LADs, LASSes, and Fractal Time | Terry is Not Peer-Reviewed!

Terry Bollinger
2023-03-06.10:51 EST Mon
[Email Excerpts]

Subject: some ruminations on five big problems about the universe [Excerpt 1 of 2]
From: Terry Bollinger
Date: 2023-03-06.12:21 EST Mon

Roger,

What I meant regarding those five mysteries of physics is that until you make the deepest levels of physics sufficiently self-consistent, it's easier to identify or even see which threads to pull on to resolve these genuinely intriguing problems.

In addition to stripping away all of that non-physical Planck scale nonsense, here's an example of a blocking issue much closer to home for anyone doing physics: The universe has only *three* primary dimensions, not four. Until folks get that part fixed in the maths, there's no way to understand issues such as dark matter anomalies since all current proposals assume xyzt spacetime.

The problem is that once you strip away the math noise created by applying the Lorentz transformation *twice* in special relativity — once to dilate time, once to contract length — you don't have enough data to create four *independent* variables for specifying Lorentz invariant distances. The three independent variables measure separations not in length but in the square root of areas consisting of length multiplied by duration. The Lorentz Area Distance (LAD) equivalent of one meter becomes one Lorentz meter, $1\ m_L$, or $1.8263737\ \sqrt{ns{\cdot}m}$ [1]. Using LAD metrics also dispenses with the need for the wonky and mostly after-the-fact concept of Lorentz invariant "proper time."

That sounds absurdly complicated, yes? Why bother if LAD metrics if they are equivalent to distances measured in ordinary meters, just with different units? The difference is that the universe becomes a state machine after you switch to LAD units.

There's no longer any math-noise option for believing some already-solved block happens to exist and inexplicably obeys the laws of physics. Time and the speed of light only emerge after locally causal bits of the state machine configure into data exchange loops. Loops are everything, not just for relativity but also to explain in detail what quantum wave collapse is and works. This time-creating looping process is fractal and hierarchical, with "particles" forming the lowest level of loop resolution and things like galactic rotations up around the top end.

There is no single definition of time. Duration emerges at multiple scales with multiple loop scales. For large LADs, length emergence dominates and becomes the bottleneck. That's why conventional length metrics approximate LADs well at interstellar and intergalactic distances.

Finally, if you take the complete three-dimensional collection of all component states plus the multi-scale LAD distances between all those causal states, you end up with a singular Lorentz Area State Space (LASS) representing the entire universe's state. There's no block universe, no multiverse, just a single state space that corresponds precisely to the total mass and energy of the universe, one that changes over "time."

The subtler point is that since multiple loop scales within the LASS *create* time, isolating LASS dynamics from the universe's large-scale structure is impossible. The ambiguities in time make them a bit more like quantum states, just with more restrictions. The idea of a "single," universal concept of time takes a huge hit. Large-scale time is, at best, an average of many smaller-scale time loops.

And yes, I just defined the universe's large-scale structure using LADs and LASSes. The universe may be more Norse than we suspected.

Cheers,
Terry

Subject: quantum foam: hmmm [Expanded excerpt 2 of 2]
From: Terry Bollinger
Sent: 2023-03-06.10:51 EST Mon

Hi Roger,

Oddly, it's my simpler arguments that sometimes get me into a bit of hot water, e.g., the unavailability of even one of the many Astrophysica videos in which I participated.

Here's one example:

"Since special relativity's vacuum has no discernable features from any observer's frame, it is impossible to make meaningful assertions about space and time without using rulers and clocks made of real mass and energy."

That doesn't sound too controversial to me. After all, the idea that physics experiments are possible only by first creating instruments composed of tangible matter and energy is readily understandable to a broad audience. It is also nicely in keeping with the past two or three centuries of physics experimentation. Finally, the idea of defining space and time purely in terms of physical measuring devices is very much in keeping with Einstein's approach in his 1905 special relativity papers.

However, the only alternative to defining space and time solely in terms of data from physical devices is to declare the existence of a spacetime "substance" that exists independently of finite-resolution rulers and clocks. Since belief in the independent existence of spacetime, independent of materials and clocks, is the foundation of much of modern theoretical physics speculation, proposing that no such substance exists turns out to be more controversial than one might expect. Multiverses, for example, are extremely popular in pop culture, and their proposed existence is a direct extrapolation of some infinitely malleable spacetime fabric combined with quantum uncertainty.

Historically, Faraday was the first to propose that the vacuum is a substance capable of supporting densely packed, well-defined field vectors. Faraday's field vectors required an aether whose tiniest bits and pieces could support the highest observed wave frequencies observed traversing the vacuum. Since atoms were not yet universally accepted, the issue of infinite resolution versus finite atomicity likely never crossed Faraday's mind.

Interestingly, Maxwell's first complete model of electromagnetic phenomena emphatically *was* a finite-resolution aether model, that is, a model with both a well-defined size scale and a frame of reference. Maxwell began his quest with a self-imposed rule that he would only use mechanical models to capture the properties of electromagnetic phenomena. His first successful model for electromagnetic lines of force used literal machines that he called "molecular vortices." These vortices had more structure than modern models since they included internal rotations and always had implied resolution limits.

Ironically, when Maxwell switched to the then-emerging field of differential equations to convert his machines into purely mathematical equations, he also lost the finite granularity of his earlier model, replacing it with the same infinite-smoothness model of the vacuum that Faraday more-or-less accidentally invoked. Even today, Maxwell's more complex but surprisingly effective mechanical model may contain unrecognized insights into avoiding the vacuum density problem. For example, his original molecular vortex models included an internal rotation component that could not support infinitely high vibration modes without tearing the field lines apart. That's fascinating.

Even worse — and I honestly do not understand how this part happened — the simple fact that all early field models were *aether* models got lost during the transition to differential equations. That's bad since the aether issue emphatically does not go away even in the limit of infinitely fine vacuum granularity. Distinguishing between local aethers created by fields and energies in well-defined frames of reference and the utterly featureless vacuum of special relativity is critical to issues such as the vacuum density problem.

The difficulty with returning to Einstein's 1905 insistence on using only material rulers and clocks to define and measure space and time is that taking this principle seriously means that neither space nor time has meaning below the lengths and durations set by particle and quantum physics. Far from being the "fabric" of particles, as even Einstein speculated in his later years, spacetime loses resolution and *ends* at those same frequency-defined levels of resolution.

This low-resolution, what-you-see-is-what-you-get view of our universe can be profoundly upsetting to folks immersed in decades of accepting as a given that there exists an almost infinite number of branching universes. Yet the argument *against* such infinities requires little more than the observation that neither space nor time has meaning apart from finite, real-energy, real-matter rulers and clocks. For infinity folks, that sounds so… boring.

One way to deal with uncomfortable alternatives such as rulers-and-clocks spacetime is to discuss them openly and explain why they conflict with experimental evidence. This approach works both ways, of course. The vacuum density problem created by carrying Faraday-style aethers and their infinitely dense vectors into quantum field theory is, for example, an extreme case of a theory making predictions that don't match the evidence.

The other and more amusing option is to pretend that low-complexity alternatives like the one I described don't exist. That works great in print-only situations, but it can be tricky to implement in a modern world full of low-cost global communication. Thus I've taken it upon myself to develop some helpful tips for how to persuade folks to ignore simpler, less complicated models of how the universe works. Here's my most effective tip:

"Terry's arguments are not peer-reviewed. Arguments not filtered through peer review are instantly suspect and not worth reading or taking seriously. Just ignore him."

I like this one! It makes life easier for many folks, so I think I should do all I can to support it. I've slipped once or twice and submitted a few minor peer-reviewed papers in physics, but I'll try hard never to do that again, at least not for any paper written only by myself. I'm always glad to help others research, but my goals have always been to develop a good strategy for solving intransigent problems, not publishing papers.

For those who prefer to dismiss out-of-hand any unreviewed concept that leads to a more straightforward but experimentally sound model of the universe and could be tricky to dismiss in any open discussion based only on the merits of the idea, I pledge to do all I can to support the "he's not peer-reviewed!" argument. It's the least I can do since physics is a challenging problem that we all need to work on together, yes?

Finally, here's an important point to ponder about continuum maths: They are addictive, especially in their more spectacular and mind-blowing incarnations. Even Einstein eventually returned to Faraday's aethers since they are implicit in Minkowski's continuum math approach. In his later years, Einstein once bluntly stated that GR was an aether theory at a specific limit. That's a quote you don't see bandied about much! Spacetime aethers and their Planck-foam elaborations are most tempting to folks who enjoy extrema and infinities. They are even more tempting if exploring such extrema requires knowledge not readily accessible to folks without years of training. Taking special pride in unique knowledge that sets you apart has, of course, been around for millennia. Examples include the Roman version of Mithraism, the Christian Gnostics, and the Pythagorean math cult. Pythagoreans were more cultish than folks realize. They once executed one of their members for daring to prove the existence of non-rational numbers, which did not go well with Pythagoras. That's one way to win an argument, I guess!

In any case, such interplay makes for deeply fascinating, fun-to-follow social dynamics.

Cheers,
Terry

Terry Bollinger
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PDF: https://sarxiv.org/apa.2023-03-06.1051.pdf

Addendum 2023-03-09.17:00 EST Thu

See reference [1] on the next page for a graphical derivation of the Lorentz meter.

[1] **Graphical derivation of the Lorentz meter m_L**

Erratum: The pre-addendum $m_L = 57.755 \times 10^{-6}\sqrt{ns{\cdot}m}$ had both a typo and a wrong value. The intended unit was $\sqrt{s{\cdot}m}$, which gives values in the micro range and thus is less useful than $\sqrt{ns{\cdot}m}$. The value is also seriously off due to using an unverified calculation.

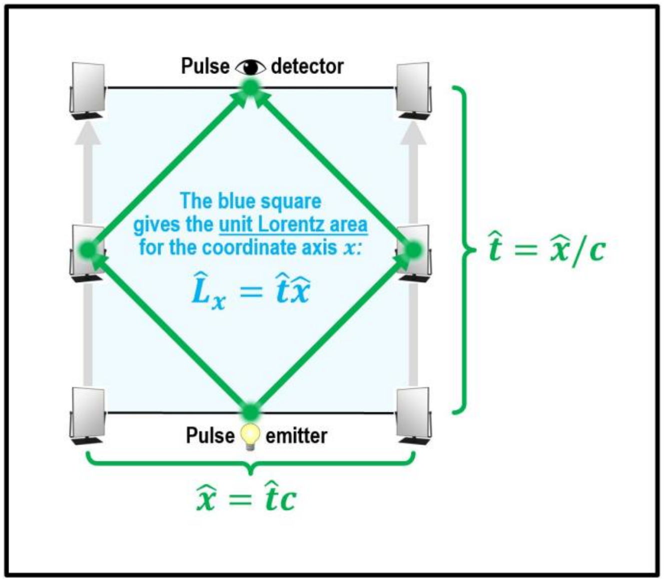

Figure 1. *Unit Lorentz area.* In special relativity, a moving object contracts in the direction of motion and dilates in time, both by the Lorentz factor $\gamma = 1/\sqrt{1-\beta^2}$. Multiplying the contracted length by expanded duration cancels the Lorentz factors to give a relativistically invariant distance metric, the *Lorentz area*, that combines space and time into one number.

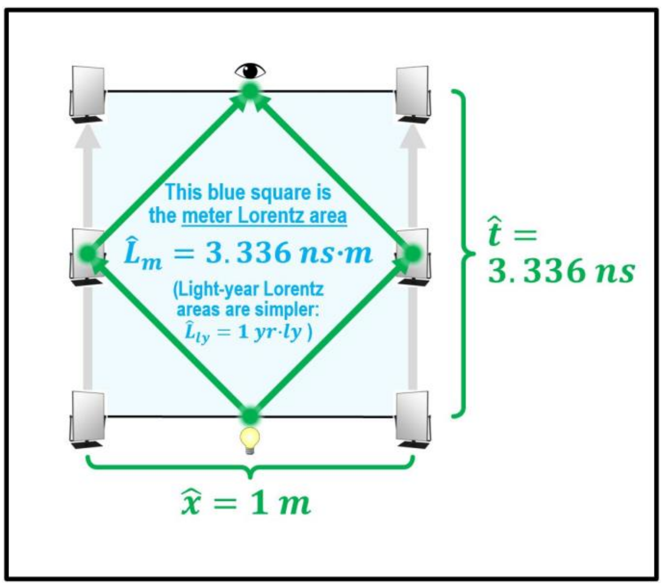

Figure 2. *Meter Lorentz area.* Every length has a corresponding Lorentz area. For meters, $ns{\cdot}m$ units give the best results. The issue is that doubling a conventional distance between two objects quadruples their Lorentz area distance. Consequently, the best units for expressing a Lorentz area are ones in which the speed of light in those units is close to 1. For example, since $c = (1\ ly)/(1\ yr) = 1$, the Lorentz area distance (LAD) between two objects $1\ ly$ apart is $1\ yr{\cdot}ly$. However, for objects $2\ ly$ apart, their LAD rises to $4\ yr{\cdot}ly$.

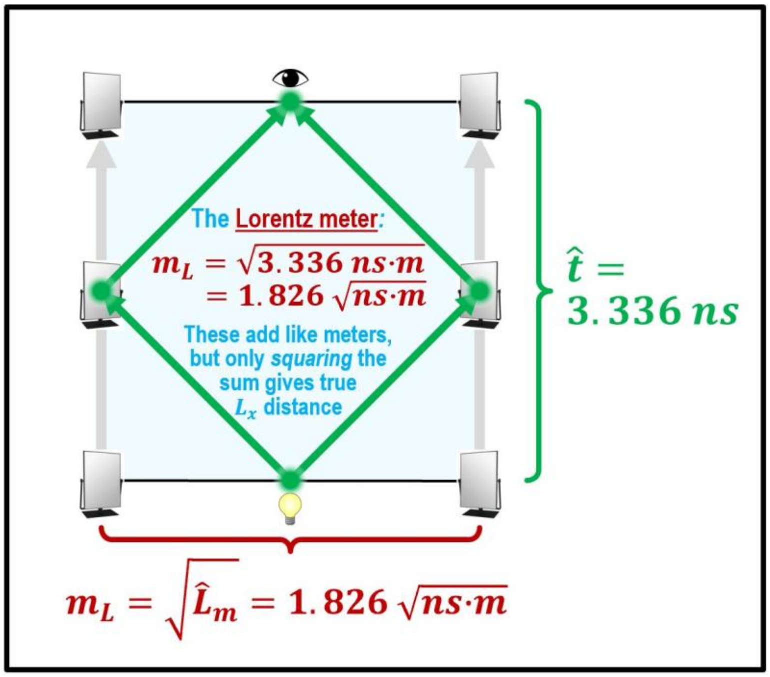

Figure 3. *Lorentz meter.* The Lorentz meter, m_L, is the square root of the meter Lorentz area. Lorentz meters are additive like space-only meters, making them more intuitive for describing large-scale structures. However, this simplicity can also be deceptive since only the *square* of the resulting sum accurately describes the invariant distances of the universe at large, making them independent of the time and space coordinate choices of any specific observer.

In summary, Lorentz areas are beneficial for describing the structure of large systems, including the universe as a whole. The main advantage of using LADs is that they remain separate from the velocity state of the observer. In contrast, the observer-intensive concepts of "length" and "duration" are local, with their impact depending on the number and degree of distribution of participating objects. For this reason, observer-only, frame-specific xyzt breakdowns should never be confused or considered as fundamental to the universe's state as the total set of observer-independent Lorenz area distances.

For example, an object rapidly accelerated to 0.6 c *immediately* begins observing the clocks of unaccelerated objects residing on its forward path as ticking twice as fast as its clocks. This faster passage of time for external objects along the forward path combines with the internal passage of time to give net time dilation predicted by the Lorentz factor each time the moving object encounters one of those forward-path clocks.

The common idea that fast-moving objects see clocks in their forward path as moving *slower* in time is incorrect. The reality of anti-dilation or time speed-up along the forward path is proven whenever the moving object encounters such objects and compares clocks.

A stand-alone copy of this addendum is available at:

https://sarxiv.org/apa.2023-03-09.1700.pdf