Core Issues in "Foundations of QFT: 2019 Annual Philosophy of Physics Conference"

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This year's workshop is focused upon three core issues[1]. Paraphrasing and rearranging their order, we examine optimal mathematical formalisms for the wavefunction and its interactions (particularly in light of the problem of renormalization), phenomenological foundations, and relativistic extensions of quantum mechanics.

Optimal Formalisms and Renormalization

The naive realist[2] wants a **vacuum wavefunction** that can be visualized in real physical three-dimensional space. The reductionist begins by modeling the vacuum wavefunction with the fundamental geometric objects of Euclid - point, line, plane, and volume elements. These comprise the eight components of a minimally complete Pauli algebra of space - one scalar, three vectors (three orientational degrees of freedom), three bivector area elements, and one trivector volume element[3–5].

Wavefunction interactions permit emergence, are modeled by the geometric product of Clifford algebra. Interactions generate the geometric vacuum S-matrix in the sixteen component basis of Dirac algebra.

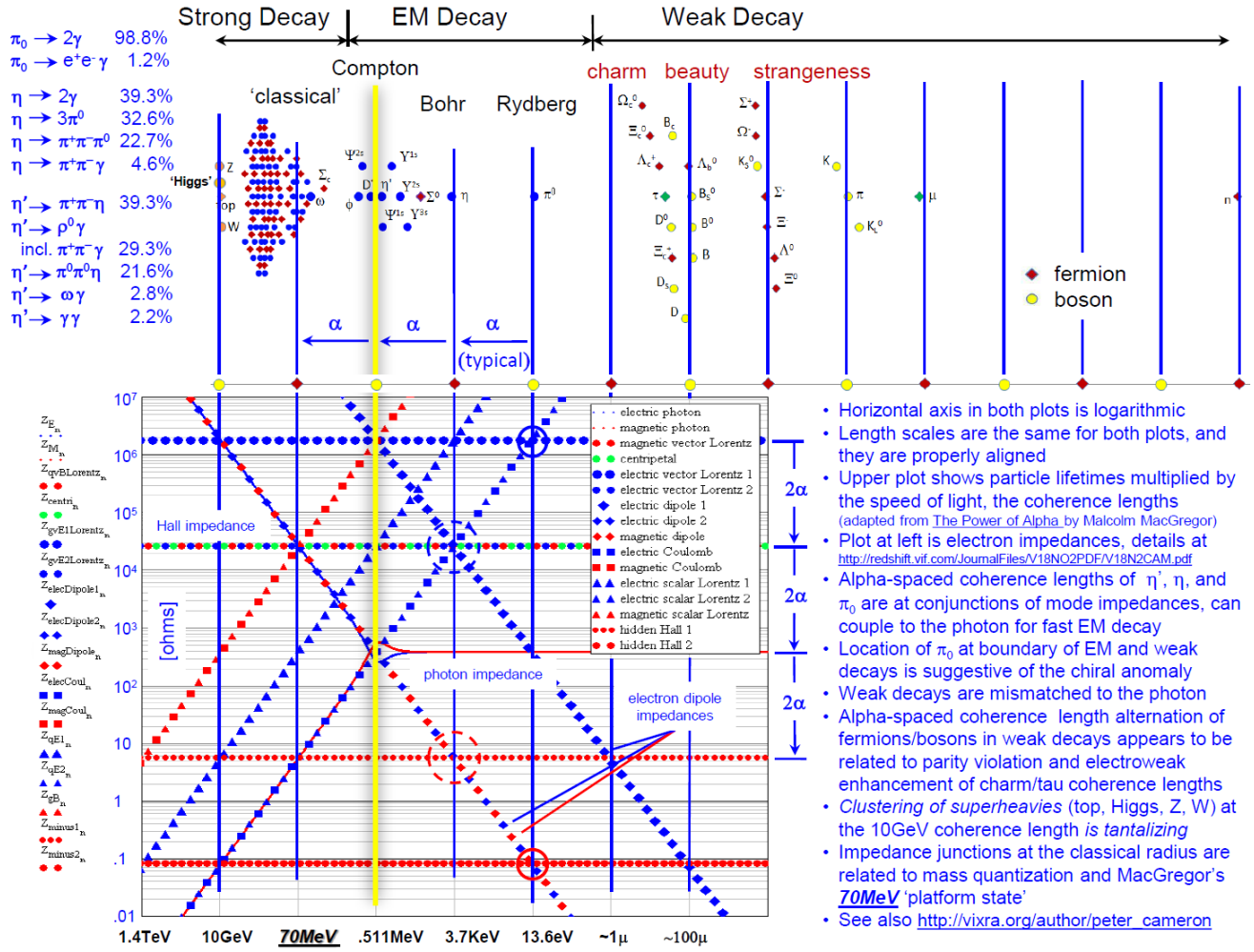

FIG. 1: Correlation of lifetimes/coherence lengths of unstable particle spectrum[6, 7] with nodes of the impedance network generated by excitation of lightest stable rest mass manifestation (mass gap) of vacuum wavefunction[8, 9], nodes where impedances are matched to permit energy transmission essential for unstable particle decay.

Physical manifestation of Geometric Wavefunction Interactions (GWI) follows from introducing the dimensionless electromagnetic coupling constant $\alpha = \frac{e^2}{2\epsilon_0 hc}$. The four fundamental constants that define α permit assignment of topologically appropriate quantized E and B fields to the eight vacuum wavefunction components, and to calculate quantized impedance networks of wavefunction interactions[8, 9].

This is important: Impedance matching governs amplitude and phase of energy flow, of information transmission.

The model is finite, confined, asymptotically free. Singularity and boundary are decoupled by infinite mismatches. No renormalization. Energy reflected from mismatches back to Compton wavelength provides confinement.

Phenomenological Foundations

The GWI model is effective at all scales, vacuum wavefunction is unchanging. Quantized E and B flux integrals associated with wavefunction components are invariant, scalar electric charge being the most familiar of the eight. The physics that emerges from their interactions is determined by the scale to which they are confined.

Figure 1 shows anchoring of the GWI model in experimental data of unstable particle lifetimes, an explanation absent from Standard Model and String Theory physics. The model is equally effective at the Planck length[10], and at the boundary of the observable universe[11], contains gravitation and dark energy.

Special Relativity and Quantum Mechanics

Relativistic QM is founded upon a fundamental logical error. QM is inherently two-body, the story of two wavefunctions and their interactions. SR is inherently three-body. The Lorentz transform is simply the Pythagorean theorem. SR requires an observer. There is no observer in two-body interactions of QM, just two wavefunctions.

The impedance network shown in figure 1 covers almost all the range of experimentally accessible physics. This would not be possible if the GWI model were not naturally relativistic, more fundamental than SR. SR is emergent.

Discussion

The optimal formalism is the geometric representation of Clifford algebra, optimal choice of fields electric and magnetic. Optimal representation is not Lagrangian analysis of energy flow, but rather that which governs amplitude and phase of that flow, the naturally gauge invariant quantized impedance networks.

The resulting model is arguably maximally natural[12], naturally finite and confined, contains both gravitation and the weak and strong nuclear forces, both dark energy and dark matter. Perhaps most welcome, it removes the paradox and confusion driving long-term proliferation of quantum interpretations[13, 14]. Philosophy sits strong at the foundation.

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[1] http://www.rotman.uwo.ca/event/foundations-of-quantum-field-theory-2019-annual-philosophy-of-physics-conference/

[2] L. Smolin, *Einstein's Unfinished Revolution: The Search for What Lies Beyond the Quantum*, Penguin Press (2019) The preface has a lucid introduction to realism, a central theme of the text.

[3] D. Hestenes, *Space-Time Algebra*, Gordon and Breach, New York (1966)

[4] D. Hestenes, "Oersted Medal Lecture 2002: Reforming the mathematical language of physics", Am. J. Phys. **71**, 104 (2003)

[5] N. Wolchover, "The Peculiar Math That Could Underlie the Laws of Nature", Quanta magazine, 20Jul2018. https://www.quantamagazine.org/the-octonion-math-that-could-underpin-physics-20180720/

[6] M. H. MacGregor, "The Fine-Structure Constant as a Universal Scaling Factor", Lett. Nuovo Cimento **1**, 759-764 (1971)

[7] M. H. MacGregor, *The Power of Alpha*, World Scientific (2007) see also http://137alpha.org/

[8] P. Cameron, "Electron Impedances", Apeiron **18** 222 http://redshift.vif.com/JournalFiles/V18NO2PDF/V18N2CAM.pdf

[9] P. Cameron, "Generalized Quantum Impedances: A Background Independent Model for the Unstable Particles" (2012) http://arxiv.org/abs/1108.3603

[10] P. Cameron, "Quantizing Gauge Theory Gravity", Barcelona conf. appl. geometric Clifford algebra, p.89-98 (2015) http://www-ma2.upc.edu/agacse2015/3641572286-EP/

[11] P. Cameron, "Quantum Gravity in the Fano Plane" (2019) http://vixra.org/abs/1904.0007

[12] S. Hossenfelder, *Lost in Math: How Beauty Leads Physics Astray*, Basic Books (2018) All about naturalness.

[13] M. Suisse and P. Cameron, "Quantum Interpretation of the Impedance Model" (2014) http://vixra.org/abs/1311.0143

[14] M. Suisse and P. Cameron, "Quantum Interpretation of the Impedance Model as informed by Geometric Algebra" (2016) http://vixra.org/abs/1608.0129