Multi-Fold Universe Dark Matter Successful Explanation and the "Too Thin Universe" but "Too Strong Gravity Lensing by Galaxy Clusters"

Stephane H. Maes[1]

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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 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.

Two recent observations are considered to have raised new concerns with conventional approach to dark Matter: the universe structures would be too thin for the dark matter conventionally predicted while gravity lensing from galaxy clusters seems too string. In this paper, we argue that our multi-fold explanation for dark matter effect is consistent with such observations.

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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 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.

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

[1] shmaes.physics@gmail.com

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 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]).

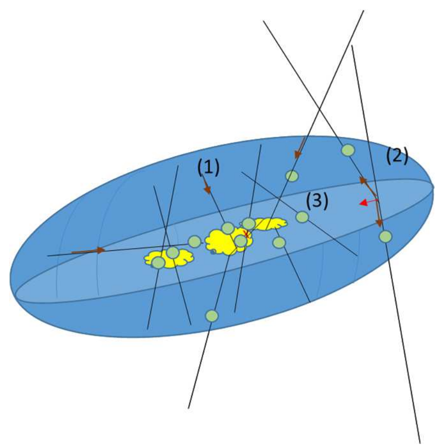

Figure 1: It illustrates how the different entanglement cases, discussed in the text, appear as dark matter with attraction towards the galaxy center and mass in the center or in halos. Green circles represent center of masses. (Reused from [5]).

[5] (see its figure 2) explains that the proposed multi-fold dark matter mechanisms due to entanglement can also account for globular galaxies where no significant dark matter is detected.

3. Too strong lenses by galaxy clusters?

A new study [7] of the gravitational lensing effect due to clusters of galaxies raised significant issues for conventional dark matter [9] and the Λ-CDM [8]: the effect is way stronger than what should be produced by the dark matter thought to be associated to the different galaxies in clusters in between the lensed galaxies. There is simply no conventional explanation yet to such an effect and popular scientific press already identifies this as implying the need for new understanding of dark matter as illustrated for example in [10 - 15]. The amount of article attest the belief that this new study can potentially have significant implications on our understanding of the universe and dark matter or even New Physics.

4. Too strong lenses by galaxy clusters? Not in a Multi-fold Universe

In a multi-fold universe, a straightforward explanation comes from the fact that if galaxies are in a cluster, entanglement can take place between entangled particles emitted from one galaxy and located / entangled within another; an effect hinted and predicted in [5] but without observable consequences so far (as dark matter effect came mostly from effects on rotation of individual galaxies or lensing due to a galaxy). Figure 2 sketches the effect.

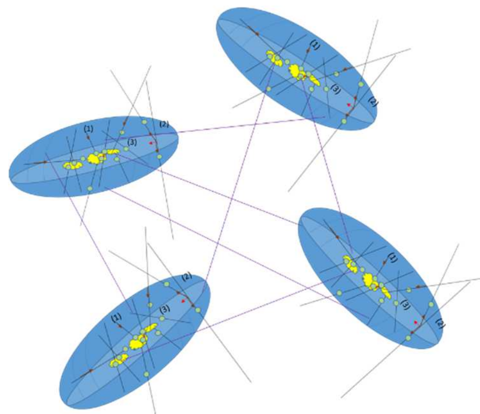

Figure 2: The violet lines between galaxies in a cluster sketch some entanglement support domain that would exist between the galaxies of the cluster. Per the dark matter mechanisms discussed in [1,5], these contribute additional gravity like attraction effects. Combinatorial considerations suggest that the additive contributions could rapidly amount to apparently 10 times or more dark matter that conventionally predicted.

As illustrated in figure 2, combinatorial ways to achieve entanglements can rapidly create much large dark matter estimates that assumed so far.

5. A Too Thin Universe?

On the other hand, another study argues that observed large structure in the universe are too thin compared to what should have been aggregated as a result of the matter + dark matter contained in the galaxies [16]. It also made the popular scientific press [17]. It is the latest of a long line of observation arguing that matter clumping is smaller than expected and that the universe is “too thin” [18,19]

Again, such observations are expected to have significant impact on conventional models, considering the Λ-CDM [8].

6. No Anorexic Multi-fold Universe

In a multi-fold universe, clumping not matching conventional dark matter estimate is explained as follows. When only matter density fluctuations existed and no entanglement could be (strongly) established with regions further away from a local clump, no attraction takes place. Initial clumping is limited. This remains valid: beyond local galaxies or clusters entanglement is nonexistent, weaker (disentanglement occurs before reaching the further away region or only fewer entangled particles can create entanglement with these regions). Without entanglement, no, or less, additional gravity-like attraction takes place and so clumping does not match what would be expected from associated dark matter models.

7. Conclusions

We extended the use cases supported by the multi-fold dark matter models proposed in [1,5]. These allow us to explain and survive the new observations that suggest excess of gravitational lensing by galaxy clusters, on one hand, and insufficient matter clumping on the other hand, when compared to conventional predictions.

The model survives the apparently contradictory challenges better than all the explanations 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 serious consider our proposed multi-fold dark matter mechanisms and investigate seriously the proposal of attractive gravity-like effect between entangled systems [1,6]. Dark matter as a result of entanglement would be a tantalizing macroscopic validation of multi-fold mechanisms and its explanation of gravity emerging from entanglement [1].

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