Faraday's Role in the Worst Prediction of Science

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NOTE: This note expands on, and adds references to, Apabistia Note apa.2024-03-19.1837.pdf, *The Empty-Space Glitch in the Field Theory Matrix*

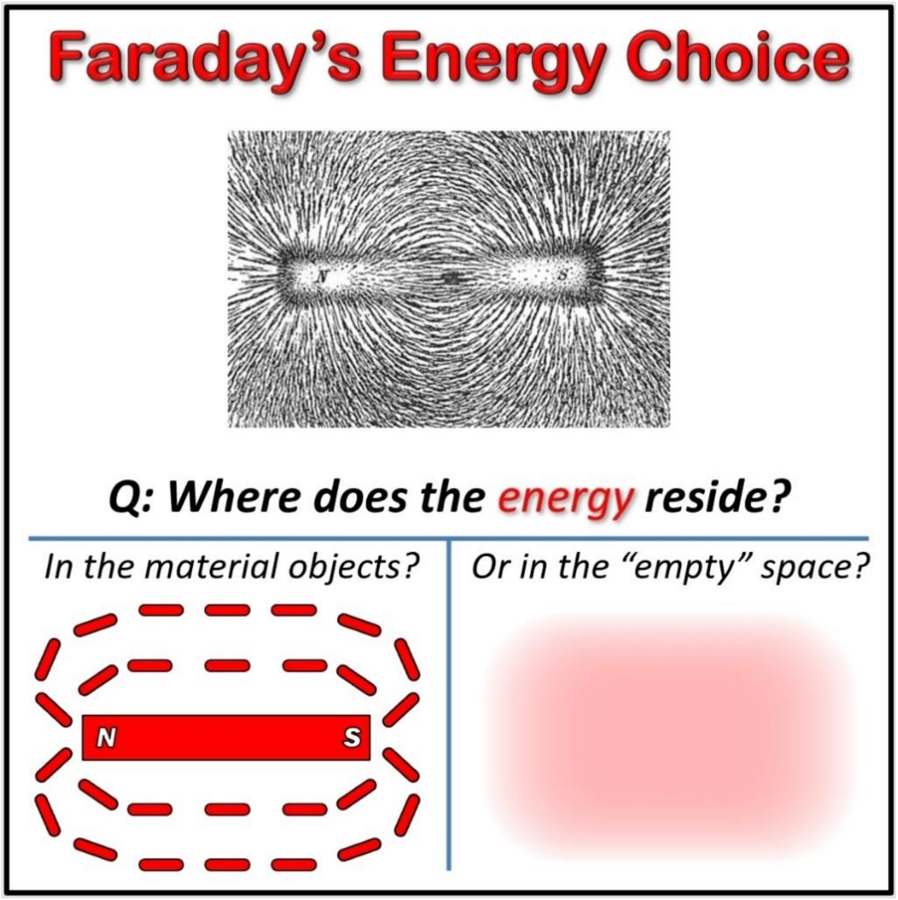

Figure 1. *Faraday's energy choice: Where does the energy reside?*

Preface: The idea that empty space — hard vacuum — can hold electromagnetic and other field energies seems so obvious to modern ears that it can be surprising to realize this idea was once part of some of the liveliest theoretical physics debates of the 1800s (Fig. 1). Michael Faraday and, later, James Clerk Maxwell chose to place the energy of magnets and light in the vacuum itself [1]. The huge advantage of this choice was its locality since it placed the energy precisely where it was needed so that, for example, local "lines" of a magnetic field immediately energized a wire moving through them. This locality also made electromagnetic waves easy to quantify, converting them into pond-like ripples that traveled stepwise through the vacuum. The disadvantage of Faraday's choice was that it converted the formerly empty vacuum into a fluid-like *aether* in which such waves traveled. More subtly, how this aether behaved energetically depended on how the observer moved through it. On the no-fields side were notable names such as Siméon-Denis Poisson, André-Marie Ampère, and Wilhelm Weber, who disliked the aether concept and preferred to keep the energy within the material parts of the system. They used "instant" energy exchanges to trade energy between parts. Decades later, both sides violated special relativity. For Faraday and Maxwell's field theory, the violation was their creation of an observer-dependent aether whose use continues, often subtly, to this day. For Weber's surprisingly well-developed theory [2][3], the fatal problem was its blatant violation of the absolute speed-of-light limit. The more useful field theory won, of course, but only at the price of filling the vacuum with energies that, when elaborated by quantum theory, gave us the worst prediction in science [4].

The Pros and Cons of Wheeler's "Planck Foam" Speculation

@TerryBollinger on 2024-03-16.19:13 EDT Sat: A simple resolution [to the vacuum-density problem — the worst prediction in science — is this]:

(1) Is the Planck-scale speculation correct? If not, *stop using it*.

(2) Does quantum field theory produce precisely the same energy densities regardless of the inertial frame of someone observing the implied physical loops and structure of the calculation? If not, recognize that the exquisite precision of field theory applies *only* to the inertial frame in which it is used, and *stop asserting* that it has anything to do with the frame-independent vacuum of special relativity.

@stargazer7644 on 2024-03-19: The Planck scale limitation is used because beyond it the calculations make no physical sense.

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[5] @stargazer7644, that's a great point and is why Wheeler's foamy-spacetime speculation caught on like wildfire. However, introducing Planck foam solely as a comforting lower limit to prevent infinities in calculations simultaneously destroys special relativity and makes it impossible to explain the experimentally well-established existence of extreme gamma rays.

Why is not hard to see: The graininess of the foam cannot support the level of smooth detail needed to let such gamma rays cross space. Given those two points, invoking Planck foam is akin to invoking a variant of Maxwell's daemons to prevent the infinities problem. The daemons see the gamma rays, realize they are too detailed, and kindly help by making corrections. One can propose foams and daemons, but do they truly help or hide the problem by giving a reason to take your eyes away from how bad the problem is?

It's hard to express how frustrating this is for someone who has worked all my life in disciplines where no one gets away with casually violating physics, especially energy conservation and the speed of light. That would be computer science, not math or physics. We get fired for ignoring such limits. Physics and math, not so much.

Take the very concept of a field theory, dating back to Faraday. It's an aether theory. *Of course*, it's an aether theory. He based his concept on how iron filings behave when distributed like little arrows throughout some region of space, and from that, he proposed that every point in *empty* space has little gizmos that can store vector states.

A Glitch in the Matrix

Did you notice the little glitch in the matrix in that statement?

It's an important one. Faraday observed material objects — iron filings and such — arrayed in a volume measurable by a single-frame-only Einstein system of rulers and clocks, and they were acting like little arrows. From that, he *extrapolated* that empty space *itself* was the source of the pointing action and that the filings did nothing more than follow the directions of the empty-space energies. The energy was in the empty space, *not* in the material filings.

Once you make that extrapolation — once you abandon the possibility that the energy resides *only* in the filings and instead assign that energy to the Einstein-defined xyzt "location" that holds the filings — you are lost forever, or at least for a couple of centuries. You *cannot* now come up with any theory that does not eventually end up with infinite energies in what you call "space."

It's not even Einstein's definition of "empty space!" His idea of empty space looked the same from *all* moving perspectives, not just those of the person who instrumented that region of space with rulers and clocks.

Feynman's Recognition of the Field Danger

Feynman saw the danger. It was the reason for his adamant insistence, at least at first, that all interactions occurred *directly* between particles. Read his work and look at his words. Even though his methods turned *into* another variant of field theory, he never trusted fields. He seems to have realized they were a disaster, but the best he could ever do was devise clever ways to "renormalize" the problems. That frustration is why, remarkably, he was willing to mock his QED theory publicly as needing replacement by "something simpler, like checkers" that didn't place *almost infinite* computation in a cubic centimeter of empty space.

Where Feynman lost traction — he never stopped trying, bless his heart — was in his adamant belief that particles are, ultimately, *points* that interact directly with each other without any local need for space-like concepts such as "volume." Though Feynman's always-exploring mind led him to explore almost every angle of the field problem, I've never seen any indication of him realizing that the concept of a "point" is *every bit as single-frame dependent as the concept of a wave*. They are two sides of the same Fourier transform coin. Near the end of his life, he even stated that his inability to solve this — which he phrased in terms of the electron self-energy problem — was one of his greatest disappointments.

Maxwell's classically mechanical molecular aether

It's time to go back again, this time to Maxwell, who depended upon (and gave proper credit to) Faraday [1].

Maxwell's theory was an aether theory, but he had the unexpectedly powerful insight that he should constrain the properties of his "molecular vortices" to what is possible in *fully classical*, matter-based mechanical analogies [6]. He made physical analogy an inviolate principle in their design. Amazingly, it worked. That's how he figured out that light was electromagnetic radiation rather than through differential equations. That refinement came later.

Ironically, Maxwell made the problem worse when he abandoned his ferociously materialistic (and thus self-limiting) modeling approach with differential equations that made his molecular vortices so small — so infinitesimal — that if you blinked hard, you would *pretend* his gizmos weren't there anymore. Instead, it all became beautiful equations — equations not of matter but of empty space. He stripped matter of relevance.

The problem is that the gizmos were still there, only smaller and nicely hidden by the pretty equations. It was still an aether, and like all Lorentz aethers, it had a "set point" or rest state in which all of physics became symmetric.

Once you take this path, you must eventually encounter vacuum infinities.

They aren't quirks anymore; they are part of the axiom set you chose when you assigned energy and orientation not to material objects like iron filings but to the metrical locations created by Einstein's complicated, single-frame, rulers-and-clock definition of space and time attached to a single user. You keep shrinking the now-hidden physical machinery — the "nano iron filings" that hold real energy — and keep producing more of them.

And yes, quantum field theory makes particles into "waves" on top of all this nice single-frame aether of super-iron filings. But seriously, does that mean the resulting waves are in any way "fundamental"? They can only exist because you filled space with devices far more complicated than the particles you are attempting to create!

Is this stuff hard to hear? Not for most folks, who can dismiss it as some dumb non-physicist criticizing things he doesn't truly understand. The problem is that folks who are deeply familiar with how utterly insane the vacuum density prediction is — most end-of-the-world cult religions are better at predicting the end of the universe than a theory that instantly explodes or implodes it — are likely to have a pretty good idea of why some of the points I make cut deeply.

But then what do you do? Do you discard two centuries of math and physics?

Of course not! Most of it works, *including* quantum field theory, as long as you apply it only to a single frame of reference with lots of energy and matter around. That's why it works great for particle accelerators and solid-state chemistry: Both are single-frame with lots of energy. The phenomenal value of *existing* maths and physics is not the problem.

The issue is that it's time to take this to the next step and stop relying on centuries-old pre-quantum, pre-relativity maths that assume infinite light speed and single-frame views as *given* in their construction. The new math needs a more Lambert-like axiom set that will be tricky to do, but, on the plus side, a lot of computational and conceptual nonsense will also disappear. Superposition gives way to generative options, and quantum uncertainty becomes nothing more than the noise you get with any form of finite-resource, finite-resolution computation.

"Space, "time, "points," and "waves" were never first-order concepts. Why is this a surprise to physicists? Don't you take your Poincare symmetries seriously? You *cannot* have *xyzt* concepts that require so much Einstein-level prep and manipulation by a *single* speed-of-light-limited observer and expect them to generalize across the entire universe.

Causality, in contrast, does dive deeper. So does Fourier symmetry, though it is more a matter of how the deeper non-point, non-wave, non-fully-orthogonal universe expresses itself in the classical approximation. Lamport networks — the same methods used to keep the Internet self-consistent — are also a huge clue.

There are no multiverses, no true superposition, and no pretty waves traveling through space. But boring? Not at all! You don't discard the 1700s concepts of "space" and "time" as first-order without some truly fascinating, bizarre, and unexpected consequences. Clue in Penrose-level thinking for that next level, but with new math.

Addendum on 2024-03-21.12:00 EDT Thu

After a brief, incomplete look at Weber's work, including two recent attempts to modernize it [3][8], my best assessment is that a path does exist for restructuring Weber's theory to make it (a) fully compliant with special relativity, (b) easier to use, (c) computationally efficient, and (d) capable of converging fully to the phenomenal successes of quantum field theory at the limiting case in which the observer's metrical (Einstein) inertial frame fully dominates the setup, accelerations, and subsequent observations. These constraints apply to the setup and metrics collection of all variants of earth-resident particle accelerators, and so would help explain the paradoxical mix of extremely high and mind-bogglingly deficient predictive power in current quantum field models.

Wave functions as *non-fundamental* projections into specific local inertial frame coordinates

If you are interested in having a go at this — and if you are good at this kind of stuff, please don't underestimate yourself, but also please do your homework — one of the critical ideas needed (and this is *new*, hot of the presses, so to speak) is that *wave trains are a form of observer-induced state transformation*. Please note that I did not say "wave collapse" because all wave trains exemplify such transformations. Such waves include, emphatically, Schrödinger and photon (Maxwell, really) wave functions, which are examples of what you get by applying (I'm inventing words here) "diffractive" observation to an expanding… not a wave! A potential? Way overused in physics. Unformed quantity? Clumsy. Hebrew tohu? It is overused, vague (not used much), and seems to mean something more akin to an empty desert. Sanskrit nirakar (niraakaar, निराकार)? Many languages share this one through its use in Hinduism, and in both religious and secular contexts, it seems specifically to mean "without attributes." That's not bad, so I'll go with nirakar.

The nirakar state and function

Example: The *nirakar function* of a photon's worth of energy radiated by some distant star does *not* look anything like a wave as it travels through intergalactic space. It only takes on the form of a wave when some well-defined Einstein metrical frame [9] defines past and future, left and right, up and down, and back and forth. The pre-quantum, pre-classical *nirakar state* of a system leverages these observer definitions to shape itself into a wave train, one in which "back and forth" in particular also has a highly specific *time* meaning: phase-forward is the future, phase-backward is the past, both as defined by the observer [10].

An indication that the system remains partially in the nirakar state is that the Fourier equivalence between the spacetime and momentum-energy quantum wave functions holds. The Fourier connection makes sense if you realize that the only way a Fourier transform can access and transform *all* of some system's classically visible state is through the pre-space, pre-classical-time properties of the nirakar state.

The *particle* case occurs only when that shaping gets so specific that the photon's energy gets locked into an extremely tight location in the observer space. Even that is extremely transient at the particle level since particle wave functions (e.g., a neutron after passing through a narrow passage) tend to explode quickly if not bound by additional forces.

If mapped into a cosmic-scale extrapolation of the local classical spacetime of an observer, the nirakar function for, say, a photon emitted on the other side of the universe looks like an expanding wavefront with some front-to-back thickness that corresponds to time uncertainty in the emission of the photon. However, no matter how tempting this interpretation "feels" to our *xyzt*-optimized neurology, *it is invalid because it uses* an extrapolation of local spacetime that is meaningless under the Einstein definition of *measurable* coordinate systems. It is like a minnow splashing its tail and thinking it has created a huge wave "instantly" washes over the universe [11]. Experimentally measurable definitions of local inertial coordinate systems expand, *at best*, at light speed [12].

A far better approach to spacetime — and one that will almost certainly be needed to adapt Weber-class "no aethers allowed" into viable theories that converge precisely into QFT and QED at the single-Einstein-frame metrics collation limit — is to think of it as an *excited* system [13] state. In a close analogy to how angular momentum excites bound systems into higher energy states, creating linear momentum pairs excites two parts of a system into a higher linear momentum energy state that remains "motionless" relative to the launch frame but while expanding in breadth.

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