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# New Physics is often not so new

Stephane H. Maes<sup>1</sup> 

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## Abstract:

*Based on both the strength of the Standard Model (SM), often lamented by some looking to evolve it, and the results obtained in the multi-fold theory that can qualitatively answer many open issues with SM and the Standard Cosmological Model ( $\Lambda$ CDM), we argue that typically, the recent widely published hints of New Physics aren't. In fact they usually are not confirmed by later experimentations, or other theories, or the  $SM_G$ , the standard model with gravity effects non-negligible at its scales, which we do not consider as new Physics, but just the addition of gravity to it.*

*Alternatively, we see them explainable by the multi-fold theory, that most would argue as New Physics, assuming it were confirmed, but that we prefer to see as rather confirming SM and  $\Lambda$ CDM by adding the  $SM_G$ , and multi-fold explanations, at the difference of other approaches like supersymmetry, superstrings, or say MOND. Indeed no new fundamental particle or force are involved, and there is no need to macroscopically invalidate or modify GR.*

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## 1. Introduction

The paper was originally published just as a blog on [7]. It is based on [57] that argues also that many “hot topics” are not new physics because they result either from errors in the model, errors in the experiments, or considerations missing so far in Physics.

We like to consider the  $SM_G$  and multi-fold models as examples of the latter (considerations missing so far in conventional Physics, i.e., non multi-fold physics): there are no new forces or fundamental particles, beyond the SM, involved, and the model does not macroscopically invalidate GR.

*In this short paper, references added on March 25 2023 appear in italic, as does new text added then, that is then explicitly marked. A benefit of publishing preprint/paper a while later after publishing at [7], that gives us the possibility to complement our analyses as well as report later confirmation or hints of confirmation of our positions.*

## 2. The $SM_G$ and the Multi-fold theory

The multi-fold paper [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 [1], detailing contributions to dark matter and dark energy [1,37-40,42,47,70,76,85,86,89,95,96,100], and explaining other Standard Model (SM) mysteries without requiring New Physics beyond the Standard Model other than the addition of non-negligible gravity effects

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to the Standard Model Lagrangian [1,4-35,36-42,43-49,50,51,52-56, 62-103]. All this is achieved in a multi-fold universe that may well model our real universe, which of course 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 [1,13,30,33,35,77,78], 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 (Schwarzschild for photons and concretized spacetime coordinates, and metrics between Reissner Nordstrom [2] and Kerr Newman [3] for massive and possibly charged particles – the latter being possibly extremal). Particles result from patterns of massless Higgs random walk (massless particles above gravity electroweak symmetry breaking [1,23,77-79]) or condensates of massless Higgs (massive, below gravity electroweak symmetry breaking [1,22,85-87]), implementing solitons obtained by space time matter induction and scattering from a 7D spacetime [1,29,30,63]. Although possibly surprising, [1] recovers results consistent with others (see [4] and its references), while also being able to justify the initial assumptions of black holes from the gravity or entanglement model in a multi-fold universe. The resulting gravity model recovers General Relativity at larger scale, as a 4D process [1,71,102], with massless gravity, but also with massive gravity [1,10,62] components at very small scale that contributes making gravity non-negligible at these scales. Semi-classical models also turn out to work well till way smaller scales than usually expected.

### 3. Examples of non-New Physics

[57] illustrates that, recently, hints of New Physics as new force or particles, or macroscopically modifying gravity are rarely verified as new or requiring new physics. The examples discussed in [57] include:

- Gamma burst in Black Hole mergers
- X17 as new particle and “fifth force”?
- Dark matter detection by XENON experimentation
- Is dark matter detected in the DAMA/LIBRA detector
- Has the LHCb collaboration broken the Standard Model acceptable CP violation?
- Is there an ‘extra’ type of neutrino present?
- Does the Muon g-2 experiment break the Standard Model?
- Does the Hubble tension provide sign of New Physics?

[57] does a good job at argue against New Physics in general.

### 4. Multi-fold predictions

#### 4.1. Comparing notes

Many of the examples provide match our prediction of now new physics...

For example, consider:

- Is the XENON experiment finally detecting dark matter? See for example [58]. Note that with respect to [59], that negating the detection of dark matter effects does not invalidate the multi-fold proposals for right-handed neutrinos as in [1,6,27,28,30,45,77-79]. *Note added on March 25, 2023: Since, more publications confirm no new physics.*
- Has the LHCb collaboration broken the Standard Model? See [50]. *Note added on March 25, 2023: Since, more publications strongly hint new physics.*
- Is there an 'extra' type of neutrino present? See [1,6,27,28,30,45,77-79]. *Note added on March 25, 2023: Since, more publications strongly hint no new physics, e.g. [112].*
- Does the Muon g-2 experiment break the Standard Model? See [51]. *Note added on March 25, 2023: Since, more publications strongly hint no new physics. See [110,111] and references therein.*

*Text added in March 25, 2023:*

## 4.2 Other examples

- *Does the W boson mass break the SM? See [87] for our analysis. Recent publications strongly hint no new physics [109]*

## 4.3 SM<sub>G</sub>: potentially solving many SM open issues

Multi-fold and SM<sub>G</sub> can (at least partially) address many open problems in physics. Several of these proposals can also apply to just the SM<sub>G</sub>, even without multi-fold properties.

SM open issues that can be addressed:

- The strong CP problem [SM<sub>G</sub> is sufficient] [1,24]
- Stability of the Electroweak vacuum [SM<sub>G</sub> is sufficient] [1,26]
- The neutrino mass and existence of right-handed neutrinos. SM<sub>G</sub> is sufficient, to justify the existence of the right-handed neutrinos, but something like the gravity electroweak symmetry breaking and multi-folds are key to explain how it hides behind the Higgs boson and at the entrance and exit of the multi-folds [1,6,27,28,30,45,77-79].
- Why three and only three generations per fermion families? [SM<sub>G</sub> is sufficient] [1,25]
- The absence of observed magnetic monopoles [SM<sub>G</sub> is sufficient] [1,46]
- The absence of observed proton decay [SM<sub>G</sub> is sufficient] [1,21]
- Following the last 2 bullets above, the subsequent challenges to supersymmetry, superstrings and most GUTs and TOEs [SM<sub>G</sub> is sufficient but multi-fold universe reinforces the challenges to these theories with gravity asymptotic safety] [1,5,12,17,23,58,46,78,81].
- Matter antimatter asymmetry and origin of the existence of matter as well as the now confirmed way that antimatter falls down like matter [1,28,104].
- The mass gap for Yang-Mills theories [Discrete spacetime and right-handed neutrinos existence are also needed], and QCD [1,33,79].
- Space time matter induction and scattering as source of the types of SM particles [SM<sub>G</sub> may, or may not, be sufficient as multi-folds are how the 7D  $\epsilon$  neighborhood are created and felt in 4D spacetime through

the multi-fold mechanisms and entry/exit points (and mappings). Anything else requires another way to achieve the same, without leading to problems with explaining how chiral fermions would exist or how we do not perceive 7D macroscopic dimensions. Also massless particle behaviors above the gravity electroweak symmetry breaking may need a different model if not involving random walks.]

[1,22,b,56,77-79,83]

- Particles as microscopic black holes, and solitons of massless Higgs random walk patterns, or condensates and the gravity electroweak symmetry breaking instead of point particles [SM<sub>6</sub> may be sufficient] [1,4,78,79].

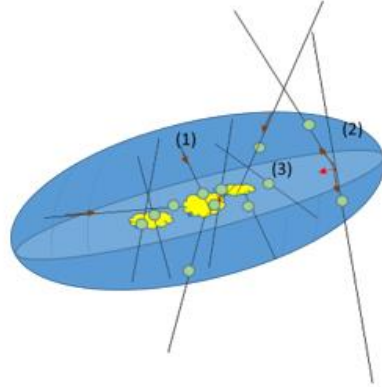
*Text added on March 25, 2023:*

- *Asymptotic safety of gravity [We argue that a GR based spacetime is sufficient] [1,12,13,17,23,73,18,81,105].*
- *Why the SM, or SM<sub>6</sub>,  $Sl(2, \mathbb{C}) \times U(1) \times SU(2) \times SU(3)$  symmetries [91]. There, we show that the symmetries of the 7D embedding space appearing in space time matter induction and scattering are coming directly from the multi-fold SM<sub>6</sub>, and include the Lorentz symmetries of spacetime and gravity, and the symmetries of the SM. To our knowledge no other theory out there has ever been able to provide such an unambiguous explanation, in general simply because they do not have the multi-folds as generators of the symmetries or do not have the embedding 7D spacetime. In the 7D embedding spacetime, symmetries can now be Spin(7,7), because of the doubling for left and right chirality (spacetime orientation). The same considerations explain how and why the algebra doubling on non-commutative geometry in 4D also predicts the SM particles including neutrino mixing [1,30,78,91].*
- *A quasi TOE explaining most of Today's physics, based on the least action principle and the action path integral [96].*
- *The double copy duality between Yang Mills and (Einstein) gravity, explained by multi-fold gravity, and, as a result, multi-folds are also indirectly encountered in Yang Mills theory: Yang mills interactions also define GR gravity via the duality that models particle doubling, i.e. two entangle particles, real or virtual. That is the E/G conjecture [1,11,63,65,75,88,106].*
- *The problems facing superstrings, supergravity, M-Theory and most popular GUTs and TOEs [1,5,7,12,13,16,17,21,23,36,46,49, 62,66,73,78,80,81].*
- *Trans-Planckian Censorship Conjecture [105].*

In general these results come from gravity smearing symmetries (and anomalies) that otherwise would have allowed, for example, proton decay, or magnetic monopoles, or from modifying the Lagrangian (i.e. the dynamics) of the system just enough to ensure the observed behaviors.

#### 4.4 Multi-fold: potentially solving many open issues in Standard Cosmology and no need for MOND

Multi-folds explain (some) dark matter effects as entanglement between entangled particles emitted from sources in the galaxy: attraction appears as gravity towards the center of mass [1,47], in a halo around. Validating such contributions is, at this stage, the best way to validate that our real universe may be multi-fold [1,47].



*Figure 1: It illustrates how entanglement between entangled systems (particles and radiation) can produce attractive effects analogous to dark matter in a multi-fold universe. (From [1]).*

This model [1,47] is compatible with many observations including the existence of galaxies with no or little dark matter [37-39]. The principle is very simple: if entangled particles are captured by another system or destroyed by interactions, the effect disappears or at least reduces.

It also supports recent studies that show dark matter density is essentially within a certain radius that seems to be expanding with time [70]: as time passes, radiation reaches further, and so does entanglement or explains why, in a multi-fold universe, dark matter effects occurs between entangled systems, not beyond. So one can therefore also conclude that it does not really attract as many other galaxies and the observations mentioned in [86,108] are also compatible with multi-fold dark matter effects: the Standard Cosmological Model ( $\Lambda$ -CMD) [101] can't account for the amount/distribution of disk galaxies out there, because, if formed by mergers, many should lose angular momentum and not rotate fast enough to be disk shaped. Alternate gravity theory like MOND, variations on the GR and Newton theory at large distances, would be compatible with these results, because, without as many mergers as in  $\Lambda$ -CMD where they are due to the dark matter, which increases attraction between galaxies. In a multi-fold universe, dark matter effects occur between entangled systems, not beyond. So one can therefore also conclude that it does not really attract as many other galaxies as in , and the observations reported in [86,108] are therefore also compatible with multi-fold dark matter effects [71].

Multi-fold dark matter effects is possibly the most promising way to validate that entanglement creates gravity like effects, and therefore to validate if our real universe is a multi-fold universe. We do not imply that there are no other mechanisms involved in dark matter, but we argue that such alternatives, e.g., axions, may not be needed, especially after [1,24,28,76]. It presents the advantage that it would explain why no dark matter has ever been observed and remain such a theoretical mystery, and, at the difference of MOND, we do not have to modify GR in ways that have been so far invalidated by observations.

*Note added on March 25, 2023: Many issues encountered with dark matter due to recent observations can also be qualitatively compatible with the multi-fold dark matter effects [86,87,107]. Again these offer better alternatives than MOND, which has fundamental issues with gravitational lensing, as mentioned in [107].*

Multi-fold mechanisms can also explain the observed expansion of the universe, and its acceleration as the result of quantum walks, and fluctuations of the positions of the particles and the resulting impact on the multi-fold effects: a contribution appears that "expands" and "accelerates the expansion" of spacetime as in figure 6 [1,40,76]. These results also can explain why the cosmological constant is small compared to the value expected from the SM quantum field vacuum energy: it is due to the multi-fold effects of fluctuations rather than the energy of the fluctuations [40,95].

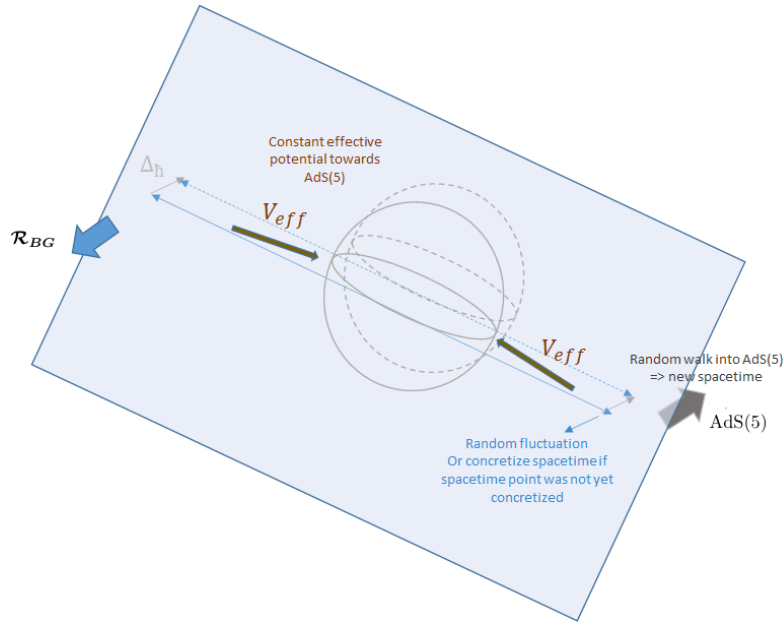


Figure 2: It shows how position fluctuations introduce a multi-fold effect potential contribution external to spacetime that can explain the acceleration of the universe expansion, in a multifold universe. (From [1])

Finally quantum random walk can explain the early universe inflation (exponential expansion), and the current steady contribution of expansion to the cosmological constant. With such models, the cosmological constant may vary in time, and within dense matter versus sparse vacuum [1,13,35,85] (Note added on March 26, 2023: This is why a paragraph was added at the bottom of section 6.1 in the web version (URL) of [100]. Although we do not believe that it supports the papers / proposal that [100] reviews, it indeed implies a larger dark energy effect near black holes, driven by their curvature, but no relevant mass increase due to the universe expansion anyway). At the beginning of the universe, with a localized or distributed region, every step is accompanied by additional spacetime (inflation) particle creations, in particular massless Higgs bosons. This reduces after inflation, but continues to this day as part of the expansion, as shown in figure 7. Particle / anti-particle pairs creations involve expanding interstitial steps that can take place, e.g. when there would be particle overlap, which matches the vision of expansion everywhere (not just pushes at the edges). This is also true for the mechanism described in figure 6. The particle and interstitial steps reduce multipoint correlations rendering ability to detect, without implying that inflation did not exist; a different conclusions from more conventional models [42].

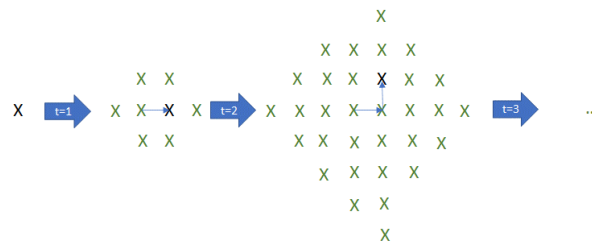


Figure 3: Inflation effects due to the random walk (of massless Higgs particles) and interstitial growth with each particle creating many pairs of particles and anti-particles. After inflation, such generation is greatly reduced and random: many of the spacetime locations become "not yet concretized" and "awaiting to be occupied" by future particles in random walks, and random walks create new spacetime locations at a much lower rate, and, instead of concretizing spacetime, locations are waiting to be concretized). (Note added on March 25, 2023: from [108]).

The multi-fold mechanisms imply only positive curvature [1], unless if we start from a significantly negative background. It matters for cosmology, and to validate compatibility with many theories, like supersymmetry, that only exist in negative cosmological constant universes [1,5,12,13,16].

*Note added on March 25, 2023: The multi-fold dark energy effects are also a better alternative to proposals like voids, black holes as source of dark energy. See [100] and references therein.*

## 4.5 Ultimate Unification and fundamental particle desert at energies above electroweak symmetry breaking

[1,93,94] shows how the weak gravity conjecture (WSG) is no more strictly respected as typically expected in multi-fold universes, due to the multi-fold effects, the Ultimate Unification (UU) [23] and massive gravity [10]. As a result, instead of the typical models of GUTs, already in trouble with the lack of observed proton decay [21] or magnetic monopoles [96], and asymptotic safety of gravity [1,12,13,17,23,73,78,81,105], it is projected that at high energies, or very small spatial scales, all particles behave the same way with interactions at a same magnitude, instead of a grand unification where all forces become ones. *Note added on March 25, 2023: [78], provides a clear explanation: below a certain spatial scale, solitons and charges / quantum numbers are way larger than the scale effects and interactions are only random walks, entanglement/gravity, collisions/scatterings.*

The new fundamental particle landscape is expected to be desert between the electroweak scale and UU and above [1,23,60,61,51,56,77-79,87,89,93,94,96].

It leads to the proposal that the UU associate particle is the Higgs field, just as for inflation: it populates concretized spacetime locations, and it is responsible for the random walk during inflation [1,40]. It is the condensation of the Higgs field that results into massive SM particles as Qballs of superconductor Higgs condensate that also regularize singularity or over extremality of the microscopic black holes [4]. Above the multi-fold gravity electroweak, massless SM particles are the result of patterns of random walks of massless Higgs bosons [1,22,56,77-79,83]. Condensates and patterns match solitons solution of GR in 7D, through 7D space time matter induction and scattering.

Such a model recovers and explains models for particles as microscopic blackholes, as well as a Higgs-based inflation theory [1,30,35,39,78,81]. It also explains results of GFT (Group Field Theory) and non-commutative geometry [1,30,35,78]. With regularized black holes, behaviors match but singularities do not exist and there is no crossing of horizons, the Qball's skin, or Hawking evaporation, therefore avoiding all the issues of other typical of models suggesting that particles are black holes but unable to account for example with the fact that microscopic black holes should immediately evaporate, because the temperature of a black hole horizon increases as its size decreases [1,4].

As a result, we expect a desert of new fundamental particle above the energy scales of the gravity electroweak symmetry breaking [1,23,51,56,77-79,87,89,93,96]. Also in that context, [22,30,78,91]. Indeed, these latter two papers show how no particles are beyond the ones known today (with our interpretation of the Majorana / neutrino (or possibly related to  $M^*$  in [29], which is to be revisited in the future). For other similar analysis and references, consider also [60,61] which are making the case for a similar new fundamental particles and new physics desert; and therefore also no supersymmetry or superstrings.

## 4.6 Unphysicality of superstrings and supersymmetry

At very small scales or large energies, 2D processes dominate in the multi-fold theory and in many other sensible or apparently consistent theories [32]. As a result, we can prove that gravity is asymptotically safe, for sure in multi-fold, but also most probably in the real universe [12,13]. Indeed most of the reasonings of [13] can be repeated with other theories that also indicate a 2D process at very small scales.

As we encountered multi-fold in GR, we de facto not only provided that multi-fold and multi-fold spacetime reconstruction recovers GR, but also that GR is asymptotically safe [73].

*Note added on March 25, 2023: Establishing the Trans-Planckian Censorship Conjecture (TCC) also implies asymptotic safety of gravity [ss]. And, Since writing of the preprint for this paper, we have produced a new non-perturbative proof of asymptotic safety of gravity [I], based on the Yang Mills / gravity double copy duality [89]. This duality also show that Yang Mills Gauge QFTs also contain multi-folds [75,88,106].*

Other results have shown that asymptotic gravity is not compatible with the standard model if we have supersymmetry (above 6D), superstrings/supergravity/M-theory (10 or 11D) or most GUTs and TOEs [12,78]. It seems like a death knell to these theories. Especially after we proved that, as even conjectured by the string community, superstrings can only live in a negative curvature universe [7,12,13,16], something at best only plausible in 2D regime, where all consistent theories of gravity converge anyway. Our universe has a small but positive curvature... *Note added on March 25, 2023: [78], and references therein, further confirm that such incompatibilities remain in the presence of matter (fermions, bosons and scalars) along with gravity.*

Interestingly, one can show that the main reason why strings were considered as the ideal TOE, i.e. the recovery of a spin-2 graviton, and supersymmetric Yang Mills in 10D, is naturally the result of how strings are modeled, not a divine indication of it being the right TOE [1,5,7]. It is because the Hilbert Einstein action is trivially contained in the string actions, as is their association to negative (or at best flat) curvature [13,39].

Note also our arguments that gravitons are unphysical (as non-perturbative particles in 4D spacetime), so no new physics there either [1,14,63,72,75,88].

## 5. Conclusions

The paper argues that many recent cases where New Physics was involved did not warrant such claims. Either the results, arguments, or theoretical were incorrect or imprecise, or can be (qualitatively) explained with adding multi-fold and/or  $SM_G$  considerations.

Consistently, the multi-fold theory indicates that there are no new fundamental particles or forces involved (except for UU considerations, involving massless Higgs random walks [78]), that GR does not need to be modified and that the SM is correct other than for the addition of gravity à la  $SM_G$ , the SM with gravity non-negligible effects at the SM scales.

*Note added on March 25, 2023: The new fundamental particle desert above the energies of the gravity electroweak symmetry breaking is also made in [89].*

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