Explaining Imbalance of Tidally Ejected Stars from Open Stars Clusters without MOND

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Abstract:

Results from a recent paper, and accompanying popular articles, have argued that the observed asymmetry in the numbers, and distributions, of stars tidally ejected in front, versus at the tail of open stars clusters, would favor the MOND theory (Modified Newtonian dynamics), over Newton gravity, and hence General Relativity (GR).

This paper disputes such conclusions by showing that the observed asymmetry can equally well be qualitatively explained with multi-fold mechanisms, which propose that macroscopic entanglements between real particles are behind the effects of Dark Matter, and that entanglements of virtual particles explain gravity. This is captured by the E/G conjecture.

Considering other similar results, and the fact that we encounter hints of multi-folds in our real universe, in particular with GR at Planck scales, we believe that the explanation proposed in our paper is another viable alternative to relying on MOND. As the multi-fold theory recovers GR, our approach does not require modifying GR, with ideas like MOND. In such a universe we can justify why more starts are ejected in the front than at the tail of galaxy clusters, where the galaxies tends to dilute.

1. Introduction

In a multi-fold universe [1,8-10,22,*128,134,135,148*], gravity emerges from entanglement through the multi-fold mechanisms. As a result, gravity-like effects appear in between entangled particles [1,24,25], whether they be real or virtual. Long range, massless gravity results from entanglement of massless virtual particles [1,26]. Entanglement of massive virtual particles leads to massive gravity contributions at very smalls scales [1,27]. It is at the base of the E/G Conjecture [24], and the main characteristics of the multi-fold theory [22]. Multi-folds mechanisms also result in a spacetime that is discrete, with a (2D) random walk fractal structure, and non-commutative geometry, which is Lorentz invariant, and where spacetime nodes and particles can be modeled with microscopic black holes [1,16,27-32]. All these recover General Relativity (GR) at large scales, and semi-classical models remain valid till smaller scale than usually expected. Gravity can therefore be added to the Standard Model (SM) resulting into what we define as SM_G: the SM with gravity effects non-negligible at its scales. This can contribute to resolving several open issues with the Standard Model, and the Standard Cosmological model (ΛCDM) [81] without new Physics other than the addition of gravity [1,4-40,46-69,73-*148*].

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Among the multi-fold SM_G discoveries, the apparition of always in-flight, and hence non-interacting, right-handed neutrinos, coupled to the Higgs boson, is quite notable. It is supposedly always around the right-handed neutrinos, due to chirality flips by gravity of the massless Weyl fermions [1,30,53,57,59,61,94,*113*], induced by 7D space time matter induction and scattering models, and hidden behind the Higgs boson or field at the entry, exit and mapping points of the multi-folds [1,30,94,*138*]. Massless Higgs bosons are modeled as minimal microscopic black holes mark concretized spacetime locations. They can condensate into Dirac Kerr-Newman soliton Qballs to produce massive and charged particles [1,4], thereby providing a microscopic explanation for a Higgs driven inflation, the electroweak symmetry breaking, the Higgs mechanism, the mass acquisition, and the chirality of fermions and spacetime; all resulting from the multi-fold gravity electroweak symmetry breaking [1,4,23,27,28,31,32,58,60-62,69,*143*]. Above the gravity electroweak symmetry breaking, massless particles result from random walk patterns dictated by the 7D space time matter induction and scattering. The multi-fold theory has also concrete implications on New Physics like supersymmetry, superstrings, M-theory and Loop Quantum Gravity (LQG): they are not physical [1,8-21,84,*131,141*].

Multi-folds are encountered in GR, at Planck scales [5,6] and in Quantum Mechanics[2] (QM) if different suitable quantum reference frames (QRFs) are to be equivalent relatively to entangled, coherent or correlated systems [7]. This shows that GR and QM are different facets of something that they cannot well model by themselves: multi-folds.

The paper starts with an overview of the multifold dark matter mechanisms [1,24,25,35], and past papers discussing qualitative alignments with observations and simulations [1,36-40,47], including several cases that were presented as arguments to favor MOND (See [41,42] and reference therein) over GR. Our past results indicate that MOND was not the only explanation, and that indeed multi-fold dark matter effects were as suitable. Our paper aims at reaching a similar conclusion here.

We summarize results obtained in [43], that seem to indicate, again, that MOND would be the preferred model at the large scales of galaxies and above; arguments relished by popular science articles [44,45]. In [46], we commented that such a conclusion may not be warranted.

The paper shows how it is possible to qualitatively account for the reported asymmetric distributions of stars tidally ejected from galaxies.

Considering results as in [6], and our answers to so many open issues with the SM_G as discussed for example in [1,4-40,46-69,73-*148*], we can then argue that these conclusions can apply to our real universe.

2. Multi-Fold explanation for Dark Matter

[1,35] recover automatically dark matter with its model of attractive effective potential appearing between physical (real) entangled systems [25], at the difference of the virtual entangled particles which already account for gravity [1,24-26,*134,135,148*].

Accordingly, emitted massless (or quasi massless, like neutrinos) particles are entangled in pairs, or with their sources or intermediate systems. It account for extra gravity like attraction towards the geometrical center of the entangled systems and / or halos around galaxies. It is illustrated in figure 1 (from [35]).

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[2] Standing in for Quantum Physics in general.

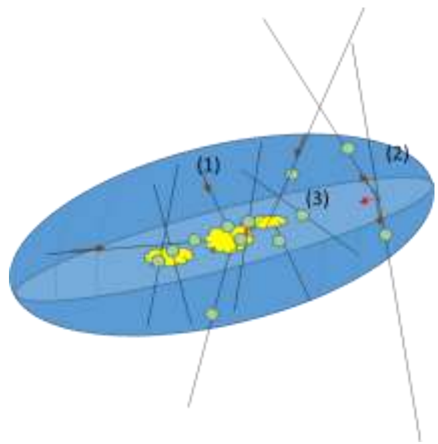

Figure 1: It illustrates how the different entanglements cases, discussed in the text, appear as dark matter with attraction towards the galaxy center and the centers of mass in the galaxy, or in halos. Green circles represent the center of masses. (Reused from [1,35]).

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

[25,36,38] provide additional analyses of astronomical observations that challenge conventional dark matter theories. It shows that we can account for all the reported behaviors, and don't need MOND for that.

[37,40] provides other examples where the multi-fold dark matter effects match simulations, results and/or observations. In these cases, simulated loss of dark matter in galaxy close encounters, excess of disk galaxies vs. what is conventionally predicted, is explained by less galaxy-to-galaxy attraction due to multi-fold dark matter effects, and dark matter halo expansion with time. With multi-fold dark matter effects, MOND [41,42] are no longer "the only alternative explanation" to such conventional dark matter challenges.

3. Multi-fold gravity

[1] describes how, in multi-fold universes, gravity results from the multi-fold mechanisms between virtual particles radiated[3] by sources of energy, e.g., mass. Such a mechanism recovers GR, and Newtown gravity as approximation, with massless gravity at large, and semi classical scales, and massless plus massive gravity at the very short range of massive particle [1,6,26].

Multi-fold gravity is also at the basis of SM_G, a standard model with gravity, where the gravity effects are not negligible at the scales of the SM: effects increase as the scale reduces, and the massive particle ranges start to roughly match the SM scales, so massive effects can also start to contribute.

4. The latest, among many, push for MOND

[3] Proportionally to the mass or energy content of the source.

According to a recent paper [43], and associated popular science articles like [44,45], there is an observed asymmetry of the number of stars ejected in the leading versus the trailing tails of five open clusters of gas forming stars. Note that's only five clusters, probably not enough to be truly conclusive. [43] analyses open clusters of stars and gas, and tidal ejection, which is due to interactions with other stars in the cluster and tidal effects.

This asymmetry is counterintuitive for GR based models.

In [43], the authors rather focus on Newton gravity, but we know that GR is well approximated at such scales by Newton gravity. They argue that their reported observations can be well justified, if one assumes that MOND (Modified gravity [41,42]) reigns instead of conventional GR/Newton gravity. The argument goes as follows: MOND predicts a weakening of gravity as acceleration increases. Figure 2, illustrates it for a simple open cluster model. The acceleration felt in the front (leading tail) is smaller than in the (trailing tail). Therefore, per the MOND theory, the stars in the trailing tail feel a stronger attraction back towards the cluster, and stronger tidal effects, than the ones in the leading tail.

A priori, GR, or Newtown gravity, can't justify such an observed statistical behavior.

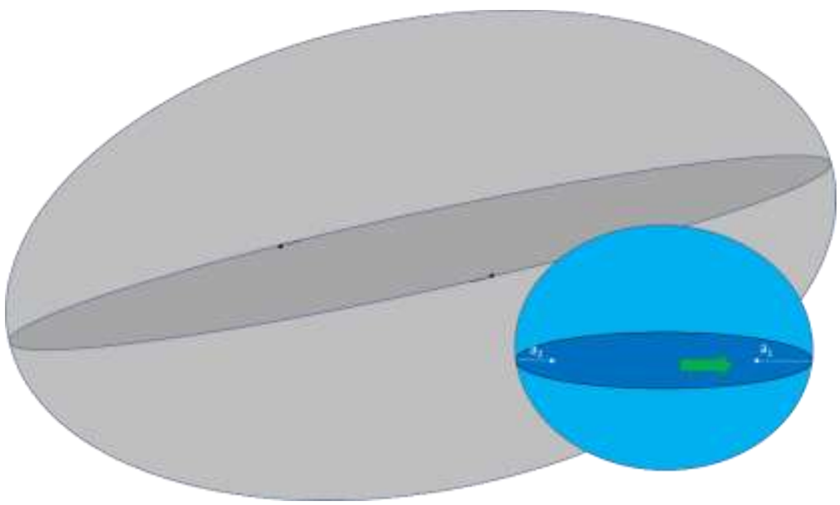

Figure 2: Consider the blue open cluster of stars and gas. It may or may not also be influenced by (a) galaxy(ies), in grey, to recover situations as in [70]. The direction of motion of the cluster is indicated by the green arrow. As the cluster content catches up with the head of the cluster, the attraction effect is expected to increase on the leading side and decrease on the tailing end. Going back to basic Newtown law, it means that the acceleration a_1 is larger than the acceleration a_2. With MOND, the gravity effects would therefore be smaller near the head, while the stars are pulled together by the movement which increases the chances of interactions leading to ejection. In the back, we have stars moving away towards the center and front, and therefore less likely to interact till there. The MOND is busy preventing ejections, pulling back in more strongly any potentially ejected star candidates. As a result we would get stronger tidal effect in front and more possibilities of ejection, consistent with [43,44,45]. However, the cluster expands via it rear and will eventually melt away.

Per figure 2, stars in the front are getting denser in front, which means more opportunity for interaction that result in ejection, and gravity is weaker in front which encourages ejection from the cluster. In the back, gravity pull starts towards center and front where the previous reasoning applies. As a result, the back has less interaction and rather leaks gas or expands the cluster consistent with [43,70].

5. Open clusters of stars in a multi-fold universe

Let us repeat the analysis, and now consider the model of figure 2 in a multi-fold universe. Because of the movement of the clusters, and following the multi-fold mechanisms from [1,*a133-135,148*], including dynamic effects [*109*], the result is that:

- In front (leading tail), gravity pulls consistently towards the center of the cluster because the center of mass of multi-fold associated to pairs of particles and anti-particles (as well as dark matter effects for real particles) moves towards the center, while the content also catches up. It overall increases the chances of interactions resulting in ejection in the front from the cluster.
- In the trailing tail, the opposite occurs and the geometric centers of mass dilute, which results in attraction of the content towards the front and center and towards the end. It reduces the amount of candidate interactions that can produce ejection. Any ejection is still dominantly attracted towards the center and front, which balance contributions from the end, reducing the opportunities to eject from the cluster. Again, the effects expand the clusters (star and gas) but not with ejection [43,70].

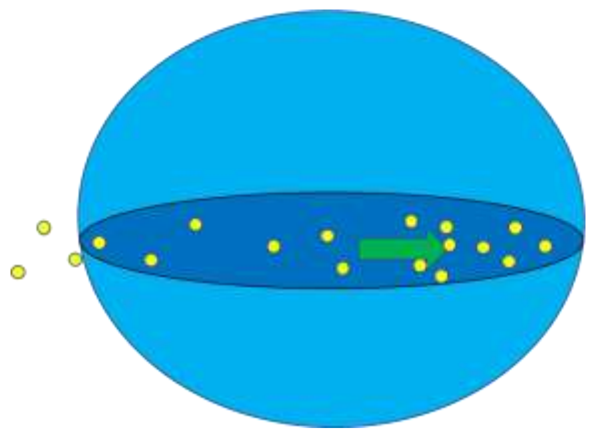

Figure 3: Consider the blue open cluster of stars and gas. Yellow dots represents how the geometrical center (entry points in [1]) of the multi-folds. They are more strongly pulled in towards the center on the leading side and less strongly towards the center and front in the trailing end where it can expand. Yet gravity effects reduces near the head itself and increase in back. As a result, there is an asymmetry that will increase the "interactions" between cluster elements in the front, and reduce it in the trail, even if its pulls open the cluster: opportunities to have interactions resulting into ejection are larger in front than in the back, and ejection from the cluster are easier in the front, while the back dilutes.

In figure 3 and the associated reasoning, we combine effects of multi-fold dark matter and gravity: the involved multi-fold geometrical centers can be both for multi-folds between entangled virtually particles (multi-fold gravity)[1], or between entangled real particles (multi-fold dark matter effects) [35].

6. Conclusions

The paper shows that MOND is not the only possible explanation for the observed asymmetry in the distribution of stars tidally ejected from open clusters.

The fact that multi-fold mechanisms lead to similar qualitative behaviors should again position it as an alternative to MOND, deserving at the minimum the same considerations, especially as we have been able, time and time again, to explain with multi-folds what some claimed that only MOND can explain. The multi-fold theory has the big advantage that it actually does not modify GR, or the Newton gravity approximations. It rather explains additional phenomena, like dark matter, dark energy, or in this case the effect of the dynamics on the overall gravity effects, analogous for example to frame dragging effects of GR [*109*].

This is also to be added to all the other cases where we have shown that multi-fold can explain observations as well as MOND, without the problematic tuning issues that are very well summarized in [71,72].

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References:

[1]: Stephane H. Maes, (2020-2022) "Quantum Gravity Emergence from Entanglement in a Multi-Fold Universe", HIJ, Vol 2, No 4, pp 136-219, Dec 2022, https://doi.org/10.55672/hij2022pp136-219, https://shmaesphysics.wordpress.com/2020/06/09/paper-published-as-preprint-quantum-gravity-emergence-from-entanglement-in-a-multi-fold-universe/, https://shmaesphysics.wordpress.com/2022/11/09/quantum-gravity-emergence-from-entanglement-in-a-multi-fold-universe-2/, and viXra:2006.0088, (June 9, 2020). Errata/improvements/latest updates at https://zenodo.org/doi/10.5281/zenodo.7792911.

[2]: Wikipedia, "Reissner–Nordström metric", https://en.wikipedia.org/wiki/Reissner%E2%80%93Nordstr%C3%B6m_metric. Retrieved on March 21, 2020.

[3]: Wikipedia, "Kerr–Newman metric", https://en.wikipedia.org/wiki/Kerr-Newman_metric. Retrieved on March 21, 2020.

[4]: Stephane H Maes, (2021), "More on Multi-fold Particles as Microscopic Black Holes with Higgs Regularizing Extremality and Singularities", viXra:2210.0004v1, https://shmaesphysics.wordpress.com/2021/02/28/more-on-multi-fold-particles-as-microscopic-black-holes-with-higgs-regularizing-extremality-and-singularities/, February 25, 2021.

[5]: Stephane H Maes, (2020), "Multi-folds, The Fruit From The Loops? Fixing "Oops for The Loops" May Encounter Multi-folds in General Relativity And The E/G Conjecture", viXra:2212.0206v1, https://shmaesphysics.wordpress.com/2021/12/31/multi-folds-the-fruit-from-the-loops-fixing-oops-for-loops-encounters-multi-folds-and-the-e-g-conjecturein-general-relativity/, January 1, 2022.

[6]: Stephane H Maes, (2022), "Deriving the Multi-fold Theory from General Relativity at Planck scale", viXra:2302.0129v1, https://shmaesphysics.wordpress.com/2022/02/22/deriving-the-multi-fold-theory-from-general-relativity-at-planck-scale/, February 22, 2022.

[7]: Stephane H Maes, (2022), "From Quantum Relational Equivalence to Multi-folds Encounter in the Real Universe and Confirmation of the E/G conjecture", viXra:2302.0108v1, https://shmaesphysics.wordpress.com/2022/02/12/from-quantum-relational-equivalence-to-multi-folds-encounter-in-the-real-universe-and-confirmation-of-the-e-g-conjecture/, February 7, 2022.

[8]: Stephane Maes, (2020-2023), "Web Site Tracking all Publications around the Multi-fold universe", Navigation page listing all papers, https://shmaesphysics.wordpress.com/shmaes-physics-site-navigation/.

[9]: Stephane H Maes, (2021), "The Multi-fold Theory: A synopsis", viXra:2112.0144v1, https://shmaesphysics.wordpress.com/2021/12/24/the-multi-fold-theory-a-synopsis-so-far-v2-end-of-2021/, December 24, 2021. Note that additional links will always be available

at https://shmaesphysics.wordpress.com/2021/05/03/the-multi-fold-theory-a-synopsis-so-far/ to track the latest and interim versions of the synopsis, as they may be published under different tittle or URL/publication numbers.

[10]: Stephane H Maes, (2022), "Understanding the Multi-fold theory principles and the SM_G", osf.io/xc74t, https://shmaesphysics.wordpress.com/2022/03/11/understanding-the-multi-fold-theory-principles-and-the-sm_g/, March 11, 2022. Also as Stephane H Maes, (2022), "A tutorial on the Multi-fold theory principles and the SM_G", viXra:2303.0154v1, https://shmaesphysics.wordpress.com/blog-2/a-tutorial-on-the-multi-fold-theory-principles-and-the-sm_g/, March11, 2022..

[11]: Stephane H. Maes, (2022), "Comment on LQG, Superstrings, Supersymmetry and most GUTs/TOEs, all have big problems exposed by the Multi-fold Theory", https://shmaesphysics.wordpress.com/2021/12/27/the-multi-fold-theory-a-synopsis/#comment-3293. Published on January 9, 2022.

[12]: Stephane H. Maes, (2020), "Comment on why no supersymmetry", https://shmaesphysics.wordpress.com/2020/10/11/circular-arguments-in-string-and-superstring-theory-from-a-multi-fold-universe-perspective/#comment-934. Published on October 12, 2020.

[13]: Stephane H Maes, (2020), "Renormalization and Asymptotic Safety of Gravity in a Multi-Fold Universe: More Tracking of the Standard Model at the Cost of Supersymmetries, GUTs and Superstrings", viXra:2102.0137v1, https://shmaesphysics.wordpress.com/2020/09/19/renormalization-and-asymptotic-safety-of-gravity-in-a-multi-fold-universe-more-tracking-of-the-standard-model-at-the-cost-of-supersymmetries-guts-and-superstrings/, September 18, 2020.

[14]: Stephane H Maes, (2020), "Circular Arguments in String and Superstring Theory from a Multi-fold Universe Perspective", viXra:2103.0195v1, https://shmaesphysics.wordpress.com/2020/10/11/circular-arguments-in-string-and-superstring-theory-from-a-multi-fold-universe-perspective/, October 5, 2020.

[15]: Stephane H Maes, (2021), "The String Swampland and de Sitter Vacua: A Consistent Perspective for Superstrings and Multi-fold Universes", viXra:2208.0078v1, https://shmaesphysics.wordpress.com/2021/01/12/the-string-swampland-and-de-sitter-vacua-a-consistent-perspective-for-superstrings-and-multi-fold-universes/, January 9, 2021.

[16]: Stephane H Maes, (2021), "Quantum Gravity Asymptotic Safety from 2D Universal Regime and Smooth Transition to Dual Superstrings", viXra:2208.0151v1, https://shmaesphysics.wordpress.com/2021/02/07/quantum-gravity-asymptotic-safety-from-2d-universal-regime-and-smooth-transition-to-dual-superstrings/, January 29, 2021.

[17]: Stephane H Maes, (2020), "A Non-perturbative Proof of the Asymptotic Safety of 4D Einstein Gravity, With or Without Matter", https://doi.org/10.5281/zenodo.7953796, https://shmaesphysics.wordpress.com/2022/05/04/a-non-perturbative-proof-of-the-asymptotic-safety-of-4d-einstein-gravity-with-or-without-matter/, May 4, 2022, viXra:2305.0138.

[18]: Stephane H Maes, (2020), "Dualities or Analogies between Superstrings and Multi-fold Universe", viXra:2006.0178v1, https://shmaesphysics.wordpress.com/2020/06/14/dualities-or-analogies-between-superstrings-and-multi-fold-universes/, June 14, 2020.

[19]: Stephane H Maes, (2020), "Alignments and Gaps Between Multi-fold Universes And Loop Quantum Gravity", viXra:2006.0229v1, https://shmaesphysics.wordpress.com/2020/06/19/multi-fold-universes-analysis-of-loop-quantum-gravity/, June 18, 2020.

[20]: Stephane H Maes, (2020), "Superstrings Encounter of the Second, Third or Fourth Types?", viXra:2010.0140v1, https://shmaesphysics.wordpress.com/2020/07/19/superstrings-encounter-of-the-second-third-or-fourth-types/, July 5, 2020.

[21]: Stephane H Maes, (2022), "Oops For The Loops II: Real Oops; LQG Does Not Optimize the Hilbert Einstein Action", viXra:2301.0036v1, https://shmaesphysics.wordpress.com/2022/01/05/oops-for-the-loops-ii-real-oops-lqg-does-not-optimize-the-hilbert-einstein-action/, January 5, 2022.

[22]: Stephane H. Maes, (2022), "What is the Multi-fold Theory? Its Main Characteristics in a Few Words", vixra:2207.0172v1, https://shmaesphysics.wordpress.com/2022/07/28/what-is-the-multi-fold-theory-its-main-characteristics-in-a-few-words/, July 28, 2022.

[23]: Stephane H. Maes, (2022), "Justifying the Standard Model U(1) x SU(2) x SU(3) Symmetry in a Multi-fold Universe", https://doi.org/10.5281/zenodo.8422911, https://shmaesphysics.wordpress.com/2022/08/08/justifying-the-standard-model-u1-x-su2-x-su3-symmetry-in-a-multi-fold-universe/, August 8, 2022, (viXra:2310.0040v1).

[24]: Stephane H Maes, (2020), "The E/G conjecture: entanglement is gravity and gravity is entanglement", viXra:2010.0139v1, https://shmaesphysics.wordpress.com/2020/10/15/the-e-g-conjecture-entanglement-is-gravity-and-gravity-is-entanglement/, October 15, 2020.

[25]: Stephane H Maes, (2020), "Gravity-like Attractions and Fluctuations between Entangled Systems?", viXra:2010.0010v1, https://shmaesphysics.wordpress.com/2020/06/25/gravity-like-attractions-and-fluctuations-between-entangled-systems/, June 24, 2020.

[26]: Stephane H Maes, (2020), "Massless and Massive Multi-Gravity in a Multi-fold Universe", viXra:2010.0095v1, https://shmaesphysics.wordpress.com/2020/06/30/massless-and-massive-multi-gravity-in-a-multi-fold-universe/, June 19, 2020.

[27]: Stephane H Maes, (2020), "Explaining Dark Energy, Small Cosmological Constant and Inflation Without New Physics?", viXra:2006.0261v1, https://shmaesphysics.wordpress.com/2020/06/19/explaining-dark-energy-small-cosmological-constant-and-inflation-without-new-physics/, June 19, 2020.

[28]: Stephane H Maes, (2020), "Multi-fold Higgs Fields and Bosons", viXra:2204.0146v1, https://shmaesphysics.wordpress.com/2020/11/10/multi-fold-higgs-fields-and-bosons/, November 6, 2020.

[29]: Stephane H. Maes, (2022), "Schwinger effect and charged black holes", https://shmaesphysics.wordpress.com/2020/11/01/multi-fold-black-holes-entropy-evolution-and-quantum-extrema/#comment-4686, September 25, 2022.

[30]: Stephane H Maes, (2021), "Multi-fold Gravity-Electroweak Theory and Symmetry Breaking", viXra:2211.0100, https://shmaesphysics.wordpress.com/2021/03/28/multi-fold-gravity-electroweak-theory-and-symmetry-breaking/, March 16, 2021.

[31]: Stephane H Maes, (2021), "Multi-fold Non-Commutative Spacetime, Higgs and The Standard Model with Gravity", viXra:2212.0037v1, https://shmaesphysics.wordpress.com/2021/04/18/multi-fold-non-commutative-spacetime-higgs-and-the-standard-model-with-gravity/, April 11, 2021.

[32]: Stephane H Maes, (2022), "Multi-fold Discrete Fractal Spacetime, and the Viability of Local vs. Non-Local Hidden Variables", https://doi.org/10.5281/zenodo.10344634, https://shmaesphysics.wordpress.com/2022/10/30/multi-fold-discrete-fractal-spacetime-and-the-viability-of-local-vs-non-local-hidden-variable-viability/, October 30, 2022, osf.io/qevys, viXra:2312.0065v1.

[33]: Stephane H Maes, (2022), "Unruh effects, Hawking Black Hole Evaporation, Quantum Corrected Larmor Formula, Numbers of Particles in Curved Spacetime: "Same-Same, but Just A Bit Different"", https://doi.org/10.5281/zenodo.8306942, https://shmaesphysics.wordpress.com/2022/07/25/unruh-effects-hawking-black-hole-evaporation-quantum-corrected-larmor-formula-numbers-of-particles-in-curved-spacetime-same-same-but-just-a-bit-different/, July 25, 2022, (viXra:2309.0005).

[34]: Stephane H. Maes, (2022), "Time-Varying Multi-fold Dark Energy Effects and Implications for the Hubble Tension", https://doi.org/10.5281/zenodo.10396357, https://shmaesphysics.wordpress.com/2022/11/13/time-varying-multi-fold-dark-energy-effects-and-implications-for-the-hubble-tension/, November 13, 2022, https://osf.io/preprints/osf/rxk8n, viXra:2312.0083v1. Also as Stephane H. Maes, (2022), "The Possibility of a Multi-fold Time-Varying Hubble Constant", viXra:2312.0083v1.

[35]: Stephane H Maes, (2020), "Explaining Dark Matter Without New Physics?", viXra:2007.0006v1, https://shmaesphysics.wordpress.com/2020/06/21/explaining-dark-matter-without-new-physics/, June 21, 2020.

[36]: Stephane H Maes, (2020), "Multi-Fold Universe Dark Matter Successful Explanation and the "Too Thin Universe" but "Too Strong Gravity Lensing by Galaxy Clusters"", viXra:2102.0079v1, https://shmaesphysics.wordpress.com/2020/09/15/multi-fold-universe-dark-matter-successful-explanation-and-the-too-thin-universe-but-too-strong-gravity-lensing-by-galaxy-clusters/, September 14, 2020.

[37]: Stephane H Maes, (2020), "Multi-Fold Universe Dark Matter Effects Survive Low-Mass Galaxies with Dark Matter Deficits and Excesses", viXra:2105.0042v1, https://shmaesphysics.wordpress.com/2020/10/14/multi-fold-universe-dark-matter-effects-survive-low-mass-galaxies-with-dark-matter-deficits-and-excesses/, October 14, 2020.

[38]: Stephane H Maes, (2020), "Multi-Fold Dark Matter Effects and Early Supermassive Black Holes", viXra:2105.0041v1, https://shmaesphysics.wordpress.com/2020/10/15/multi-fold-dark-matter-effects-and-early-supermassive-black-holes/, October 15, 2020.

[39]: Stephane H Maes, (2020), "No Gravity Shield in Multi-folds Universes", viXra:2010.0032v1, https://shmaesphysics.wordpress.com/2020/06/26/no-gravity-shields-in-multi-folds-universes/ , June 26, 2020.

[40]: Stephane H Maes, (2022), "Hints of Multi-fold Dark Matter Effects in the Universe", osf.io/krw7g, https://shmaesphysics.wordpress.com/2022/03/14/hints-of-multi-fold-dark-matter-effects-in-the-universe/, March 14, 2022, https://zenodo.org/record/7791678.

[41]: Mordehai Milgrom, (2014), "The MOND paradigm of modified dynamics", Scholarpedia, 9(6):31410.

[42]: Wikipedia, "Modified Newtonian dynamics", https://en.wikipedia.org/wiki/Modified_Newtonian_dynamics. Retrieved on March 2, 2019.

[43]: Pavel Kroupa, et al., (2022), "Asymmetrical tidal tails of open star clusters: stars crossing their cluster's prah challenge Newtonian gravitation", arXiv:2210.13472v1.

[44]: Michael Irving, (2022), "Puzzling astronomical observations support alternative theory of gravity", https://newatlas.com/science/mond-alternative-theory-gravity-observations/, October 26, 2022. Retrieved on October 27, 2022.

[45]: Micah Hanks, "NEWTON'S LAW OF UNIVERSAL GRAVITATION IS CHALLENGED BY CONTROVERSIAL NEW ASTROPHYSICS DISCOVERY", October 28, 2022, https://thedebrief.org/newtons-law-of-universal-gravitation-is-challenged-by-controversial-new-astrophysics-discovery/. Retrieved on October 29, 2022.

[46]: Stephane H. Maes, "Comments on asymmetry of distributions of ejected star from gas clusters", https://shmaesphysics.wordpress.com/2020/06/21/explaining-dark-matter-without-new-physics/#comment-4813 and subsequent comments, October 27, 2022

[47]: Stephane H Maes, (2022), "Multi-fold Dark Matter and Energy Effects Fit The Ratios to Normal Matter in the Universe", https://zenodo.org/doi/10.5281/zenodo.10071554, https://shmaesphysics.wordpress.com/2022/08/14/multi-fold-dark-matter-and-energy-effects-fit-the-ratios-to-normal-matter-in-the-universe/, August 14, 2022, (https://osf.io/mahsu, viXra:2311.0018v1).

[48]: Stephane H Maes, (2020), "Derivation of the Equivalence Principle in a Multi-fold Universe", viXra:2010.0090v1, https://shmaesphysics.wordpress.com/2020/06/29/derivation-of-the-equivalence-principle-in-a-multi-fold-universe/, June 19, 2020.

[49]: Stephane H Maes, (2020), “Progress on Proving the Mass gap for Yang Mills and Gravity (maybe it’s already proved…)”, viXra:2006.0155v1, https://shmaesphysics.wordpress.com/2020/06/12/progresses-on-proving-the-mass-gap-for-yang-mills-and-gravity-maybe-its-already-proven/, June 12, 2020.

[50]: Stephane H Maes, (2020), “Gravity Induced Anomalies Smearing in Standard Model so that Protons May Never Decay, Except in Black holes“, viXra:2006.0128v1, https://shmaesphysics.wordpress.com/2020/06/13/gravity-induced-anomalies-smearing-in-standard-model-so-that-protons-may-never-decay-except-in-black-holes/, June 13, 2020.

[51]: Stephane H Maes, (2022), ”Gravity or Magnetic Monopoles? You Cannot Have Both! II“, viXra:2006.0190v2, https://shmaesphysics.wordpress.com/2022/08/20/gravity-or-magnetic-monopoles-you-cannot-have-both-2/, August 20, 2022; Stephane H Maes, (2020), ”Gravity or Magnetic Monopoles? You Cannot Have Both!“, viXra:2006.0190, https://shmaesphysics.wordpress.com/2020/06/15/gravity-or-magnetic-monopoles-you-cannot-have-both/, June 15, 2020.

[52]: Stephane H Maes, (2020), ”Ultimate Unification: Gravity-led Democracy vs. Uber-Symmetries”, viXra:2006.0211v1, https://shmaesphysics.wordpress.com/2020/06/16/ultimate-unification-gravity-led-democracy-vs-uber-symmetries/, June 16, 2020.

[53]: Stephane H Maes, (2020), ”Right-handed neutrinos? Mass? Ask Gravity”, viXra:2007.0018v1, https://shmaesphysics.wordpress.com/2020/06/21/right-handed-neutrinos-ask-gravity/, June 23, 2020.

[54]: Stephane H Maes, (2020), ”Strong CP Violation Tamed in The Presence of Gravity”, viXra:2007.0025v1, https://shmaesphysics.wordpress.com/2020/06/23/strong-cp-violation-tamed-in-the-presence-of-gravity/ , June 21, 2020.

[55]: Stephane H Maes, (2020), “Gravity Dictates the Number of Fermion Generations: 3”, viXra:2007.0068v1, https://shmaesphysics.wordpress.com/2020/06/24/gravity-dictates-the-number-of-fermion-generations-3/, June 24, 2020.

[56]: Stephane H Maes, (2020), “Gravity Stabilizes Electroweak Vacuum – No Bubble of Nothing to Worry About!”, viXra:2007.0173v1, https://shmaesphysics.wordpress.com/2020/06/24/gravity-stabilizes-electroweak-vacuum-no-bubble-of-nothing-to-worry-about/, June 24, 2020.

[57]: Stephane H Maes, (2020), ”More Matter Than Antimatter, All Falling Down”, viXra:2010.0121v2, https://shmaesphysics.wordpress.com/2020/07/05/more-matter-than-antimatter-all-falling-down/, July 5, 2020. (V2: April 8, 2021)

[58]: Stephane H Maes, (2020), “Tracking Down The Standard Model With Gravity In Multi-Fold Universes”, viXra:2011.0208v1, https://shmaesphysics.wordpress.com/2020/08/30/tracking-down-the-standard-model-with-gravity-in-multi-fold-universes/, August 20, 2020.

[59]: Stephane H Maes, (2020), “No Conventional Sterile Neutrinos In a Multi-fold Universe: just SMG business as usual”, viXra:2103.0202v1, https://shmaesphysics.wordpress.com/2020/10/02/no-conventional-sterile-neutrinos-in-a-multi-fold-universe-just-smg-business-as-usual/, October 1, 2020.

[60]: Stephane H. Maes, (2020), “Particles of The Standard Model In Multi-Fold Universes”, viXra:2111.0071v1, https://shmaesphysics.wordpress.com/2020/11/05/particles-of-the-standard-model-in-multi-fold-universes/, November 4, 2020.

[61]: Stephane H Maes, (2022), “Can Chirality Flips Occur in a Multi-Fold Universe? What About Conservation Laws? II”, viXra:2204.0152v2, https://shmaesphysics.wordpress.com/2022/08/20/can-chirality-flips-occur-in-a-multi-fold-universe-what-about-conservation-laws-ii/, August 20, 2022 & Stephane H Maes, (2020), “Can Chirality

Flips Occur in a Multi-Fold Universe? What About Conservation Laws?", viXra:2204.0152, https://shmaesphysics.wordpress.com/2020/12/07/can-chirality-flips-occur-in-a-multi-fold-universe-what-about-conservation-laws/, December 6, 2020.

[62]: Stephane H Maes, (2020), "Viable Lattice Spacetime and Absence of Quantum Gravitational Anomalies in a Multi-fold Universe", viXra:2205.0143v1, https://shmaesphysics.wordpress.com/2020/12/13/viable-lattice-spacetime-and-absence-of-quantum-gravitational-anomalies-in-a-multi-fold-universe/, December 4, 2020.

[63]: Stephane H Maes, (2021), "New Physics with LHCb to explain loss of lepton universality, or just gravity?", viXra:2103.0191v1, https://shmaesphysics.wordpress.com/2021/03/29/new-physics-with-lhcb-to-explain-loss-of-lepton-universality-or-just-gravity/, March 29, 2021.

[64]: Stephane H. Maes, "A bold prediction on the muon anomalous magnetic moment, and expected results to be published on April 7, 2021 by the Fermilab Muon g-2, and its explanation", viXra:2104.0030v1, https://shmaesphysics.wordpress.com/2021/04/01/a-bold-prediction-on-the-muon-anomalous-magnetic-moment-and-expected-resulted-to-be-published-on-april-7-2021-by-the-fermilab-muon-g-2-and-its-explanation/, April 1, 2021.

[65]: Stephane H Maes, (2021), "New Physics is often not so new", osf.io/z3sj6, https://shmaesphysics.wordpress.com/2021/04/27/new-physics-is-often-not-so-new/, April 27, 2021, https://zenodo.org/records/7791704.

[66]: Stephane H Maes, (2022), "Direction of Possible Multi-folds Corrections to the W Boson Mass", osf.io/qvewa, https://shmaesphysics.wordpress.com/2022/04/08/direction-of-possible-multi-folds-corrections-to-the-w-boson-mass/, April 8, 2022, viXra:2304.0020.

[67]: Stephane H Maes, (2022), "Multi-folds in Yang Mills Feynman Diagrams", osf.io/y8fpd, https://shmaesphysics.wordpress.com/2022/04/05/multi-folds-in-yang-mills-feynman-diagrams/, April 5, 2022, viXra:2303.0161.

[68]: Stephane H. Maes, (2022), Stephane H. Maes, (2022), "A Conjecture: No Dark Matter will be discovered at LHC, or elsewhere", (v2) https://doi.org/10.5281/zenodo.8175806, https://shmaesphysics.wordpress.com/2022/07/08/a-prediction-no-dark-matter-will-be-discovered-at-lhc-or-elsewhere/, July 8, 2022, viXra:2307.0119.

[69]: Stephane H. Maes, (2022), "Invalidation and Proof of the Mass Gap, and Viability of The Standard Model on a Discrete Spacetime", https://doi.org/10.5281/zenodo.8237456, https://shmaesphysics.wordpress.com/2022/07/15/invalidation-and-proof-of-the-mass-gap-and-viability-of-the-standard-model-on-a-discrete-spacetime/, July 15, 2022. (viXra:2308.0059)..

[70]: Holger Baumgardt and Junichiro Makino, (2003), "Dynamical evolution of star clusters in tidal fields", Mon. Not. R. Astron. Soc. 340, 227–246.

[71]: Ethan Siegel, (2018), "There's A Debate Raging Over Whether Dark Matter Is Real, But One Side Is Cheating", https://www.forbes.com/sites/startswithabang/2018/07/26/theres-a-debate-raging-over-whether-dark-matter-is-real-but-one-side-is-cheating/?sh=5610cc027ae4. Retrieved on August 5, 2020.

[72]: Ethan Siegel, (2022), "Why modifying gravity doesn't add up. The Universe gravitates so that normal matter and General Relativity alone can't explain it. Here's why dark matter beats modified gravity.", Bing Think, https://bigthink.com/starts-with-a-bang/modifying-gravity/. Retrieved on October 19, 2022.

[73]: Stephane H Maes, (2022), "Comments on Multi-fold mechanisms as Hermitian vs. Unitary processes", https://shmaesphysics.wordpress.com/2020/06/25/gravity-like-attractions-and-fluctuations-between-entangled-systems/#comment-4359, July 27, 2022.

[74]: Stephane H Maes, (2020), "Multi-Fold Black Holes: Entropy, Evolution and Quantum Extrema", viXra:2105.0136v1, https://shmaesphysics.wordpress.com/2020/11/01/multi-fold-black-holes-entropy-evolution-and-quantum-extrema/, October 31, 2020.

[75]: Stephane H Maes, (2020), "The W-type Multi-Fold Hypothesis and Quantum Physics Interpretation of wave Functions and QFT", viXra:2207.0118v1, https://shmaesphysics.wordpress.com/2020/12/24/the-w-type-multi-fold-hypothesis-and-quantum-physics-interpretation-of-wave-functions-and-qft/, December 20, 2020.

[76]: Stephane H Maes, (2020), "Implicit Multi-Fold Mechanisms in a Neural Network Model of the Universe", viXra:2012.0191v1, https://shmaesphysics.wordpress.com/2020/09/12/implicit-multi-fold-mechanisms-in-a-neural-network-model-of-the-universe/, September 12, 2020.

[77]: Stephane H Maes, (2020), "Interpretation of "Neural Network as the World"", viXra:2012.0197v1, https://shmaesphysics.wordpress.com/2020/09/14/interpretation-of-neural-network-as-the-world/, September 14, 2020.

[78]: Stephane H Maes, (2020), "Entangled Neural Networks from Multi-fold Universes to Biology", viXra:2207.0174v1, https://shmaesphysics.wordpress.com/2020/12/31/entangled-neural-networks-from-multi-fold-universes-to-biology/, December 25, 2020.

[79]: Stephane H Maes, (2020), "Area Laws Between Multi-Fold Universes and AdS", viXra:2010.0207v1, https://shmaesphysics.wordpress.com/2020/08/10/area-laws-between-multi-fold-universes-and-ads/, August 10, 2020.

[80]: Stephane H Maes, (2022), "Trans-Planckian Censorship Conjecture: Factual in Multi-fold Universes as well as GR Universes", viXra:2303.0025v1, https://shmaesphysics.wordpress.com/2022/03/13/trans-planckian-censorship-conjecture-factual-in-multi-fold-universes-as-well-as-gr-universes/, March 12, 2022.

[81]: Wikipedia, "Lambda-CDM model", https://en.wikipedia.org/wiki/Lambda-CDM_model. Retrieved on August 14, 2022.

[82]: Stephane H Maes, (2020), "No Gravity Induced Wave Function Collapse in a Multi-fold Universe", viXra:2012.0152v1, https://shmaesphysics.wordpress.com/2020/09/11/no-gravity-induced-wave-function-collapse-in-a-multi-fold-universe/, September 11, 2020.

[83]: Stephane H Maes, (2020), "Multi-fold Gravitons In-N-Out Spacetime", viXra:2010.0155v1, https://shmaesphysics.wordpress.com/2020/07/27/multi-fold-gravitons-in-n-out-spacetime/, July 27, 2020, (posted September 6, 2020).

[84]: Stephane H Maes, (2022), "Gravitational Bootstrap, S-matrix, Superstrings, and The Plausible Unphysicality of Gravitons", viXra:2301.0155v1, https://shmaesphysics.wordpress.com/2022/02/06/gravitational-bootstrap-s-matrix-superstrings-and-the-plausible-unphysicality-of-gravitons/, February 6, 2022.

[85]: Stephane H Maes, (2021), "Spacetime and Gravity are 2D around Planck Scales: A Universal Property of Consistent Quantum Gravity", viXra:2211.0001v1, https://shmaesphysics.wordpress.com/2021/03/23/spacetime-and-gravity-are-2d-around-planck-scales-a-universal-property-of-consistent-quantum-gravity/, March 20, 2021.

[86]: Stephane H Maes, (2021), ""Quantum Gravity Emergence from Entanglement in a Multi-Fold Universe": 2D or 2+1D spacetime at small scales", viXra:2103.0142, https://shmaesphysics.wordpress.com/2021/03/20/quantum-

gravity-emergence-from-entanglement-in-a-multi-fold-universe-2d-or-21d-spacetime-at-small-scales/, March 20, 2021.

[87]: Stephane H Maes, (2022), "The Replica Trick, Wormholes, Island formula, and Quantum Extremal Surfaces, and How the AdS/CFT Correspondence Conjecture, and Hence the M-theory, Encounters Multi-folds", https://doi.org/10.5281/zenodo.10207057, https://shmaesphysics.wordpress.com/2022/09/20/the-replica-trick-its-wormholes-islands-and-quantum-extremal-surfaces-and-how-the-ads-cft-correspondence-conjecture-and-hence-the-m-theory-encounters-multi-folds/, September 26, 2022, (osf.io/xwf6q/). Also published as: Stephane H Maes, (2022), "The Replica Trick, Wormholes, Island formula, and Quantum Extremal Surfaces", September 26, 2022 (viXra:2311.0154v1).

[88]: Stephane H. Maes, (2022), "CO2 and CH4 absorption powered by nuclear fusion, via fission, is the only way to manage climate change and the Planet's trigger points", viXra:2211.0154v1, https://shmaes.wordpress.com/2022/04/09/co2-and-ch4-absorption-powered-fission-is-the-only-way-to-manage-climate-change-and-the-planets-trigger-points/, April 9, 2022.

[89]: Stephane H Maes, (2021), "Oops For The Loops: Mounting LQG Woes And A Challenge To The LQG Community", viXra:2212.0168, https://shmaesphysics.wordpress.com/2021/12/30/oops-for-loops-mounting-lqg-woes-and-a-challenge-to-the-lgq-community/, December 29, 2021.

[90]: Stephane H. Maes, (2021-2022), "Our universe is 4D", Comments and following comments at https://shmaesphysics.wordpress.com/2020/09/19/renormalization-and-asymptotic-safety-of-gravity-in-a-multi-fold-universe-more-tracking-of-the-standard-model-at-the-cost-of-supersymmetries-guts-and-superstrings/#comment-1416. January 16, 2021 and after.

[91]: Stephane H Maes, (2021), "Multi-fold gravity and double copy of gauge theory", osf.io/xun82, https://shmaesphysics.wordpress.com/2021/05/04/multi-fold-gravity-and-double-copy-of-gauge-theory/, May 4, 2021, viXra:2303.0114.

[92]: Stephane H Maes, (2022), "The Yang Mills Double Copy leads to New AdS/CFT + Gravity Correspondences, or How the M-theory encounters Multi-fold Universes", v1.1, https://doi.org/10.5281/zenodo.7827248, https://shmaesphysics.wordpress.com/2022/04/22/the-yang-mills-double-copy-leads-to-new-ads-cft-gravity-correspondences-or-how-the-m-theory-encounters-multi-fold-universes/, April 22, 2022. (v1: at zenodo.7827249).

[93]: Stephane H Maes, (2020), "Entanglement Concretizes Time in a Multi-fold Universe", viXra:2010.0083v1, https://shmaesphysics.wordpress.com/2020/06/28/entanglement-concretizes-time-in-a-multi-fold-universe/, June 28, 2020.

[94]: Stephane H Maes, (2021), "Right-handed Neutrinos and Traversable Wormholes: the key to entanglement, gravity and multi-folds extensions to ER=EPR?", viXra:2211.0173v1, https://shmaesphysics.wordpress.com/2021/04/03/right-handed-neutrinos-and-traversable-wormholes-the-key-to-entanglement-gravity-and-multi-folds-extensions-to-erepr/, April 3, 2021.

[95]: Stephane H Maes, (2021), "How the ER = EPR, GR = QM and AdS/CFT correspondence conjectures, can be explained in multi-fold theory, along with the E/G conjecture. A call to the Physics Community!", viXra:2111.0144v2, https://shmaesphysics.wordpress.com/2021/11/28/how-the-er-epr-gr-qm-and-ads-cft-correspondence-conjectures-can-be-explained-in-multi-fold-theory-and-the-e-g-conjecture-explains-and-realize-in-a-multi-fold-universe-a-call-to-the-physics-comm/, December 28, 2021.

[96]: Stephane H Maes, (2020), "Particles, Especially Virtual Particles, in a Multi-fold Universe vs. QFT", viXra:2010.0133v1, https://shmaesphysics.wordpress.com/2020/07/11/particles-especially-virtual-particles-in-a-multi-fold-universe-vs-qft/ , July 10, 2020.

[97]: Stephane H Maes, (2020), "A Multi-fold Universe Genesis Inspired By Explosive Total Collision: The Source Of The Big Bang?", viXra:2208.0082v1, https://shmaesphysics.wordpress.com/2021/01/17/a-multi-fold-universe-genesis-inspired-by-total-explosion-collision-the-source-of-the-big-bang/, January 12, 2021.

[98]: Stephane H. Maes, (2022), "JWST and the Big Bang invalidation", https://shmaesphysics.wordpress.com/2021/01/17/a-multi-fold-universe-genesis-inspired-by-total-explosion-collision-the-source-of-the-big-bang/#comment-4577, and following comments. August 21, 2022.

[99]: Stephane H Maes, (2020), "Different approaches to compute Hawking Black Holes Decay", viXra:2208.0009v1, https://shmaesphysics.wordpress.com/different-approaches-to-compute-hawking-black-holes-decay/, August 1, 2022. (Originally published July 11, 2020).

[100]: Stephane H Maes, (2020), "Comments to "Yes, Stephen Hawking Lied To Us All About How Black Holes Decay"", https://osf.io/v7thb/, https://shmaesphysics.wordpress.com/2020/07/11/comments-to-yes-stephen-hawking-lied-to-us-all-about-how-black-holes-decay/, July 11, 2020.

[101]: Stephane H. Maes, (2022), "Schwinger effect dominates near the horizon of charged black holes near extremality and reduces the charge", https://shmaesphysics.wordpress.com/2022/07/25/unruh-effects-hawking-black-hole-evaporation-quantum-corrected-larmor-formula-numbers-of-particles-in-curved-spacetime-same-same-but-just-a-bit-different/#comment-4687, September 23, 2022.

[102] Stephane H Maes, (2022), "Charm of the proton", https://shmaesphysics.wordpress.com/2021/03/29/new-physics-with-lhcb-to-explain-loss-of-lepton-universality-or-just-gravity/#comment-3791, March 27, 2022.

References added on December 20, 2023

[103]: Stephane H. Maes, (2022), "Multi-fold Gravity can Violate P-Symmetry. It is Aligned With Observations of Asymmetry of the Orientation of Tetrahedra of Galaxies", https://shmaesphysics.wordpress.com/2022/12/10/multi-fold-gravity-can-violate-p-symmetry-it-is-aligned-with-observations-of-asymmetry-of-the-orientation-of-tetrahedra-of-galaxies/, December 10, 2022.

[104]: Stephane H Maes, (2021), "Multi-fold Embeddings, Space Time Matter Induction or Gravity Asymptotically Safe and The AdS/CFT Correspondence Conjecture, they all can recover the Standard Model", viXra:2212.0120v1, https://shmaesphysics.wordpress.com/2021/12/20/multi-fold-embeddings-space-time-matter-induction-or-gravity-asymptotically-safe-and-the-ads-cft-correspondence-conjecture-they-all-can-recover-the-standard-model-or-smg/, December 20, 2021.

[105]: Stephane H Maes, (2022), "2D Random Walks of Massless Higgs Bosons as Microscopic Interpretation of the Asymptotic Safety of Gravity, and of the Standard Model", https://shmaesphysics.wordpress.com/2022/12/28/2d-random-walks-of-massless-higgs-bosons-as-microscopic-interpretation-of-the-asymptotic-safety-of-gravity-and-of-the-standard-model/, December 28, 2022.

[106]: Stephane H. Maes, (2022), "Multi-folds, Non-Commutative Spacetime, Spin, and All That", https://shmaesphysics.wordpress.com/2022/12/31/the-principles-of-quantum-mechanics/, December 31, 2022.

[107]: Stephane H. Maes, (2022), "A Better Quantum Extremal Surface and Island Interpretation that explains the Associated Massive Gravity", https://shmaesphysics.wordpress.com/2022/12/03/a-better-quantum-extremal-surface-and-island-interpretation-that-explains-the-associated-massive-gravity/, December 3, 2022.

[108]: Stephane H. Maes, (2023), "Yeah or Nay on Black Holes as Explanation for Dark Energy?", osf.io/369pd, https://shmaesphysics.wordpress.com/2023/03/01/yeah-or-nay-on-black-holes-as-explanation-for-dark-energy/, V3, March 26, 2023. (V2: March 12, 2023, V1: Stephane H. Maes, (2023), "Yeah or Nay on Black Holes as

Explanation for Dark Energy?", viXra:2303.0031, https://shmaesphysics.wordpress.com/2023/03/01/yeah-or-nay-on-black-holes-as-explanation-for-dark-energy/, March 1, 2023).

[109]: Stephane H. Maes, (2023), "Dynamic sources, Dynamic Multi-folds, and General Relativity Lense-Thirring and Frame Dragging Effects", https://shmaesphysics.wordpress.com/2023/03/12/dynamic-sources-dynamic-multi-folds-and-general-relativity-lens-thirring-and-frame-dragging-effects/, March 12, 2023.

[110]: Stephane H. Maes, (2023), "The Multi-fold Least Action Principle, a Quasi Theory Of Everything", https://shmaesphysics.wordpress.com/2023/02/19/the-multi-fold-least-action-principle-a-quasi-theory-of-everything/, February 19, 2023.

[111]: Stephane H. Maes, (2023), "Maybe, black holes do not systematically decohere quantum states", https://shmaesphysics.wordpress.com/2020/11/01/multi-fold-black-holes-entropy-evolution-and-quantum-extrema/#comment-6315, March 7, 2023.

[112]: Stephane H. Maes, (2023), "No electroweak / Higgs mass hierarchy problem in multi-fold theory", https://shmaesphysics.wordpress.com/2021/03/28/multi-fold-gravity-electroweak-theory-and-symmetry-breaking/#comment-6794, March 30, 2023.

[113]: Stephane H. Maes, "Right-handed neutrinos in the multi-fold stabilize the multi-fold unconstrained KK space time matter induction and scattering", https://shmaesphysics.wordpress.com/2021/04/03/right-handed-neutrinos-and-traversable-wormholes-the-key-to-entanglement-gravity-and-multi-folds-extensions-to-erepr/comment-page-1/#comment-6875, April 8, 2023.

[114]: Stephane H. Maes, (2022-2023), "Confusing mathematical duality to predict quantum computing algorithm, with building a wormhole", https://shmaesphysics.wordpress.com/2020/10/11/circular-arguments-in-string-and-superstring-theory-from-a-multi-fold-universe-perspective/comment-page-1/#comment-5093, and following related comments, November 30, 2022.

[115]: Stephane H. Maes, (2023), "No lack of clumpiness, just as needed", https://shmaesphysics.wordpress.com/2020/06/21/explaining-dark-matter-without-new-physics/comment-page-1/#comment-6974. April 12, 2023.

[116]: Stephane H. Maes, (2023), "Multi-fold Universes, Multiverses and Many Worlds", https://shmaesphysics.wordpress.com/2023/04/08/multi-fold-universes-multi-folds-and-many-worlds/, April 8, 2023.

[117]: Stephane H. Maes, (2023), 'Comment on black hole decoherence", https://shmaesphysics.wordpress.com/2020/11/01/multi-fold-black-holes-entropy-evolution-and-quantum-extrema/#comment-6315, March 7, 2023.

[118]: Stephane H Maes, (2023), "Comments of the universe is too smooth", https://shmaesphysics.wordpress.com/2020/06/21/explaining-dark-matter-without-new-physics/#comment-6086, February 9, 2023, and https://shmaesphysics.wordpress.com/2020/06/21/explaining-dark-matter-without-new-physics/#comment-6974, April 12, 2023.

[119]: Stephane H Maes, (2023), "Our real universe is macroscopically 4D. Hints come from every direction & show that it had to be so", https://shmaesphysics.wordpress.com/2023/04/23/our-real-universe-is-macroscopically-4d-hints-come-from-every-directions-show-that-it-had-to-be-so/, April 23, 2023.

[120]: Stephane H. Maes, {2022), "Black holes effects outside the black holes do not mean that Hawking radiation is not occurring at its horizon", https://shmaesphysics.wordpress.com/different-approaches-to-compute-hawking-black-holes-decay/#comment-5027, November 23, 2022.

[121]: Stephane H Maes, (2023), “No Gravitational Evaporation of Everything à la Schwinger, only for Black Holes”, https://shmaesphysics.wordpress.com/2023/07/15/no-gravitational-evaporation-of-everything-a-la-schwinger-only-for-black-holes/, July 15, 2023.

[122]: Stephane H Maes, (2023), “Unstable QFT and SM with Gravity except in a Multi-fold Universe”, https://shmaesphysics.wordpress.com/2023/07/19/unstable-qft-and-sm-with-gravity-except-in-a-multi-fold-universe/, July 19, 2023.

[123]: Stephane H. Maes, (2023), “Comments about massive galaxies without dark matter”, https://shmaesphysics.wordpress.com/2020/10/14/multi-fold-universe-dark-matter-effects-survive-low-mass-galaxies-with-dark-matter-deficits-and-excesses/#comment-7430, July 20, 2023.

[124]: Stephane H Maes, (2023), “Less Cracks in the Standard Cosmology in a Multi-fold Universe with its Quantum Random walks”, https://shmaesphysics.wordpress.com/2023/06/20/less-cracks-in-the-standard-cosmology-in-a-multi-fold-universe-with-its-quantum-random-walks/, June 19, 2023.

[125]: Stephane H. Maes, (2021), “Neutrons are forming an external skin in Nuclei and Neutron Stars”, https://shmaes.wordpress.com/2021/05/08/neutrons-are-forming-an-external-skin-in-nuclei-and-neutron-stars/, May 8, 2021.

[126]: Stephane H. Maes, (2023), “Ad Astra With Warp Drives? Probably Not”, https://shmaesphysics.wordpress.com/2023/12/09/ad-astra-longe-with-warp-drives-probably-not/, December 9, 2023.

[127]: Stephane H Maes, (2023), “2D gravity and 2D Yang Mills Physics is all what matters”, htatps://shmaesphysics.wordpress.com/2023/04/23/our-real-universe-is-macroscopically-4d-hints-come-from-every-directions-show-that-it-had-to-be-so/comment-page-1/#comment-7588, August 5, 2023.

[128]: Stephane H Maes (2023), “The Multi-fold Theory – Draft Raw Compendium of Research Papers (till August, 2023)”, https://doi.org/10.5281/zenodo.8242021, https://shmaesphysics.wordpress.com/2023/08/12/the-multi-fold-theory-draft-raw-compendium-of-research-papers-till-august-2023/, August 12, 2023. (https://osf.io/swqmb).

[129]: Stephane H Maes, (2023), “Barnett’s resolution of the Minkowski – Abraham dilemma holds, no 4-vector issue”, https://shmaes.wordpress.com/2023/08/11/barnetts-resolution-of-the-minkowski-abraham-dilemma-holds-no-4-vector-issue/, August 13, 2023.

[130]: Stephane H. Maes, (2023), “Persisting on No Decoherence due to Gravity, Black Holes, or Spacetime Curvature Superpositions”, https://shmaesphysics.wordpress.com/2023/08/18/persisting-on-no-decoherence-due-to-gravity-black-holes-or-spacetime-curvature-superpositions/, August 18, 2023.

[131]: Stephane H. Maes, (2023), “No supersymmetry at D<=4 with a positive cosmological constant”, https://shmaesphysics.wordpress.com/2022/07/08/a-prediction-no-dark-matter-will-be-discovered-at-lhc-or-elsewhere/#comment-7563. July 23, 2023.

[132]: Stephane H. Maes, (2023), “The universe is exactly the only thing that it could be if it is a 4D multi-fold universe! No fine-tuning problem, no invocation of God or multiverses”, https://shmaesphysics.wordpress.com/2023/04/08/multi-fold-universes-multi-folds-and-many-worlds/comment-page-1/#comment-8037, October 7, 2023.

[133]: Stephane H. Maes, (2023), “Justification for the multi-fold mappings, and dynamic multi-fold mechanism”, https://shmaesphysics.wordpress.com/2020/12/24/the-w-type-multi-fold-hypothesis-and-quantum-physics-interpretation-of-wave-functions-and-qft/comment-page-1/#comment-8092, October 29, 2023.

[134]: Stephane H. Maes, (2020-2023), "Quantum Gravity Emergence from Entanglement in a Multi-Fold Universe – V3: Update to section 4.1 – Multi-folds for Entanglement and EPR", https://shmaesphysics.wordpress.com/quantum-gravity-emergence-from-entanglement-in-a-multi-fold-universe-v3-update-to-section-4-1-multi-folds-for-entanglement-and-epr/.

[a135]: Stephane H. Maes, (2020-2023), "Quantum Gravity Emergence from Entanglement in a Multi-Fold Universe", V3, https://zenodo.org/doi/10.5281/zenodo.7792911, October 29, 2023.

[136]: Stephane H. Maes, (2023), "Path integrals and wormholes impact on the cosmological constant", https://shmaesphysics.wordpress.com/2022/09/20/the-replica-trick-its-wormholes-islands-and-quantum-extremal-surfaces-and-how-the-ads-cft-correspondence-conjecture-and-hence-the-m-theory-encounters-multi-folds/comment-page-1/#comment-7978, September 3, 2023.

[137]: Stephane H. Maes, (2023), "Microscopic interpretation of mass acquisition from massless Higgs bosons", https://shmaesphysics.wordpress.com/2021/02/28/more-on-multi-fold-particles-as-microscopic-black-holes-with-higgs-regularizing-extremality-and-singularities/#comment-8412, November 5, 2023.

[138]: Stephane H. Maes, (2023), "Justifying the Multi-folds Mechanisms, Mapping, Tenancy and More", https://shmaesphysics.wordpress.com/2023/11/10/justifying-the-multi-folds-mechanisms-mapping-tenancy-and-more/, November 10, 2023.

[139]: Stephane H. Maes, (2023), "In multi-fold theory, the expansion of the universe is not a mirage", https://shmaesphysics.wordpress.com/2020/06/19/explaining-dark-energy-small-cosmological-constant-and-inflation-without-new-physics/#comment-7242, June 20, 2023.

[140]: Stephane H. Maes, "Multi-fold dark energy is also a fluctuation of quantum vacuum fluctuations", https://shmaesphysics.wordpress.com/2020/06/19/explaining-dark-energy-small-cosmological-constant-and-inflation-without-new-physics/#comment-6111, February 18, 2023.

[141]: Stephane H. Maes, (2023), "No supersymmetry", https://shmaesphysics.wordpress.com/2023/11/21/no-supersymmetry/, November 21,2023.

[142]: Stephane H. Maes, (2023), "It's experimentally validated: antimatter falls down, no antigravity", https://shmaesphysics.wordpress.com/2020/07/05/more-matter-than-antimatter-all-falling-down/#comment-8018 and subsequent comments, September 27, 2023.

[143]: Stephane H. Maes, (2023), "Particle internal symmetries and anti-particles when modeled as microscopic black holes or random walk patterns", https://shmaesphysics.wordpress.com/2021/02/28/more-on-multi-fold-particles-as-microscopic-black-holes-with-higgs-regularizing-extremality-and-singularities/#comment-8634, November 28, 2023.

[144]: Stephane H Maes, (2020), "Call for Collaboration", https://shmaesphysics.wordpress.com/2020/09/07/do-you-want-a-phd-or-who-knows-a-nobel-price-in-physics/, September 6, 2020. See also comments on the page, below the paper.

[145]: Stephane H. Maes, (2023), "Information has no mass", https://shmaesphysics.wordpress.com/2023/12/14/information-has-no-mass/, December 14, 2023

[146]: Stephane H. Maes, (2023), "A Fractal spacetime just leads to rescaled cosmological constant. Yet that may provide a time varying effect", https://shmaesphysics.wordpress.com/2022/10/30/multi-fold-discrete-fractal-spacetime-and-the-viability-of-local-vs-non-local-hidden-variable-viability/comment-page-1/#comment-8896. December 14, 2023.

[147]: Stephane H. Maes, (2023), "Gravity is Quantum", https://shmaesphysics.wordpress.com/2023/12/19/gravity-is-quantum/, December 19, 2023.

[148]: Stephane H. Maes, (2023), "Multi-folds for Entanglement and EPR", https://zenodo.org/doi/10.5281/zenodo.10059877, https://shmaesphysics.wordpress.com/2023/11/01/multi-folds-for-entanglement-and-epr/ October 29, 2023, (viXra:2311.0001v1), also as "Update to section 4.1 of "Quantum Gravity Emergence from Entanglement in a Multi-Fold Universe" – Multi-folds for Entanglement and EPR", https://shmaesphysics.wordpress.com/2023/10/29/update-to-section-4-1-of-quantum-gravity-emergence-from-entanglement-in-a-multi-fold-universe-multi-folds-for-entanglement-and-epr/, (https://osf.io/54ycm/).