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Can Chirality Flips Occur in a Multi-Fold Universe? What About Conservation Laws?

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Abstract:

In a multi-fold universe, gravity emerges from Entanglement through the multi-fold mechanisms. As a result, gravity-like effects appear in between entangled particles that they be real or virtual. Long range, massless gravity results from entanglement of massless virtual particles. Entanglement of massive virtual particles leads to massive gravity contributions at very smalls scales. Multi-folds mechanisms also result into a spacetime that is discrete, with a random walk fractal structure and non-commutative geometry that is Lorentz invariant and where spacetime nodes and particles can be modeled with microscopic black holes. All these recover General relativity at large scales and semi-classical model remain valid till smaller scale than usually expected. Gravity can therefore be added to the Standard Model. This can contribute to resolving several open issues with the Standard Model (SM) without new Physics other than gravity. These considerations hint at a even stronger relationship between gravity and the Standard Model.

In past papers, we have argued that chirality flips can occur in the presence of non-negligible gravitational effects. In multi-fold universes, it led us propose mechanisms to justify the absence of proton decay and the possible existence in flight of right-handed neutrinos and left-handed anti-neutrinos. However, we based these proposals on helicity flips at scales above mass acquisition by the Higgs mechanisms. We did not discuss the obvious implications on conservation of the weak hypercharge or weak isospin. This paper does so.

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1. Introduction

The new preprint [1] proposes contributions to several open problems in physics like the reconciliation of General Relativity (GR) with Quantum Physics, explaining the origin of gravity proposed as emerging from quantum (EPR-Einstein Podolsky Rosen) entanglement between particles, detailing contributions to dark matter and dark energy and explaining other Standard Model (SM) mysteries without requiring New Physics beyond the Standard Model other than the addition of gravity to the Standard Model Lagrangian. All this is achieved in a multi-fold universe that may well model our real universe, which remains to be validated.

With the proposed model of [1], spacetime and Physics are modeled from Planck scales to quantum and macroscopic scales, and semi classical approaches appear valid till very small scales. In [1], it is argued that spacetime is discrete, with a random walk-based fractal structure, fractional and noncommutative at, and above, Planck scales (with a 2-D behavior and Lorentz invariance preserved by random walks till the early moments of the universe). Spacetime results from past random walks of particles. Spacetime locations, and particles, can be modeled as microscopic black holes (minimal Schwarzschild for photons and spacetime coordinates, and metrics between Reisner Nordstrom [2] and Kerr Newman [3] for massive and possibly charged particles – the latter being possibly extremal). Although surprising, [1] recovers results consistent with other like [4], while also being able to justify the initial assumptions of black holes from the gravity, or entanglement model, in a multi-fold universe. The

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resulting gravity model recovers General Relativity at larger scale, as a 4-D process, with massless gravity, but also with massive gravity components at very small scale that make gravity significant at these scales. Semi-classical models also turn out to work well till way smaller scales than usually expected.

The present paper revisits, and completes, the analysis and implications of chirality flips due to gravity in multi-fold universes versus more conventional helicity flips. These chirality flips are behind the proposals made in [1,5-9], and therefore the derivations of the SM_G (Standard Model with non-negligible gravity at its scale) properties that differ or clarify the SM.

In this paper, we remain at a high level of discussion of the analysis and references are generic for the subjects. It makes the points accessible to a wider audience and keeps the door open to further papers or discussions devoted to details of interest. Yet, it requires the reader to review [1], as we do not revisit here all the details of the multi-fold mechanisms or reconstruction of spacetime. More targeted references for all the material discussed here are compiled in [1] and derived papers.

2. Conventional helicity flips vs. chirality flips

As discussed in [1,5-9], we relied on [10-12] to show how helicity can be flipped by gravity (curved space in semiclassical mode or linearized conventional gravitons). {10-12] did not agree on the behavior for massless chiral fermions; the discrepancies were interpreted in [1,5,6] to the difference between semi-classical and quantized approximations and on that basis favored [10], with helicity flips also in the massless cases.

For massless (Weyl) fermions, helicity flips are equivalent to chirality flips. Based on the reasoning, if a massless chiral fermion interacts with gravity, its chirality will flip back and forth.

3. Problems with chirality flips

Chirality flips due to interaction with the Higgs boson confer mass to the fermions. As left-handed and right-handed fermions have different quantum numbers for the weak isospin and weak hypercharge, these appear not conserved. They are because of the Higgs bosons, in the vacuum carrying the difference required to conserve these quantum numbers.

If massless Weyl fermion have their helicity flipped, a priori, no candidate is involved to preserve conservation of weak isospin and weak hypercharge.

4. Gravity induced chirality flips in multi-fold universes

In [9], we proposed a scenario whereby every concretized spacetime location is associated to Higgs fields through Higgs boson microscopic black holes. As a results, even when interacting with gravity (curved spacetime or effective potential) instead of Higgs bosons, there is always an associated (set of) Higgs bosons where a Weyl fermion is located when chirality flips. The Higgs boson can carry or provide the deltas in weak isospin and weak hypercharge; essentially as in conventional Higgs interactions and chirality flips can take place as envisaged in [1,5-9].

5. Conclusions

We have completed the model of fermion chirality flips in multi-fold universe due to gravity. The model of Higgs microscopic black holes at any concretized spacetime location derived in [9] enables chirality flips of chiral fermions in between the mass generation interactions with the Higgs boson. Of course, post chirality flips helicity flips can also take place with the massive fermions.

Proposals for right-handed neutrinos [6,7,9] and absence of proton decay due to stronger lepton and baryon number symmetries [5] remain valid.

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