Dark Energy and Żenczykowski's Hadron-Spacetime Duality

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2023-11-10.18:24 EST Fri
https://medium.com/@terrybollinger/while-not-young-creative-or-ambitious-i-am-old-annoyingly-disrespectful-and-enjoy-helping-b11759635c56

A Comment on the Starts With A Bang (Medium Member-Only) post:
Ask Ethan: What drives the expansion of the Universe? (Nov 10, 2023)
https://medium.com/starts-with-a-bang/ask-ethan-what-drives-the-expansion-of-the-universe-87bf582c944f

At the end of his excellent but (alas!) members-only post, Ethan Siegel hypothesizes a direct connection between early energetic cosmic inflation and present-day dark energy domination. He concludes his essay with the hope that some young, creative, ambitious person reading his essay may eventually validate and explain his hypothesis. Here's my comment on his essay:

While not young, creative, or ambitious — I am old, annoyingly disrespectful, and enjoy helping others succeed far more than helping myself — I would make one oddly simple suggestion: If space and time are nothing more than properties matter akin to charge or spin, as Piotr Żenczykowski suggests [1], then it becomes challenging *not* to end up in a reciprocal relationship. The explosive energy at the start of some vast cycle becomes inhibitive towards the end as this reciprocal relationship shifts between the two ends. It becomes a matter of resource allocation rather than independent effects.

Żenczykowski's paper makes the most explicit assertion I've encountered in peer-reviewed journal literature that the trio of orthogonal down-quark charges axes observed in Standard Model fermions are the *sources* of the complicated emergent behaviors that, at classical single-frame scales, we think of as space and time. If Żenczykowski is correct, the resulting emergent property pairs would be delightfully and deliciously ironic.

In the paper, Żenczykowski summarizes the situation this way: "... the emergence of space [is] a byproduct of the transition of matter from the 'algebraic rishon' level [to] leptons and hadrons." [2] And no, that interpretation cannot be found in most Standard Model literature. I suspect that's the main why Żenczykowski's remarkable and (I would assess) deeply insightful work hasn't received more attention.

Żenczykowski proposes a deeply fundamental relationship between the near-point-like scale of particles such as protons and neutrons and the vastness of the cosmos. It's a broken reciprocal symmetry in which the observed universe's ability to exhibit vast particle separations depends directly and inversely on the intensity and binding of the strong force. Similarly, compact electric charge cancelation leads to the vastness of time. For that reciprocal relation, the sharpness of emergent time depends on the compactness of electric charge cancellation, with the average resolution level set by hydrogen.

A follow-up question asked whether Żenczykowski's proposed connection between particle physics and cosmic-scale spacetime might also mean that the matter-antimatter pairs of particle physics might suggest that our universe similarly has a "sister" or anti-universe. Here's my response:

Posted 2023-11-11.12:06 EST:
https://medium.com/@terrybollinger/regarding-your-sister-universe-idea-mutually-cancelling-pairing-is-a-strikingly-persistent-feature-8ceb32570ca4

Regarding your sister universe idea, mutually canceling pairing is a strikingly persistent feature at every physics scale, from virtual particle pairs to cosmic-scale action-reaction pairs. The concept of dual universes — essentially the idea that the universe we observe is half of an exceptionally vast and profoundly persistent "virtual pair" — has been a well-defined part of the journal literature since a paper in 2004 by Jennifer Chen and Sean Carroll [6]. There are issues that Chen and Carrol did not address at that time, such as the fact that the opposing universe cannot be composed of ordinary antimatter without creating intractable broken symmetry issues.

I also have an unnervingly detailed take on this issue [7] since I independently developed the dual universe concept in 2007. I confess to being both annoyed and intrigued when I discovered that Jennifer Chen and John Carroll beat me to the idea by three years.

Since then, several authors have written on the topic and added new spins. Several later papers address the CPT symmetry issue that was not part of the 2004 Chen-Carroll paper. I do not know if Ethan Siegal has ever addressed dual universes, but I'll look later today. It would be fascinating to see his take on the issue.

References

[1] P. Żenczykowski, *Quarks, Hadrons, and Emergent Spacetime*, Foundations of Science **24** (2), 287–305 (2019). https://arxiv.org/abs/1809.05402

[2] *Note:* By "algebraic rishons," Żenczykowski appears to mean the fully orthogonal triplet of mixed-charge coordinates first described in Sheldon Glashow in his 1979 fermion-family coordinate system [3][4][5].

[3] S. L. Glashow, *The Glashow Fermion Cube [Figure]*, Apabistia Figures **1979**, 07010000 (1979). https://sarxiv.org/fig.1979-07-01.0000.jpg

[4] T. Bollinger, *Fermion Charges as 3D Displacements [Figure]*, Apabistia Figures, **2020**, 02121329 (2020). https://sarxiv.org/fig.2020-02-12.1329.jpg

[5] T. Bollinger, *Gen-1 Fermions as T3 Weak-Isospin Hypercube Bridge Vectors [Figure]*, Apabistia Figures **2022**, 01041003 (2022). https://sarxiv.org/fig.2022-01-04.1003.jpg

[6] S. Carroll and J. Chen, *Spontaneous Inflation and the Origin of the Arrow of Time*, arXiv preprint **2004**, 0410270 (2004). https://arxiv.org/abs/hep-th/0410270

[7] T. Bollinger, *On Quantizing General Relativity: An Overview [Presentation]*, Apabistia Notes **2022**, 04211039 (2023). https://sarxiv.org/apa.2022-04-21.1039.pdf