# Our Understanding of the Vacuum is Wrong

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*Message Excerpt*

Computing the energy excitation that defines the time dilation hierarchy is easy enough since it's just total relativistic energy minus rest mass energy. And one can argue, why bother? You then use it to recalculate the same velocity and Lorentz factor that you likely used to calculate the relativistic energy in the first place!

(Frankly, the trickier part is those age gradients, though they are also easy to calculate. That's the part that ensures a simple hierarchy of rigidly imposed, unambiguous time dilations still fully implement Poincare symmetries.)

Finding the Lorentz factor by adding energy to the (possibly zero) rest mass is not the usual path for finding gamma. You convert the added energy to mass, add that to the rest mass (if any), then divide the sum by the rest mass to get gamma. Zero rest mass gives infinite gamma with c velocity. (I'm on my phone and don't have a good equation writer for it. I must look into that again.)

None of that is tricky. What's mind-blowing is the need for a complete inversion of the textbook physics understanding of the vacuum. It's an inversion that necessarily changes how many of the maths are applied, at least conceptually.

I seem to be calling this inversion of the vacuum concept the next phase of physics... n-pop, maybe? Wow, does that ever sound [pop] corny!

In n-pop, one must return to the old idea that the vacuum is the absence of anything instead of a seething mass of mutually canceling fields. This true emptiness trivially solves the vacuum density problem and also trivially solves the problem of how every special relativity inertial frame sees empty space the same way.

However, the idea of a genuinely empty vacuum is challenging for physicists. In effect, Quantum field theory (QFT) gives every point in spacetime a copy of the entire Standard Model "genome," ready to be activated by adding energy.

Subtly, though, space-attached QFT also implies the presence of an aether-like inertial frame. That's because all experimental invocations of the QFT genome add frame-locked energy to create new particles. Because the generating energy is frame-locked, it's no longer a special relativity vacuum and begins to look more like an aether.

Even worse, any attempt to calculate the energy density of space with QFT attached winds up being bogus since it's also multiplying and generalizing that localized, frame-locked result as if it applies to all points of relativistic space. You can't do that without adding energy to every one of those points, so ending up with vacuum density problems is not surprising.

For n-pop, the Standard Model QFT genome is attached not to the vacuum but energy.

The energy can be as tiny as a single photon. But it gets even stranger since QFT requires vibrations in space and time. Thus, not only must a single photon's worth of energy contain the QFT DNA for the entire Standard Model, but also the rules for creating a local version of space and time in which its EM field can vibrate.

Attaching QFT to energy also ends free lunches provided by an infinitely available vacuum. You can only calculate as much reality as you have energy, with everything below that dissolving into quantum-blurred randomness. A low-energy photon can barely define energy moving through space, with a couple of quantum numbers to keep it company.

That is a profoundly different take on how reality works. Yet, ironically, it is also highly compatible with special relativity's point that energy-free space does not belong uniquely to any inertial frame.

In n-pop, Feynman's quantum electrodynamics (QED) renormalization process looks more like pouring a finite volume of water into a complex, branching network. The more complex loops at the edges fade out by drought: They never get enough energy to instantiate. I've found at least one solid paper in which this pattern seems to show up, but the authors sounded a bit baffled by the effectiveness of the fade-out technique they used.

Enough for now. Please don't worry too much about everything I just dropped on you. I appreciate the chance to think out loud a bit. There's no better way to understand a new concept than to explain it clearly, at least to yourself and eventually to others!

Cheers,
Terry

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PDF: https://sarxiv.org/apa.2022-08-27.0029.pdf