F-theory and Milgrom's MOdified Newtonian Dynamics (MOND)

ABSTRACT Is F-theory somehow related to the fact that 5^9 divides the order of the monster group? Is Milgrom underestimated by most astrophysicists? Does the Koide formula suggest that string vibrations are confined to 3 copies of the Leech lattice? Is Lestone's heuristic string theory somehow related to the fact that 7^6 divides the order of the monster group? I say that my 3 most important ideas are: (1) Milgrom is the Kepler of contemporary cosmology. (2) The Koide formula is essential for understanding the foundations of physics. (3) Lestone's heuristic string theory is essential for understanding the foundations of physics. Do most physicists agree with me concerning the preceding 3 ideas? No, but the passage of time should settle the status of each of the 3 ideas. For the sake of argument, let us assume that Milgrom's MOND is empirically valid and that conventional physics cannot explain MOND. I have speculated that MOND is explained by the Fernández-Rañada-Milgrom effect and by string theory with the finite nature hypothesis. It seems to me that my previous attempts at explaining a multiverse model for MOND are somewhat unsatisfactory. In this communication I speculate on how the geometry of strings and branes might be a smoothing of a Wolframian model involving the monster group and the 6 pariah groups. I also attempt to clarify my speculation on how the Fernández-Rañada-Milgrom effect might explain the flyby anomaly.

STRING THEORY AND M-THEORY

According to Michael J. Duff, "The uniqueness problem and the dimension problem were suddenly solved simultaneously by Witten in his, by now famous, talk in at the University of Southern California in February 1998. Witten put forward a convincing case that the distinction we used to draw between the five consistent string theories was merely an artifact of our approximation scheme and that when looked at exactly, there was really only one theory, which subsumed all the others. Moreover this theory was a supersymmetric theory in eleven dimensions! In fact, when viewed at distances much larger than the Planck length, it is approximated by our old friend eleven-dimensional supergravity!"
https://arxiv.org/pdf/hep-th/0111237.pdf "The world in eleven dimensions: a tribute to Oskar Klein" (page 25), 2001

According to Edward Witten, "… Nonabelian gauge theories, supplemented in time by other ingredients that I have not yet mentioned, notably supersymmetry and string theory, led physicists to gradually ask new kinds of questions that involved geometrical concepts and techniques not previously used in physics. In time it was realized that things could be turned around and that the quantum field theory methods could be used to draw inferences about geometry. And so it is that although quantum field theory is a rather old subject, its mathematical influence is in many respects rather recent and still lies mainly in the future."
http://www.ams.org/notices/199809/witten.pdf "Magic, Mystery, and Matrix", 1998, Notices of the AMS, Volume 45, Number 9

According to Katrin Becker, Melanie Becker, and John H. Schwarz, "At sufficiently high

energy supersymmetry in ten or 11 dimensions should be manifest." https://books.google.com/books?id=WgUkSTJWQacC&pg=PA356 "String Theory and M-Theory: A Modern Introduction", 2006

My guess is that string theory with the infinite nature hypothesis implies supersymmetry, the curling up of extra spacetime dimensions, the existence of magnetic monopoles, and the conservation of gravitational energy, while string theory with the finite nature hypothesis implies Wolframian pseudo-symmetry, the building up of quantum information from Fredkin-Wolfram information, the nonexistence of magnetic monopoles, and the non-conservation of gravitational energy.

MOND AND THE FLYBY ANOMALY

"Cosmological models that invoke warm or cold dark matter can not explain observed regularities in the properties of dwarf galaxies, their highly anisotropic spatial distributions, nor the correlation between observed mass discrepancies and acceleration. These problems with the standard model of cosmology have deep implications, in particular in combination with the observation that the data are excellently described by Modified Newtonian Dynamics (MOND)." https://arxiv.org/abs/1301.3907 Kroupa, Pavel, Marcel Pawlowski, and Mordehai Milgrom. "The failures of the standard model of cosmology require a new paradigm." *International Journal of Modern Physics* D 21.14 (2012): 1230003.

"Since around 2000, eight new determinations of the gravitational constant G (also known as big G or Newton's constant) have appeared, almost all with declared uncertainties of about 20 ppm, but the total spread is about 400 ppm." http://www.nature.com/nphys/journal/v12/n2/full/nphys3651.html "Gravity on the balance" by Terry Quinn, *Nature* 2016

Replace the -1/2 in the standard form of Einstein's field equations by -1/2 + dark-matter-compensation-constant, where this constant is approximately sqrt((60±10)/4) * 10^-5 — this replacement is what I call the Fernández-Rañada-Milgrom effect. The idea is that there is an anomalous gravitational redshift which is uniform with respect to the fundamental metric tensor. For a number of years, I have suggested that the Gravity Probe B science team misinterpreted their own experiment — my guess is that the 4 ultra-precise gyroscopes functioned within design specifications and confirmed the Fernández-Rañada-Milgrom effect. Suppose I am wrong — that does not necessarily prove that the Gravity Probe B science team made the correct interpretation. A re-analysis of the Gravity Probe B data might indicate the presence of MOND-chameleon particles or other MONDian physics.

According to Buchman and Turneaure (2011), "A number of unexpected gyro

disturbance effects were observed during the mission: spin-speed and polhode damping, misalignment and roll-polhode resonance torques, forces acting to the gyroscopes, and anomalies in the measurement of the gyro potentials. We show that all these effects except possibly polhode damping can be accounted for by electrostatic patch potentials on the gyro rotors and the gyro housing suspension and ground-plane electrodes." Note that there are 27 references listed by Buchman and Turneaure, but there are no references to Milgrom's MOND. Did Buchman and Turneaure merely demonstrate the theoretical possibility that electrostatic patch potentials can simulate the Fernández-Rañada-Milgrom effect? According to Buchman and Turneaure, "The gravity probe B satellite was launched on April 20, 2004, which we designate as day 1 in the figures. The GP-B operations then went through three phases: (1) initial operations and calibrations lasting 128 days, (2) science data acquisition starting on day 129 for gyros 1, 2, and 3 and on day 149 for gyro 4, and continuing until day 450 for gyro 1, day 459 for gyros 2 and 3, and day 482 for gyro 4, and (3) post-mission calibration lasting until day 527 (September 29, 2005). Unexpected forces and torques acting on the gyroscopes during these phases led to our understanding that surface potentials on the rotor and housing electrodes are substantially larger than we had anticipated." Were the unexpected forces and torques acting on the gyroscopes verified in laboratory experiments involving similar patch-potentials on similar gyroscopes?

Anderson, et al. (2008) found an empirical formula to fit the flyby velocity change as a function of the declinations of the incoming and outgoing asymptotic velocity vectors, δ(in) and δ(out), respectively:
$\Delta V(\infty) / V(\infty) = K * (\cos(\delta(in)) - \cos(\delta(out)))$, where the constant K is expressed in terms of the Earth's rotation velocity ω(E), the Earth's radius R(E), and the speed of light c as $K = 2 * \omega(E) * R(E) / c$.

According to Páramos and Hechenblaikner (2012), "… no acceleration profile exists for the crucial perigee passages, so that the flyby anomaly cannot be characterized as an additional force acting upon the bodies. … Thus, one can only assign an averaged value to the putative force causing such deviations from the expected path of the spacecraft: this is found to be of the order of 10^–4 m/s^2 Antreasian and Guinn (1998). Albeit tentative, this enables the direct comparison with several known sources for perturbations to the hyperbolic trajectories, e.g. Earth oblateness, other Solar System bodies, relativistic corrections, atmosphere drag, Earth albedo and infrared omissions, solar wind and spin-rotation coupling, etc. Antreasian and Guinn (1998); Laemmerzahl, Preuss and Dittus (2006). …
these are all orders of magnitude smaller than the required value, with the exception of Earth oblateness."

In connection with the Anderson-Campbell-Ekelund-Ellis-Jordan flyby formula, Bertolami, Francisco, P.J.S. Gil, & Páramos wrote (2011): "… this expression appears to

suggest that the Earth's rotation may be generating a much larger effect than the frame dragging predicted by General Relativity. This, however, is in contrast with the recent measurements of this effect performed by the Gravity Probe B probe …, which orbits the Earth at a height of about 600 km, well within the onset zone of the reported flyby anomaly."

Note that (10^–4 m/s^2 / 9.8 m/s^2) is roughly 10^–5 so that the dark-matter-compensation-constant is roughly of the correct magnitude for explaining the flyby anomaly. For the sake of completeness, there should be a data analysis of the Gravity Probe B data under the assumption that the 4 ultra-precise gyroscopes worked correctly. If Newton's law of gravity is non-relativistically incorrect, recalculation of Earth oblateness is necessary.

https://arxiv.org/pdf/1210.7333.pdf "Probing the Flyby Anomaly with the future STE-QUEST mission" by Jorge Páramos and Gerald Hechenblaikner, 2012

https://arxiv.org/abs/1109.2779 "Probing the Flyby Anomaly with the Galileo Constellation" by Orfeu Bertolami, Frederico Francisco, Paulo J. S. Gil, & Jorge Páramos, 2011

http://relativity.livingreviews.org/Articles/lrr-2003-1/ "Relativity in the global positioning system" by Neil Ashby, 2003, *Living Reviews in Relativity* 6 (2003): 1.

https://en.wikipedia.org/wiki/Born_coordinates

https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.100.091102 John D. Anderson, James K. Campbell, John E. Ekelund, Jordan Ellis, & James F. Jordan. "Anomalous orbital-energy changes observed during spacecraft flybys of Earth." *Physical Review Letters* 100, no. 9 (2008): 091102.

http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.106.221101 "Gravity Probe B: Final Results of a Space Experiment to Test General Relativity" by C. W. F. Everitt et al., *Physical Review Letters* 106 (2011): 221101.

http://physics.aps.org/articles/v4/43 "Viewpoint: Finally, results from Gravity Probe B" by Clifford M. Will, *Physics* 4 (2011): 43.

http://aip.scitation.org/doi/abs/10.1063/1.3608615 "The effects of patch-potentials on the gravity probe B gyroscopes" by Sasha Buchman & John P. Turneaure *Review of Scientific Instruments* 82, no. 7 (2011): 074502.

WOLFRAMIAN PSEUDO-SUPERSYMMETRY

What is Wolframian pseudo-supersymmetry? At this stage, I cannot give a satisfactory answer to the preceding question. Wolfram conjectured that there

exist 4 or 5 simple rules that suffice to give satisfactory approximations to both quantum field theory and general relativity theory. If string theory with the finite nature hypothesis is a success then string theory with the infinite nature hypothesis must be “almost” a success, and therefore there should be a Wolframian replacement for supersymmetry. In string theory with the infinite nature hypothesis, a string is an entity that might be measured if the energy-density were sufficiently high and the string would actually display extra dimensions. In string theory with the finite nature hypothesis, a string is a smooth approximation to a digital stringy mechanism that functions as a tiny component of Wolfram’s mobile automaton. The digital string mechanism is entirely virtual and the 6 extra string dimensions are interpreted as 3 dimensions of linear momentum + 3 dimensions of angular momentum. (There might be 7 extra dimensions if antimatter time is included.) The role of the digital string mechanism is to transfer Fredkin-Wolfram information from Wolfram’s automaton into a model of quantum field theory (or quantum gravity). Every bit of quantum information is formed from a huge amount of Fredkin-Wolfram information spread over a huge, but finite, number of alternate universes.

The four numbers 2^46, 3^20, 5^9, and 7^6 each divide the order of the monster group.
http://en.wikipedia.org/wiki/Monster_group — so what?

Consider the Koide formula and Lestone’s heuristic string theory.
http://en.wikipedia.org/wiki/Koide_formula
https://arxiv.org/abs/physics/0703151 “Physics based calculation of the fine structure constant” by John P. Lestone, 2009
http://permalink.lanl.gov/object/tr?what=info:lanl-repo/lareport/LA-UR-16-27659 Los Alamos Report LA-UR-16-27659 “Semi-classical Electrodynamics: A Short Note” by John Paul Lestone, issued 2016-10-05

Does the Koide formula imply that string vibrations are confined to 3 copies of the Leech lattice?
Does Lestone’s heuristic string theory imply that leptons are 2-spheres and that quarks are 3-spheres?
http://en.wikipedia.org/wiki/Leech_lattice
http://en.wikipedia.org/wiki/Standard_Model

If n virtual particles move independently of each other, there should be n dimensions of virtual space. 72 virtual dimensions = 64 dimensions of virtual space + 1 dimension of matter time + 1 dimension of antimatter time + 3 dimensions of virtual linear momentum + 3 dimensions of virtual angular momentum — if the preceding equation is correct then the interior of the multiverse might be a 72-ball with a boundary consisting of a 71-ball.

Measurement would occur exclusively on the boundary. Consider the following speculations:

46 dimensions = 26 dimensions of bosonic string theory + 10 dimensions of general relativity in a matter universe + 10 dimensions of general relativity in an antimatter universe
http://en.wikipedia.org/wiki/Bosonic_string_theory
2^46 represents 46 independent copies of (matter time + antimatter time).

20 dimensions = 10 dimensions of general relativity in a matter universe + 10 dimensions of general relativity in an antimatter universe
3^20 represents 20 independent copies of (3 dimensions of space).

9 spherical dimensions = (dimension of 3-sphere of up/down quark) + (dimension of 3 sphere of charm/strange quark) + (dimension of 3 sphere of top/bottom quark)
5^9 represents 9 independent copies of an M-theory 5-brane.
https://arxiv.org/pdf/hep-th/9711053.pdf “Black Hole Entropy in M-theory” by Juan Maldacena, Andrew Strominger, & Edward Witten, 1997

6 spherical dimensions = (dimension of 2-sphere of electron) + (dimension of 2-sphere of muon) + (dimension of 2-sphere of tauon)
7^6 represents 6 independent copies of the 7-sphere.

The structure of the monster group allows interfaces to the 6 pariah groups so that string vibrations in the 3 copies of the Leech lattice can yield smooth approximations proving that string theory with the infinite nature hypothesis “almost” works.

The only prime numbers p such that p divides the orders of all six pariah groups are p = 2,3, and 5.
http://wikipedia.org/wiki/Pariah_group
Does 5^9 divide the order of the monster group because there are 3 dimensions of space, 3 dimensions of linear momentum, and 3 dimensions of angular momentum?

According to Tetsuji Kimura, there exists a [p,q] 7-brane in F-theory.
https://arxiv.org/abs/1602.08606 “Exotic Brane Junctions from F-theory”, 2016
http://en.wikipedia.org/wiki/F-theory
Does 71 = 1 + 7 * 10 have some meaning in terms of F-theory? What if, anything, does F-theory mean in terms of the monster group and the 6 pariah groups? Does the fact that 13^3 divides the order of the monster group has some relevance to F-theory and to bosonic string theory? I say that all of my ideas

might be wrong except for one idea: Milgrom is the Kepler of contemporary cosmology — that is what the empirical evidence implies. http://www.weizmann.ac.il/particle/milgrom/ Mordehai (Moti) Milgrom, Weizmann Institute of Science