Multi-Fold Universe Dark Matter Effects Survive Low-Mass Galaxies with Dark Matter Deficits and Excesses

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October 14, 2020

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 or regions. No New Physics is introduced in terms of new particles beyond the Standard Model or modifying long range gravity: only the modeling of gravity as emerging from entanglement, in a multi-fold universe.

The observations of the existence of low mass galaxies, with excess of dark matter, in some cases, and with deficits in dark matters in others, were presented as proof that dark matter exists as cold dark matter. This paper shows that multi-fold dark matter effects of entanglement can explain the observations and are not in any ways weakened. Of course, it is to be added with the other examples, where our models explain dark matter, and galaxy behaviors, better than conventional explanations, and without requiring New Physics.

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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 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 (concretized) results from past random walks of particles. Spacetime locations and particles can be modeled as microscopic blackholes (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. The 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 work well till way smaller scales than usually expected.

[1,5] derived an explanation for Dark matter in a multi-fold universe, without requiring New Physics.

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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 [1,5], as we do not revisit here all the details of the multi-fold mechanism or reconstruction of spacetime. More targeted references for all the material discussed here are compiled in [1].

2. Multi-Fold Explanation to Dark Matter

[1,5] recovers automatically dark matter with its model of attractive effective potential appearing between physical (real) entangled systems [6], at the difference of virtual ones that already account for gravity.

Accordingly emitted massless (or quasi massless, i.e. neutrinos) particles are entangled in pairs or with their source or intermediate systems. This account for extra gravity like attraction towards the center and / or halos around galaxies. It is illustrated in figure 1 (from [5]).

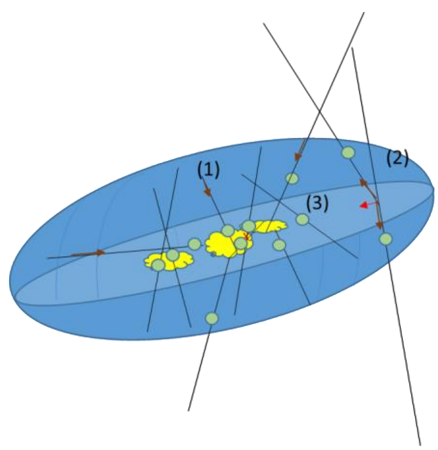

Figure 1: It illustrates how the different entanglements cases, discussed in the text, appear as dark matter with attraction towards the galaxy center and mass in the center or in halos. Green circles represent center of masses. (Reused from [5]).

[5] (see its figure 2) explains that it can also account for globular galaxies where no significant dark matter is detected.

[7] provided additional analyses of astronomical observations that challenged conventional dark matter theories. It shows that we can account for all the reported behaviors.

3. Low-Mass Galaxies with Deficits or Excess of Dark Matter

In 2019, low-mass galaxies have been observed with respectively:

- Excess of dark matter with respect to the typical 5 to 1 ratio [8,9,10,12]
- Deficit of dark matter [11,12]

[12], a popular science article, provides a perfect summary of the discoveries and the associated problem. Low masses are assumed to result from interactions with other galaxies that resulted into expelling, i.e. losing, a large number of stars and gas or being expelled and later recombined into a diffuse galaxy. If dark matter were cold matter, then we can expect that they remain with the main galaxy from where stars were expelled (because rather living in halos around the galaxies the matter would not have been influenced and expelled the same way). At best,

a smaller amount would have been expelled. On the other hand, the expelled stars that then recombined into a diffuse galaxy would not have come along with much dark matter.

As a result, the observation of the two types of galaxies (with excess and deficit of inferred dark matter) is presented by many, including [12] as proof that dark matter exists and is in the form of cold dark matter.

Never mind the fact that the envisages scenarios could also have resulted into purer dark matter galaxies as expelled galaxies (recombining dark matter). These are not really observable, or tracked, today unless through gravitational lensing and other universe mass density estimates. They may in fact be part of some of the conventional explanations that could be advanced for the effects discussed in [7].

4. Not only cold dark matter in multi-fold universes

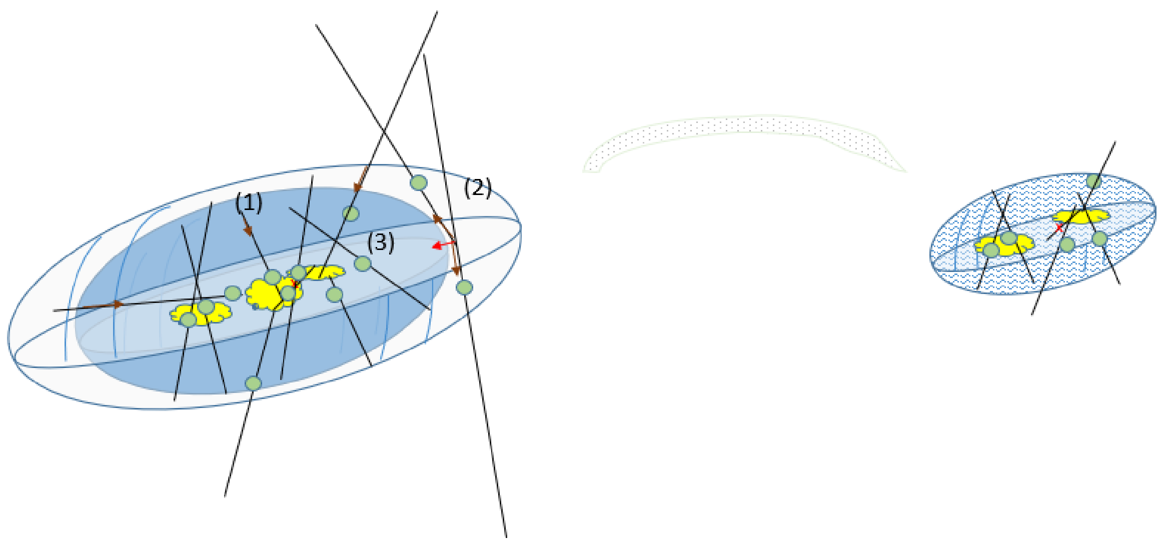

Figure 2: It shows the excess of entanglement per normal matter on the left side and the deficit on the right side for expelled matter recombined into a galaxy. The entanglement effects create the dark matter effects analogous to conventional cold matter.

Following [5], we see that expelled matter will at best generate its own entanglement and not benefit of the rest of the original galaxy effects and history (all the particles out there still with systems in the galaxy or still attracting towards the galaxy center.

So expelled matter will have (at least for a while) only little entanglement effects and hence weaker than expected multi-fold dark matter effects.

On the other hand, the “mother galaxy” will continue to have all these (historical) entangled particles (particles to particles and particles to galaxy systems) attracting towards it, despite having possibly way less matter. Therefore they will present stronger multi-fold dark matter effects.

It is illustrated in Figure 2.

As multi-fold dark matter effects are what the conventional papers call dark matter, the multi-fold dark matter is as suited, and validated, by the observations and explanations of section 3, as cold dark matter.

5. Conclusions

We extended the use cases supported by the multi-fold dark matter models proposed in [1,5,7]. These allowed us to explain, and survive, the new observations that suggest that the observation of low mass galaxies with respectively excess or deficits of dark matter. Entanglement in multi-fold universes work as well.

The model survived the apparently challenge as well as the dominant explanation based on cold matter, that is touted out there . While this is by no means a validation of the multi-fold universe proposal, we consider that it is another supporting and corroborative hint that should encourage the community to seriously consider our proposed mechanisms, and investigate seriously the proposal of attractive gravity-like effect between entangled systems [1,6].

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References: (most references come from popular science to make the discussion more approachable)
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