

## String Theory and Euler's Constant

### ABSTRACT

I say that my 6 most important ideas are: (1) Milgrom is the Kepler of contemporary cosmology. (2) The main problem with string theory is that string theorists fail to realize that Milgrom is the Kepler of contemporary cosmology. (3) The Koide formula is essential for understanding the foundations of physics. (4) Lestone's heuristic string theory is essential for understanding the foundations of physics. (5) String theorists need the physical analogue of Mochizuki's IUT. (6) Fernández-Rañada's idea that there exists an anomalous gravitational redshift everywhere in the universe can, together with Milgrom's MOND, explain dark matter. Will the preceding 6 ideas lead to a unified theory of mathematics, theoretical physics, and theoretical computer science? My 3 main empirically testable predictions are the Fernández-Rañada-Milgrom effect, the Space Roar Profile Prediction, and the 64 Particles Hypothesis — let us assume that all 3 predictions are wrong — in that case, I am down but not out. According to Lestone's heuristic string theory, a lepton consists of 3 vibrating strings at the Planck scale. Let us assume that a massive boson consists of 1 vibrating string, while a quark consists of 9 vibrating strings. Is there a MOST PROFOUND occurrence of Euler's constant in monstrous moonshine? CONJECTURE: There exists a string formula for monstrous moonshine involving an important occurrence of Euler's constant  $\gamma$ . The formula might have the form  $\pi = \exp(a(1) \cdot \gamma^1 + (-1) \cdot a(2) \cdot \gamma^{(1+48)} + \dots + (-1)^{(n-1)} \cdot a(n) \cdot \gamma^{(1+(n-1) \cdot 48)} + \dots)$ , where each  $a(n)$  is a positive rational number that can be calculated using the monster group and the 6 pariah groups. The number 48 might represent two copies of the Leech lattice — one for matter and one for antimatter; however, the number 48 might need to be replaced by some other number, such as 12, 24, or 72 — or, perhaps the whole idea is wrong. This brief communication offers various speculations on the foundations of physics.

### CALABI-YAU MANIFOLDS VERSUS THE FINITE NATURE HYPOTHESIS

"A conjecture from physics says the generating functions of Gromov-Witten (GW) invariants of Calabi-Yau (CY) manifolds are quasi-modular forms or their invariants. This is a remarkable conjecture since we know very little about higher genus GW invariants beyond saying that their generating functions are formal series." — Yefeng Shen and Jie Zhou

<http://arxiv.org/pdf/1411.2078v2.pdf> "Ramanujan Identities and Quasi-Modularity in Gromov-Witten Theory" by Yefeng Shen and Jie Zhou, 2015

[https://en.wikipedia.org/wiki/Gromov-Witten\\_invariant](https://en.wikipedia.org/wiki/Gromov-Witten_invariant)

If nature is infinite, then string theory's foundation should be string vacua related to Calabi-Yau manifolds. If nature is finite, then string theory's foundation should consist primarily of mathematical structures that are completely finite — although the infinite mathematical structures such as Calabi-Yau would be essential structures derived through approximations from the finite structures. In any case, I say that experimental physics trumps theoretical physics trumps mathematics trumps philosophy. Have astrophysicists and string theorists woefully underestimated Professor Milgrom of the Weizmann Institute?

<http://www.weizmann.ac.il/particle/milgrom/> Welcome letter I Mordehai (Moti) Milgrom  
MOND AND STRING THEORY

I say that MOND is empirically valid, because if MOND were wrong then there is no way that Milgrom could have convinced McGaugh and Kroupa — my guess is that within a

few years the vast majority of experts will agree with me on this particular point. Assume that string vibrations are uniform with respect to the fundamental geometric tensor of general relativity theory. Then the most plausible way to modify Einstein's gravitational field equations is to replace the  $-1/2$  in the standard form of the equations by  $-1/2 + \text{dark-matter-compensation-constant}$ , i.e. what I call the Fernández-Rañada-Milgrom effect. This constant might be  $\sqrt{((60 \pm 10)/4)} * 10^{-5}$  according to empirical evidence. An easy scaling argument shows that the Fernández-Rañada-Milgrom effect is approximately equivalent to MOND. However, the Fernández-Rañada-Milgrom effect might be an overly simplistic idea that should be replaced by a TeVeS-like theory. Is string theory the best hope for understanding why MOND is empirically valid?

"String theory is the only known generalization of relativistic quantum field theory that makes sense." — Edward Witten

[http://www.sns.ias.edu/ckfinder/userfiles/files/Unravelling\(3\).pdf](http://www.sns.ias.edu/ckfinder/userfiles/files/Unravelling(3).pdf) "Unravelling string theory" by Edward Witten, NATURE, VOL 438, December 2005

"At a 1990 conference on cosmology, I asked attendees, who included folks like Stephen Hawking, Michael Turner, James Peebles, Alan Guth and Andrei Linde, to nominate the smartest living physicist. Edward Witten got the most votes (with Steven Weinberg the runner-up). Some consider Witten to be in the same league as Einstein and Newton." — John Horgan, 22 September 2014

<http://blogs.scientificamerican.com/cross-check/physics-titan-still-thinks-string-theory-is-on-the-right-track/>

THEORETICAL PHYSICS, MONSTROUS MOONSHINE, AND EULER'S CONSTANT

"Recent works in moonshine suggest deep relations between number theory and physics."

<http://arxiv.org/abs/1411.6571> "Moonshine" by John F. R. Duncan, Michael J. Griffin, & Ken Ono, 2015

"In this note, we establish a physical realization of the Riemann hypothesis in terms of the properties of bosonic strings." — He, Jejjala, & Minic

<http://arxiv.org/pdf/1501.01975v2.pdf> "From Veneziano to Riemann: A String Theory Statement of the Riemann Hypothesis" by Yang-Hui He, Vishnu Jejjala, & Djordje Minic, 2015

On 10 November 2015, Professor Bruce Berndt replied in a part to an email (sent by D. Brown), "I do not know of any formula relating Euler's constant with monstrous moonshine. Such a formula would be surprising." (See the comments section of the following nature.com article.)

<http://www.nature.com/news/the-biggest-mystery-in-mathematics-shinichi-mochizuki-and-the-impenetrable-proof-1.18509>

[http://en.wikipedia.org/wiki/Bruce\\_C.\\_Berndt](http://en.wikipedia.org/wiki/Bruce_C._Berndt)

From Wolfram Alpha:

$\pi - \exp\left(\frac{118}{59} * \gamma - (7 * 59^5) * \gamma^{49} + (2 * 59^{11}) * \gamma^{97} - (1 * 59^{17}) * \gamma^{145} + (4 * 59^{23}) * \gamma^{193} - (2 * 59^{29}) * \gamma^{241} + (2 * 59^{35}) * \gamma^{289}\right) = -2.88 * 10^{-7}$  approx.

$\pi - \exp\left(\frac{118}{59} * \gamma - (7 * 59^5) * \gamma^{49} + (2 * 59^{11}) * \gamma^{97} - (1 * 59^{17}) * \gamma^{145} + (4 * 59^{23}) * \gamma^{193} - (2 * 59^{29}) * \gamma^{241} + (2 * 59^{35}) * \gamma^{289} - (7 * 59^{41}) * \gamma^{337}\right) = 4.1276 * 10^{-8}$  approx.

The order of the monster group is

$2^{46} * 3^{20} * 5^9 * 7^6 * 11^2 * 13^3 * 17 * 19 * 23 * 29 * 31 * 41 * 47 * 59 * 71$  — but what do the factors mean in terms of the foundations of physics?

[http://en.wikipedia.org/wiki/Monster\\_group](http://en.wikipedia.org/wiki/Monster_group)

$118 = 2 * 59 = 47 + 71 = (59 - 12) + (59 + 12)$  .

My guess is that the two equations  $59 - 12 = 47$  and  $59 + 12 = 71$  have some profound significance in terms of F-theory.

According to Wikipedia, "F-theory is formally a 12-dimensional theory, but the only way to obtain an acceptable background is to compactify this theory on a two-torus. By doing so, one obtains type IIB superstring theory in 10 dimensions. The  $SL(2, Z)$  S-duality symmetry of the resulting type IIB string theory is manifest because it arises as the group of large diffeomorphisms of the two-dimensional torus."

<http://en.wikipedia.org/wiki/F-theory>

In speculative numerology it is easy to make foolish mistakes. My guess is that the real number pi is the number which best represents symmetry. My guess is that Euler's constant  $\gamma$  is a profound link between continuum mathematics and non-continuum mathematics. If there is a unified theory of mathematics, theoretical physics, and theoretical computer science then there might be a MOST PROFOUND FORMULA which incorporates pi, Euler's constant  $\gamma$ , and part of monstrous moonshine. If each massive boson is a 1-sphere at the Planck scale, then pi might be calculated in the form of the exp function applied to a series  $b(1) * X(1) + b(2) * X(1) * X(2) + \dots b(n) * X(1) * \dots * X(n) + \dots$ , where the  $X(1), X(2), \dots, X(n), \dots$  are independent and identically distributed random variables each having mean equal to Euler's constant  $\gamma$ . As a measured particle, the massive boson would be localized to a tiny 1-sphere. For a non-measured virtual particle, the quantum field related to the massive boson might be spread over some higher dimensional stringy space.

THE NUMBER 7 AS A DIVISOR OF THE MONSTER GROUP

Note that the Leech lattice can be embedded into 24-dimensional space.

[http://en.wikipedia.org/wiki/Leech\\_lattice](http://en.wikipedia.org/wiki/Leech_lattice)

[http://en.wikipedia.org/wiki/Monster\\_group](http://en.wikipedia.org/wiki/Monster_group)

Why does  $7^6$  divide the order of the monster group?

In November 2015 I posted online the following:

CONJECTURE 3: Assume (A), (B), & (C): (A) String vibrations are approximately confined to 3 copies of the Leech lattice. (B) The symmetries of string vibrations are approximately governed by the monster group and the 6 pariah groups. (C) The Clebsch surface explains why there are 3 color charges for quarks and gluons. By assuming (A), (B), & (C) there are 4 stringy formulas that accurately predict all of the free parameters of the Standard Model of particle physics, namely the formulas for bosonic mass scale, fermionic mass scale, coupling constants' scale, and unified monstrous moonshine.

(See the comments section of the following nature.com article.)

<http://www.nature.com/news/the-biggest-mystery-in-mathematics-shinichi-mochizuki-and-the-impenetrable-proof-1.18509>

If the preceding conjecture is true then the reason that  $7^6$  divides the order of the monster group might be that  $24 = 6 * 4$ , where the 4 represents 4 dimensions of space-time and the 6 represents 3 dimensions of linear momentum + 3 dimensions of angular momentum. The 6-dimensional momenta need to be represented 4 times because each dimension of space-time has 4 dimensions of quantum uncertainty.

IS NATURE INFINITE?

Note that nature might be infinite even though string vibrations are approximately

confined to 3 copies of the Leech lattice. I conjecture that string theory with the infinite nature hypothesis can satisfactorily predict all the free parameters of the Standard Model of particle physics BUT string theory with the infinite nature hypothesis CANNOT satisfactorily explain dark matter.

"Although most physicists prefer dark matter over MOND as an explanation of the excess gravitational acceleration in galaxies and the universe, the debate continues." — Klasen, Pohl, & Sigl

<http://arxiv.org/pdf/1507.03800v1.pdf> "Indirect and direct search for dark matter" by Michael Klasen, Martin Pohl, and Günter Sigl, 2015