EXPLAINING PLANET FORMATION AND THE INITIAL MASS FUNCTION OF STARS WITH A UNIVERSE COMPOSED OF MATHEMATICS PLUS RE-EVALUATION OF THE MASS-GRAVITY RELATIONSHIP

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Abstract -

This preprint is a never-print. It can never be printed in a science journal because that approach has often been tried, only to see the submission's ideas repeatedly rejected as too speculative and non-mathematical. Professor John Wheeler used to say the early papers on quantum mechanics were regarded as highly speculative. Nevertheless, editors of the 1920s published them (today's editors would be too timid). Maybe the maths in it doesn't qualify as maths since it isn't complicated (Einstein used to say a theory that can't be explained to a 6-year-old isn't really understood by its author). Or maybe editors believe the only real maths is the squiggly lines of algebra.

The distribution of stellar masses at the birth of stars is called the Initial Mass Function or IMF. Why does the IMF favour the production of low-mass stars? There is a clue in the report that most planetary systems seem to outweigh the protoplanetary disks (PPDs) in which they formed, leaving astronomers to re-evaluate planet-formation theories. (AstroNews 2019) Science must always be free to question everything**:** even the long- established idea that mass is the cause of gravity (by, according to General Relativity (Einstein 1915), warping and curving space-time). Exploration of the reverse, that gravity forms mass, sounds absurd to modern science. Yet, it has the potential to explain planet formation and the IMF.

This inverse mass-gravity relation uses the well-accepted idea that the universe is described mathematically, being flexible enough to extend that notion and suggest the universe IS maths. It could be produced by binary digits (base-2 maths) and topology, and the gravity that is the warping of space-time could interact with electromagnetism to form the quantum spin of matter particles (½) via vector-tensor-scalar geometry's photonic spin of 1 being divided by the gravitonic spin of 2. This geometric attempt at understanding gravity may be seen as related to 4 earlier theories of gravity - Mordehai Milgrom's 1983 Modified Newtonian Dynamics (MOND), its relativistic generalization

known as Jacob Bekenstein's 2004 Tensor–vector–scalar gravity (TeVeS), the TeVeS extension Bi-scalar tensor vector gravity (BSTV) proposed in 2005 by R.H.Sanders, and John Moffat's 2006 Scalar–tensor–vector gravity (STVG).

Keywords -

black hole physics, gravitation, protoplanetary discs, brown dwarfs, stars: formation, cosmology: theory

SECTION 1 - BINARY DIGITS AND TOPOLOGY

- section previously published in similar versions at numerous sites during recent years**:** most recently in (Bartlett 2019a)

These five scientists support the idea of the universe being composed of information/mathematics:

a) The digital physics pioneered by Professor Edward Fredkin believes that biology reduces to chemistry reduces to physics reduces to the computation of information. (Fredkin 2013)

b) In 1990, John Wheeler (1911-2008) suggested that information is fundamental to the physics of the universe. According to this "it from bit" doctrine, all things physical are information-theoretic in origin. (Wheeler 1990)

c) Erik Verlinde says gravity is not a fundamental force of nature, but an emergent phenomenon. In the same way that temperature arises from the movement of microscopic particles, gravity emerges from the changes of fundamental bits of information, stored in the very structure of spacetime. (Verlinde 2016)

d) Cosmologist Max Tegmark hypothesizes that mathematical formulas create reality. (Tegmark 2014)

e) "Pioneered (in the late 1980's) by Rafael Sorkin, a physicist at the Perimeter Institute in Waterloo, Canada, the theory (causal sets) postulates that the building blocks of

space-time are simple mathematical points that are connected by links, with each link pointing from past to future." (Merali 2013)

It seems plausible that the particular values of quantum spin could be determined by another set of particular values viz those in electronics' BITS or BInary digiTS, which always take the form of either 1 or 0. (Electronics could thus insert Artificial Intelligence and defiance of the Uncertainty Principle into everything from the subatomic scale through the biological to the astronomical.^) First, the 1's and 0's form the shape of a Mobius strip, which is merely two-dimensional (2-D).

^ Binary digits are proposed to be the Hidden Variables which "are an interpretation of quantum mechanics based on the belief that the theory is incomplete and that there is an underlying layer of reality that contains additional information about the quantum world. This extra information is in the form of the hidden variables, unseen but real quantities. The identification of these hidden variables would lead to exact predictions for the outcomes of measurements and not just probabilities of obtaining certain results." (Kumar 2008)

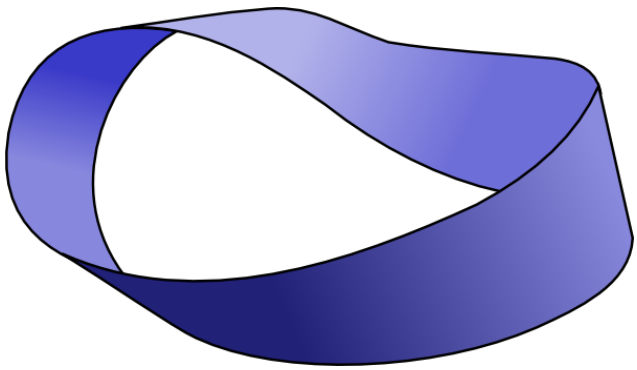

Figure 1 - MOBIUS STRIP (source: http://www.clker.com/cliparts/3/7/a/9/12205465347817139 51lummie_Mobius_Strip.svg.hi.png)

To use words from a recent science paper-

In a holographic universe, all of the information in the universe is contained in 2D packages trillions of times smaller than an atom. (Afshordi et al. 2017)

("Holographic" would have the accepted cosmological meaning of the entire universe being seen as two-dimensional information – from Mobius strips, according to this article - projected into the three dimensions we're familiar with.)

Then two strips must be joined to make a 4-D Klein bottle ((Polthier 2003) which has length, width, depth and, when Wick rotation is programmed into the strips as a subroutine (see Fig. 3), the 4th dimension of movement in time. The type of Klein bottle formed would appear to be the figure-8 Klein. A diagram of many figure-8 Klein bottles would show that their positive curvature (on the spherical parts) fits together with their negative curvature (on saddle-shaped parts) to cancel and produce, on a cosmic scale, the flat curvature of space-time (WMAP science team 2012). When you have trillions of Mobius and figure-8 Klein elements assembled, you can follow the theory of the mass-giving Higgs field being the result of various couplings. (Tanabashi, Harada & Yamawaki 2006) This theory has lost popularity since the Higgs boson was discovered. But an implication of a 1919 paper by Einstein called "Do gravitational fields play an essential role in the structure of elementary particles?" is that the coupling is between gravitons and photons. That could mean coupling is between the Mobius strip and the figure-8 Klein bottle (these exist on a level between photons/gravitons and 1's/0's, being built up into the particles and composed of the binary digits). With trillions of Mobius and figure-8 Klein elements assembled, these (now respectively called photons and gravitons) must interact via vector-tensor-scalar geometry to give matter what we call the emergent property of mass**:** similar to hydrogen and oxygen combining to give water what we call wetness. This proposed link between the Mobius strip and the Mobius doublet (figure-8 Klein bottle) would also be a link between the photon and graviton, suggesting unification of electromagnetism with gravitation. It also confirms Verlinde's idea that gravity is an emergent property (emerging from maths).

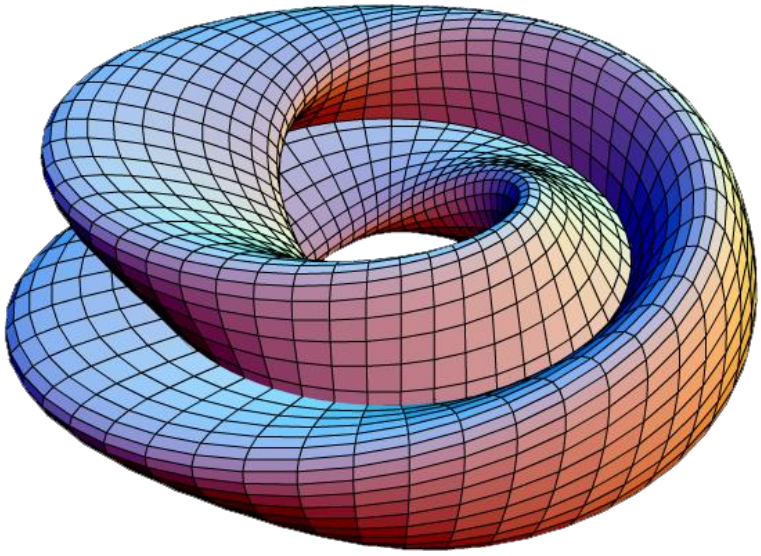

Figure 2 - MOBIUS DOUBLET (FIGURE-8 KLEIN BOTTLE)

(source: https://upload.wikimedia.org/wikipedia/commons/7/73/KleinBottle-Figure8-01.png) Note that, when considering many bottles, the reddish positive curvature fits together with the bluish negative curvature to produce the flatness implying space-time's infinity and, since space and time are always unified, its eternity. (In flat space-time, light beams travel in straight lines and can go infinite distance without ever meeting.)

SECTION 2 - WICK ROTATION, SUPERSYMMETRY, AND SIMPLY-CONNECTED

- section previously published in similar versions at numerous sites during recent years**:** most recently in (Bartlett 2019a)

Following Albert Einstein's example of turning Max Planck's quanta (which, for years, Planck and all other scientists considered purely mathematical) into explanation of the physical photoelectric effect, the Wick rotation used to describe imaginary time may be transformed from mathematical "trickery" to physical meaning, and provide a modern way to unite space and time into one space-time.

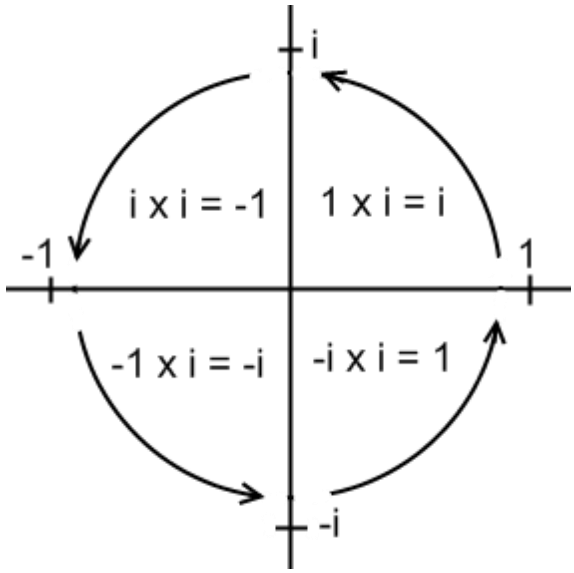

Figure 3 – WICK ROTATION: “The complex plane reveals i’s special relationship with cycles via the circle of i, also known as Wick rotation. Whenever a point on the complex plane is multiplied by i, it moves a quarter rotation around the origin or center of the plane.” (Welch 2015)

Supersymmetry (SUSY) proposes a relationship between bosons and fermions. Some scientists believe supersymmetry is a failed theory. A new approach would be proposing that the Mobius strip is a fundamental constituent of not only fermions (particles of matter) but also of bosons (particles of energy) - and therefore unites all particles.

The inner and outer surfaces of a Mobius form a continuous strip in space – unification of space with time requires a temporal continuity. This is carried out by Wick rotation’s continuous cycling between Fig. 3’s horizontal x-axis of real time and its vertical y-axis of imaginary time. Therefore, the Mobius strip combined with Wick rotation and imaginary time provides a modern way to unite space and time into one space-time. (The continuously curved Mobius surface + continuous Wick rotation = curvature of space-time.)

Informally - if an object in space consists of one piece and does not have any "holes" that pass all the way through it, it is called simply connected. A doughnut (and the figure-8 Klein bottle it resembles) is “holey” and not simply connected (they're multiply

connected). Referring to the infinite universe (see text associated with Figure 2) - a flat universe that is also simply connected implies an infinite universe. (Luminet & Lachi`eze-Rey 1995) So it seems the infinite universe cannot be composed of subunits called figure-8 Klein bottles (flat universes that are finite in extent include the torus and Klein bottle). But the changing of the Klein bottle's shape by binary digits composing photons and gravitons mimics the process of gaps in, or irregularities between, figure-8 Klein bottles being "filled in" by binary digits in the same way that computer drawings can extrapolate a small patch of blue sky to make a sky that's blue from horizon to horizon. This ensures the positive and negative shapes in different figure-8 Klein bottles are precisely joined, and makes space-time relatively smooth and continuous as Einstein thought. Plus - it gets rid of holes, making figure-8 Klein subunits feasible.

SECTION 3 - VECTOR-TENSOR-SCALAR GEOMETRY

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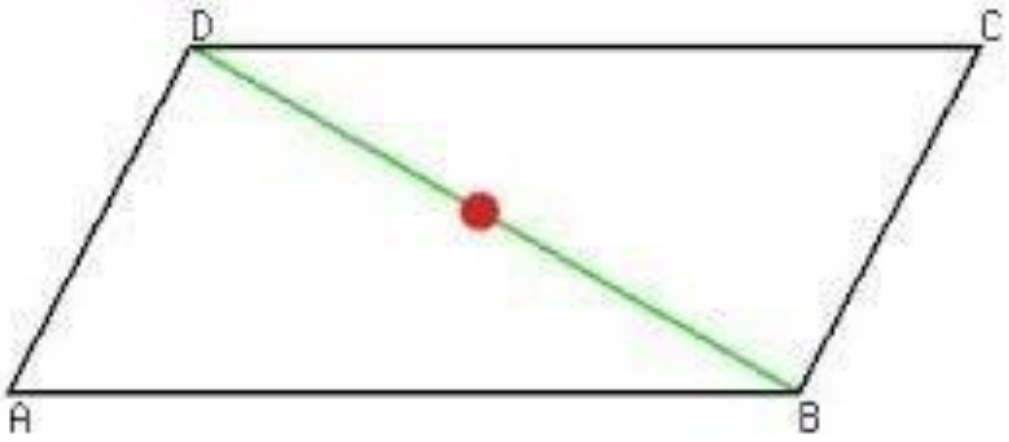
Figure 4 - PARALLELOGRAM WITH DIAGONAL AND CENTRAL SCALAR POINT



A ***vector*** is a quantity which possesses both magnitude and direction. Two such quantities acting on a point (represented by the red Scalar Higgs boson) may be represented by two adjoining sides of a parallelogram (e.g. CD and AD), so that the resultant diagonal^ (green line) also represents the vectors. The two sides and diagonal thus illustrate the graviton's spin 2 and the photon's spin 1. The resultant diagonal

represents the interaction of the sides/vectors (1÷2 = the quantum spin of every matter particle: ½). **Tensor** calculus changes the coordinates of the sides and diagonal into the coordinates of a single point on the diagonal. This scalar point is associated with particles of spin 0. If the mass^^ produced previously happens to be 125 GeV/c2, its union with spin 0 produces the Higgs boson.

^ The resultant diagonal of those two sides can be pictured as a boat being driven in, say, the vertical direction across a river while simultaneously being pushed horizontally by the river's fast-flowing current.

^^ 125 GeV/c2 united with spin 0 means the central **scalar** point of the Higgs boson is related to the vector of the graviton, and the Higgs field (the boson is an excitation of this field) is therefore united with the supposedly unrelated gravitational field (together with the latter's constant interaction with the electromagnetic field). Squaring the speed of light results in a very large number since that velocity is 300,000 kilometres per second, but this speed refers to the disturbance in space-time (the shock wave) which excites photons. As Paul Camp, Ph.D. in theoretical physics, writes (Camp 2016)

"A photon is a quantum of excitation of the electromagnetic field. That field fills all space and so do its quantum modes."

The photons themselves are relatively fixed in position and have a speed assigned the value zero. Whereas 125 giga electron volts divided by the speed of light squared gives a practically nonexistent result if the shock wave's speed is squared, any mathematical operation involving zero can be regarded as an operation not performed and dividing 125 by 0 - the speed of the photons - squared does not change the Higgs boson's mass from the experimentally verified 125 giga electron volts.

SECTION 4 – WAVES FOCUSED ON PPD SEEDS / UNSEEDED SPACETIME

The possibility proposed here is - Gravitational and electromagnetic waves focus on a "seed" or "singularity" of PPD material, "concentrically constructing" a planet (building it up layer by layer) from vector-tensor-scalar geometry's 1÷2 interaction. This produces bodies whose relatively low mass barely enables hydrogen-to-helium fusion before producing high-mass stars. Therefore, low-mass stars outnumber their high-mass

cousins. And low-mass stars are outnumbered by brown dwarfs, the failed stars that aren't quite massive enough to sustain fusion. In turn, brown dwarfs are outnumbered by planets. Researchers estimate the minimum number of brown dwarfs in the Milky Way is at least 25 billion and as high as 100 billion (the maximum estimate of stars in the Milky Way is 400 billion) – but they note even this upper figure may be an underestimate, given the probability of there being many more failed stars too faint to see at all. (Muzic et al. 2017)

It appears that a black hole is a focus of gravitational waves that is devoid of "seed" material and isn't capable of making physical astronomical bodies. The increased gravitation associated with Sagittarius A*, the supermassive black hole at the centre of our galaxy, may enable concentric construction affecting stars that will orbit Sagittarius A* within approximately 30,000 light years to be "top heavy", and to produce more massive stars in preference to low-mass ones. (Bate 2009)

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