INSIGHTS FROM A PREGEOMETRIC PERSPECTIVE OF GAUGE THEORY

Priidik Gallagher[1] (presenting author)

[1]*Laboratory of Theoretical Physics, Institute of Physics, University of Tartu, W.Ostwaldi 1, 50411 Tartu, Estonia*

e-mail of presenting author: priidik.gallagher@ut.ee

The nature of particles and fundamental interactions, despite the success of the Standard Model and General Relativity, remains yet to be fully solved. Indeed, most obviously, the classical geometrical theory of General Relativity does not even entirely and consistently mesh into the non-Abelian $U(1)\times SU(2)\times SU(3)$ quantum field theory of the Standard Model, outside of some semiclassical approach, like, for example, providing a curved background setting for the quantum field theory. The modern differential geometry of fiber bundles and connections yields a unified apparatus for working with a field theory, but not a unified theory itself, in the way commonly understood and desired in particle physics.

The problem is manifold. One possible solution follows a novel Cartan-geometric Lorentz gauge theory of Khronon gravity [1], which appears to provide a setting for the appearance of gravity, spacetime itself, and notably dark matter dust in unison through a reduction of the coframe to vector substructure [2]. When the same pregeometric principle is applied to Yang-Mills gauge theory, the first order Isokhronon theory provides a rather explicit analogy with gravity and apparent physically significant integration constant freedom, which for electromagnetism is interpretable as vacuum magnetization and polarization [3]. Nevertheless, many subtleties remain, to the geometric, and physical, requirements of the theory, applicability for proper unification, and the correct direction to focus endeavours toward, with much work still in progress.

References

1. T. G. Złośnik, F. Urban, L. Marzola, and T. Koivisto, Classical Quantum Gravity **35**, 235003 (2018).
2. P. Gallagher and T. Koivisto, Symmetry **13**, 2076 (2021).

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