Is There Evidence for Fractional Neutrinos in Cosmological Observations?

Ervin Goldfain

Photonics CoE, Welch Allyn Inc., Skaneateles Falls, NY 13153, USA

Abstract

Correlations of temperature fluctuations in the Cosmic Microwave Background are linked to the effective number of neutrino flavors present in the era of recombination (N_{eff}). The Standard Model of particle physics (SM) constrains N_{eff} to be precisely three and all results to-date are indeed compatible with this number. However, current cosmological data consistently hint that N_{eff} is somewhat larger than three. These findings may be the first tentative evidence for exotic matter that contains non-integer number of quanta per state, as first postulated by the author in 2006.

Steven Weinberg has recently pointed out that the effective number of neutrino species derived from astrophysical measurements may be at odds with the SM, a result hinting at non-baryonic Dark Matter [1-2]. Excluding the contribution of low-sampling or systematic noise in the data, a possible solution to this apparent anomaly is to postulate the existence of Goldstone bosons emerging from breaking of a previously unknown continuous symmetry.

However, a more provocative thought is to consider that all these reports are the first evidence for exotic matter composed of *fractional quanta*, as suggested by us in [3-7]. We believe that it is an intriguing possibility, worthy of further investigation and likely to be confirmed or falsified in the upcoming years.

References:

[1] http://arxiv.org/abs/1305.1971

[2] http://arxiv.org/abs/1303.5076

[3] http://www.sciencedirect.com/science/article/pii/S0960077905008659

[4] http://www.gallup.unm.edu/~smarandache/PP-15-02.pdf

[5] http://www.sciencedirect.com/science/article/pii/S1007570406001183

[6] E. Goldfain, "Non-equilibrium Theory, Fractional Dynamics and Physics of the Terascale Sector" in *New Developments in the Standard Model*, Nova Science Publishers, 41-74 **(2012)**.

[7] E. Goldfain, "Fractional Field Theory and High-Energy Physics: New Developments" in *Horizons in World Physics*, 279, Nova Science Publishers, 69-92 **(2013)**.