarks that have their own more complicated cancellation strategies to fulfill. It ends in a stalemate: An -*almost* canceled negative-positive pair that looks almost nulled out from far away but cannot find a path to complete cancellation.

But I just called a mundane hydrogen atom a "time-like structure!" Time can't possibly be *that* simple, can it? No, it's not, and that's why hydrogen is only a time-like structure. On the other hand, what do hydrogen atoms do? They move through time, or more accurately, they *persist* well enough for an observer to assign a time flow to them. The point is that when you get structures as complex as hydrogen atoms, you are far along in the quest to create the kind of history-generating time we need to exist.

Momentum pairs are a more interesting time-like structure because they come closer to implementing historical time. In momentum, the lost pair is not shattered but heads off in its *own* time-like direction — a classic Newtonian action-reaction pair. The three xyz momentum axes are, in fact, critical parts of the composite time-like structure we think of as time. Through this dependence on these momentum axes for forward motion, our version of historical time attaches additional structures that we call xyz space. These structures increase entropy and thus help stabilize the forward path of an extensive collection of cooperating entities.

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(2) What is your conception and understanding of time?

See my answer above to (1). Time is a branching structure, not a smooth flow. As best I can tell, it comes a lot closer to the Spekkens concept of a causal network [2]. However, the smoother and local-only (inertial frame) relations we paste on top of this intransigent network are what we usually call time.

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(3) Could you please elaborate on what you mean by the following two statements?

(3a) "Photons, for example, do not 'resonate' with every point of matterless space between stars and galaxies but instead exist solely as momentum oscillation relationships between bits of matter that implement the spacetime structure."

Though I distrust this analogy due to its excessively classical connotations, the easiest way to explain this is with a computer simulation analogy. A computer is compact in xyz space, yet it can implement relationships that span a virtual space as large as you wish. Much the same is true for locations of objects in xyz space: The deepest underlying representation has no concern or even fundamental limits for how entities interact, but the *rules* for making those interactions "interesting" become extremely specific. The situation is one of those Adam Smith cases where just the right amount of rules does the trick. Far from inhibiting complexity, the resulting (mostly) self-consistent framework enables new complexity to emerge and flourish.

I called my early (May 2017 at least) versions of this idea PAVIS for Physics As Virtual Instantiation Software. I seem never to have self-published that — I'll likely put my old notes out at some point — but I do mention PAVIS in this 2020 Note [3]. In short, this is not exactly a new idea for me. Others have explored many variants, though often with little regard for the critical importance of finite limits. The critical point of the PAVIS version is *not* to interpret this as a classical, already-formed computer sitting in some room. That doesn't *explain* anything; it just defers while also ignoring resource constraints. The deep physics of the PAVIS pair-production processor is instead so simple that bits and pieces of it — particle pairs, in particular — are not only visible from *within* the "simulation" but play critical roles in how it works [1]. There is no infinity of worlds or nesting of simulations, either, since *restriction* is what makes PAVIS class deep physics work. That also means, in a nice irony, that PAVIS is the diametric opposite of cost-free, energy-careless many-worlds, and even superposition models.

(3b) "I love that emergent space makes walking through a door a quantum event in which matter conspires to create the data and history of that event."

See my answer above to (3a). To be precise, though, the deep or PAVIS universe is *not* what we call quantum mechanics. Quantum mechanics is better thought of as the ratty fringes of the critically important "classical emulation" that makes our existence possible.

However, the statement means what it says: In a PAVIS universe, distance and paths are nothing more than data structures *created* by other pair-based interactions. They don't even work all the time, as demonstrated by double-slit experiments.

Does that hint that we might be missing essential physics? Sure. However, one should be *very* careful about assuming that just because the universe likes linking things in ways that don't care about distance, those of us *within* the "sim" can do the same.

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(4) What is your understanding of consciousness? Have you reached finality in your views, or are you still inquiring?

I went out on a speculative limb in [4] but haven't thought much about it since, due to working on some fascinating issues about special relativity and the impact that the overlooked but very real *age gradient* has on understanding inertial frames [5].

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(5) Which theory of consciousness do you agree most with?

My own, which does not exist yet [4]. Whatever it is, I assure you it won't look much like the current ones. It won't be point-based silliness. Something much more interesting is going on there, with forms of experimental access we haven't thought of because we don't yet *have* a meaningful theory of consciousness.

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(6) What do you think about the wave collapse idea of consciousness by Roger Penrose and Stuart Hameroff?

Despite my deep appreciation of and regard for Roger Penrose, I'm probably about as far from this idea as possible. The phrase "wave collapse" is the problem.

For me, wave collapse is identical to acceleration. Acceleration "locates" two entities relative to each other through Newtonian action-reaction, and by doing so, it rescales both of their wave functions, sometimes in an excruciatingly asymmetric fashion. That's it; mutual observation by two entities at any scale is all "observation" needed to collapse wave functions. It's astronomically commonplace, e.g., through molecules bumping into each, incredibly mundane (just acceleration). On the other hand, this operator's intensive use creates classical physics and the spacetime approximation.

I agree with Roger Penrose that wave collapse is a physical process. But rare? No, by many orders of magnitude, since acceleration wave collapse is the most common operation in the classical universe. It *creates* the classical universe. Is wave collapse, as opposed to consciousness, related to gravity? Yes, since gravity is acceleration. Something essential and exciting is going on in that relationship.

References

[1] T. Bollinger, *On Quantizing General Relativity: An Overview,* Apabistia Notes (2022 04 21), pages 13-19. To be more precise, each electron-positron virtual particle pair that blurs the charge of an atomic nucleus consists of a left-handed electron and a right-handed positron. Every matter particle in the Standard Model — every "fermion" — has two versions with opposite "chirality" or handedness. Only the left-handed versions of matter particles can "see" the weak force, while only the right-handed chiralities can see the weak force for antimatter. The vital concept missing from the Standard Model descriptions is that weak-aware versions are the only versions with positive total energy. Their mirror images — the right-handed electrons and left-handed positrons — have *negative* total energy. As a result, they can only exist briefly in our universe, but they play a vital role by helping to implement the forward flow of time.

[2] R. W. Spekkens, *The Paradigm of Kinematics and Dynamics Must Yield to Causal Structure,* in FQXi Essay Contest (Springer, 2012), pp. 5–16. Spekkens has more detailed and recent work on this topic, but this is a good introduction.

[3] T. Bollinger, *First Prediction of Momentum-Pair Creation in Stern-Gerlach,* Apabistia Notes (2020-07-28).

[4] T. Bollinger, *An Unexpectedly Specific Theory of Consciousness,* Apabistia Notes (2023-04-26).

[5] T. Bollinger, *Why Age Gradients Are Useful in Special Relativity,* Apabistia Notes (2022-09-21).