What is measurement? Why does measurement exist?

ABSTRACT

Are there 3 dimensions of space because there are 3 generations of fermions? Are the Leech lattice, the monster group, and the 6 pariah groups nature's most fundamental mathematical structures? Is string theory the only plausible way to understand the foundations of physics? Assume that ultimate reality is adequately described by one of two alternatives: string theory with the infinite nature hypothesis or string theory with the finite nature hypothesis. Do the Leech lattice, the monster group, and the 6 pariah groups enable M-theory to have a computational method? Do superpartners occur in nature if and only if nature is infinite? What is dark matter? What is the explanation for the space roar? What is measurement and why does it exist? Measurement might be a natural process that separates the boundary of the multiverse from the interior of the multiverse. Measurement might exist because there is a 26-dimensional bosonic string theory. String theory with the finite nature hypothesis might suggest 3 decisive empirical tests; if any 1 of the 3 tests is falsified the finite nature hypothesis is likely to be wrong or irrelevant to testable physics. This communication offers a somewhat vague approach to developing a computational method for M-theory. The string landscape and the curling up of extra spatial dimensions might be the results of string theory with the infinite nature hypothesis and with thinking about strings as measurable physical entities. Three decisive empirical tests and the building up of approximations to quantum information might be the results of string theory with the finite nature hypothesis and with thinking about strings as deterministic machines that transfer information.

WHAT DOES STRING THEORY NEED TO EXPLAIN?

If X's acceleration law is to string theory as Kepler's laws are to Newtonian mechanics, then who is X?

http://www.weizmann.ac.il/weizsites/milgrom/ Mordehai (Moti) Milgrom, Weizmann Institute of Science

If Milgrom's non-relativistic MOND is empirically valid, then what is the meaning of MOND in terms of the foundations of physics? My guess is as follows:

Photons and gluons cannot escape from the universe in which they are located. Gravitons travel at the speed of light on average. A statistically significant few gravitons travel slower than the speed of light. These slow gravitons cause the Fernández-Rañada-Milgrom effect. A statistically few gravitons travel faster than the speed of light and escape from the boundary of the multiverse into the interior of the multiverse. These fast gravitons cause the nonzero cosmological constant and the inflaton field. Electromagnetic radiation from the inflaton field shows up as the space roar. If the fast gravitons never escaped from the universe in which they are located, then the slow gravitons and the fast gravitons would average out, yielding Einstein's field equations with cosmological constant = zero and dark-matter-compensation-constant = zero.

A critic of the preceding guess might ask, “Where is the mathematical model of the multiverse?” Critics might say, “Describe the multiverse model with mathematical accuracy. Put up or shut up.” I would reply that describing the multiverse model is extremely difficult and that such description involves unresolved issues in mathematical physics, cosmology, and high energy physics. The following 4 references give the background for my speculation on the foundations of physics:

"Are the Graviton, the Inflaton, and the Axion the Only Fundamental Particles that Remain to be Discovered?” (18 Jan. 2014) http://vixra.org/abs/1401.0134

"Is the Space Roar an Essential Clue for Quantum Gravity?" (13 Jan. 2014) http://vixra.org/abs/1401.0101

"Is the Space Roar an Empirical Proof that the Inflaton Field Exists?" (24 Dec. 2013) http://vixra.org/abs/1312.0193

P. Kroupa, M. Pawlowski, and M. Milgrom, “The failures of the standard model of cosmology require a new paradigm” (16 Jan. 2013) http://arxiv.org/pdf/1301.3907v1.pdf

Kroupa claims, “Effective dynamics is scale-invariant/Milgromian (i.e. “dark matter” must be mathematically equivalent to Milgromian dynamics).”

http://www.youtube.com/watch?v=UPVGDXNSBZM “Pavel Kroupa - The vast polar structures around the Milky Way and Andromeda”, Nov. 18, 2013 (for quote see 54:14 of 1:12:57)

Those who challenge Kroupa’s claim about Milgromian dynamics need to dispute the empirical facts as elucidated by Kroupa, Pawlowski, Milgrom, and McGaugh.

PIONEER ANOMALY AND ITS POSSIBLE EXPLANATION

Is atomic time different from astronomical time? In the Canadian Journal of Physics, Antonio Fernández-Rañada and Alfredo Tiemblo-Ramos propose "an explanation of the Pioneer anomaly that is a refinement of a previous one and is fully compatible with the cartography of the solar system. It is based on the non-equivalence of the atomic time and the astronomical time which happens to have the same observational fingerprint as the anomaly."

http://www.nrcresearchpress.com/doi/abs/10.1139/p2012-086#.UtZzJxwhZPw Parametric invariance and the Pioneer anomaly - vol. 90, no 10, Oct. 2012, Canadian Journal of Physics

http://arxiv.org/abs/1106.4400 "The dynamical nature of time", 2011 by A. Fernández-Rañada & A. Tiemblo

"... the greatest source of uncertainty in the thermal model turned out to be due to the paint ... for which there is no literature on performance and likely degradation in the conditions on board the Pioneers"

http://www.nature.com/nphys/journal/v8/n9/full/nphys2428.html "... and farewell to the Pioneer anomaly: Nature Physics"

Note that following publication makes no reference to non-relativistic MOND:

http://arxiv.org/abs/1204.2507 "Support for the thermal origin of the Pioneer anomaly", 2012, by Turyshev et al.

If Milgrom is the Kepler of contemporary cosmology, then is the total omission of consideration or reference to MOND likely to be a bad approach to studying all the ins and outs of the Pioneer anomaly?

NO LITERATURE ON PERFORMANCE AND LIKELY DEGRADATION

The uncertainty in the thermal model is based on surmise. I surmise that Milgrom is the Kepler of contemporary cosmology. If my surmise concerning Milgrom is correct, then any scientific publication that deals with gravity and ignores Milgrom is perhaps fatally flawed. I think that there 3 main problems with the explanation of Turyshev et al. of the Pioneer anomaly: (1) totally ignoring the work of Milgrom; (2) using an UNSUBSTANTIATED GUESS ABOUT THE PROPERTIES OF A PARTICULAR PAINT; (3) committing the fallacy of unjustified statistical precision.

The computer simulation used by Turyshev et al. seems excellent, but their analysis falls short of high statistical confidence in finding an explanation for what they allege.

GRAVITY PROBE B

Did the Gravity Probe B (GPB) science team perform a 100% accurate analysis of their empirical data? The GPB scientists ignored Milgrom's non-relativistic MOND. The Gravity Probe B science team claims that they accurately modeled the "misalignment torque" which was remarkably consistent for their 4 gyroscopes.

http://arxiv.org/abs/1105.3456 "Gravity Probe B: Final Results of a Space Experiment to Test General Relativity", 2011

I claim that the 4 gyroscopes worked to within design specifications and that the so-called misalignment torque is an empirical validation of the Fernández-Rañada-Milgrom effect. The Gravity Probe B science team totally ignored the work of Milgrom, McGaugh, and Kroupa, even though the gravitational accelerations measured in the Gravity Probe B project were well within the range where Milgrom's acceleration law has been proven to be empirically accurate.

Milgrom is the Kepler of contemporary cosmology — BASED UPON EMPIRICAL EVIDENCE. Is string theory likely to be the only way to understand the basis of non-relativistic MOND?

HOW MIGHT STRING THEORY BE GIVEN A SATISFACTORY METHOD OF CALCULATION?

In string theory with the infinite nature hypothesis, the idea is to compactify the extra spatial dimensions in which the strings vibrate. In string theory with the finite nature

hypothesis, the idea is to use Wolfram's mobile automaton, the Leech lattice, the monster group, and the 6 pariah groups to uniquely define the approximate vibrations of the approximate strings. In string theory with the finite nature hypothesis, the vibrating strings are smoothings of the finite, digital representations of quantum uncertainty. Let us begin with a 10-dimensional model, called 10-GR-matter, of general relativity for a matter universe and with a 10-dimensional model, called 10-GR-antimatter, of general relativity theory for an antimatter universe. Into the two models, 10-GR-matter and 10-GR-antimatter, introduce the classical field theory of electromagnetism. Maxwell's equations can be introduced into the two models using a tensor of the first rank according to pages 98–99 of Einstein's "Meaning of Relativity", 1956, 5th edition. (See page 86 for the basic idea of the Fernández-Rañada-Milgrom effect: What is the simplest way that general relativity theory can fail? Replace -1/2 by -1/2 + dark-matter-compensation in the standard form of Einstein's field equations.)

http://press.princeton.edu/titles/484.html "The Meaning of Relativity, 5th edition", 2004

We can replace the electromagnetic tensor in the model 10-GR-matter with a 26-dimensional bosonic string model running on matter time. We can replace the electromagnetic tensor in the model 10-GR-antimatter with a 26-dimensional bosonic string model running on antimatter time. By means of the two preceding replacements we get a 72-dimensional model. This 72-dimensional model might also represent 64 dimensions of quantum uncertainty with 1 dimension of matter time, 1 dimension of antimatter time, 3 dimensions of linear momentum, and 3 dimensionsl of angular momentum. Is there another 72-dimensional model that leads to some string theoretical duality and also yields insight into measurement?

If you have a lattice, you have a pattern of points that might be used for measurement. The Leech lattice seems likely to play an important in the foundations of physics.

http://en.wikipedia.org/wiki/Leech_lattice

Imagine a 25-dimensional boson running on matter time and vibrating on the Leech lattice with 3 and only 3 energy-density levels and also a 25-dimensional boson running on antimatter time and vibrating on the Leech lattice with 3 and only 3 energy-density levels. That is to say, at each point in time (either matter time or antimatter time) the boson is a 25-dimensional physical entity. There might be a 78-dimensional bosonic string model using 3 copies of the Leech lattice.

By hypothesis there are two 25-dimensional bosons (one of matter and the other of antimatter) vibrating on the 3 copies of the Leech lattice as matter time runs in one direction and antimatter time runs in the other direction with respect to parity. There might be precisely 6 redundant representations of spacetime vibration, because the Leech lattice supports spacetime vibrations in 6 different spacetime-ORTHOGONAL directions for ANY 4-dimensional spacetime embedded into the Leech lattice. The redundant representations of spacetime can be reduced through group theory. By means of isomorphism the hypothetical 78-dimensional bosonic string theory might generate a 72-

dimensional model of bosonic string vibration based upon 3 copies of the Leech lattice, i.e., 72 dimensions = 78 dimensions – 6 dimensions of redundant spacetime representation.

http://en.wikipedia.org/wiki/Bosonic_string_theory

The preceding conjectures might establish a 72-dimensional model that might be mapped into a 72-ball using Wolfram's mobile automaton, the monster group, and the 6 pariah groups.

As of the year 2014 C.E., in the Standard Model of particle physics, there are 61 fundamental particles:

http://en.wikipedia.org/wiki/Standard_Model

The 61 fundamental particles consist of 36 quarks, 12 leptons, 8 gluons, W-plus boson, W-minus boson, Z-zero boson, photon, and Higgs boson. If there are precisely 64 dimensions of quantum uncertainty, then the graviton, the inflaton, and the axion might be the leading candidate particles for addition to the Standard Model of particle physics and there would be precisely 64 fundamental particles. Spacetime might have 16 dimensions of uncertainty with respect to itself (i.e. uncertainty from alpha-prime problem) and 64 dimensions of uncertainty with respect to itself and the energy tensor (i.e. uncertainty from combination of alpha-prime problem and h-bar problem). In the Standard Model there are 48 fundamental fermions (36 quarks and 12 leptons). 48 = 3 * 16, suggesting that the 3 generations of fermions might generate 48 dimensions of quantum uncertainty from 16 dimension of spacetime uncertainty, while the hypothetical 16 fundamental bosons generate 16 dimensions of quantum uncertainty.

IS THE PRECEDING SCENARIO WRONG OR NOT EVEN WRONG?

Many critics might say the preceding scenario is a meaningless mush of verbiage — perhaps such critics might be 100% correct. In any case, there might be some approach to string theory with the finite nature hypothesis that allows conformal theory, AdS/CFT correspondence, the Leech lattice, the monster group, and the 6 pariah groups to do the following: Give decisive predictions that confirm or refute the idea of string theory with the finite nature hypothesis. There is a problem with the finite nature hypothesis — it is difficult to see how such a wide-ranging hypothesis could be refuted. However, if the finite nature hypothesis cannot explain dark energy, dark matter, cosmological inflation, and the space roar in a satisfactory way, then the finite nature hypothesis might as well be rejected as either false or useless. With or without the finite nature hypothesis, string theory seems to be nature's way of unifying quantum field theory with general relativity theory. 't Hooft gave this outlook on page 79 of his 2004 lecture notes:

"String theory clearly appears to be strikingly coherent. What seems to be missing presently, however, is a clear description of the *local* nature of its underlying physical laws. In all circumstances encountered until now, it has been imperative that external fields, in- and outgoing strings and *D*-branes are required to obey their respective field equations, or lie on their respective mass shells. Thus, only effects due to external perturbations can be computed when these external perturbations obey equations of

motion. To me, this implies that we do not understand what the *independent* degrees of freedom are, and there seems to be no indication that these can be identified. String theoreticians are right in not allowing themselves to be disturbed by this drawback."

http://www.staff.science.uu.nl/~hooft101/lectures/stringnotes.pdf "Introduction to String Theory", version 14-05-04, Gerard 't Hooft

On page 197, Section 8 of his "Lecture Notes on String Theory", David Tong states,
"... we will consider the simplest compactification of the bosonic string: a background spacetime of the form
$R_{1,24}$ Å~ S_1 (8.1)
The circle is taken to have radius R, so that the coordinate on S_1 has periodicity
$X_{25} \equiv X_{25} + 2\pi R$
We will initially be interested in the physics at length scales $\gg$ R where motion on the S_1 can be ignored. Our goal is to understand what physics looks like to an observer living in the non-compact $R_{1,24}$ Minkowski space. This general idea goes by the name of Kaluza-Klein compactification. We will view this compactification in two ways: firstly from the perspective of the spacetime low-energy effective action, and secondly from the perspective of the string worldsheet."

http://www.damtp.cam.ac.uk/user/tong/string.html David Tong -- Lecture Notes on String Theory

Do string theorists think about observation in a rather speculative manner that might or might not be relevant to testable physics? Is string compactification the way nature works if and only if nature is infinite? In string theory with the infinite nature hypothesis, string theorists can create many different string vacua that can yield models for various values of the free parameters of the Standard Model of particle physics. However, string theory with the infinite nature hypothesis does not seem to give an appealing or compelling explanation for the space roar.

http://en.wikipedia.org/wiki/Space_roar

If string theory with the infinite nature hypothesis could explain space roar in a compelling way, then my guess is that some string theorist would by now have already published such an explanation.

IS SUPERSTRING DETERMINISM AN EMPIRICALLY VALID IDEA?

"We claim that our observations add a new twist to discussions concerning the interpretation of quantum mechanics, which we call the cellular automaton (CA) interpretation." — G. 't Hooft
http://arxiv.org/abs/1207.3612 "Discreteness and Determinism in Superstrings", 2012 by Gerard 't Hooft

Is it wise to ignore 't Hooft's ideas on determinism? Should the foundations of physics

include determinism and exclude infinity?

IS INFINITY A PHYSICALLY DUBIOUS IDEA AND A STUMBLING BLOCK FOR M-THEORY?

"Because there are so few string theories, the general framework of string theory makes certain general predictions that are out of reach without string theory: 1. Gravity ... 2. Nonabelian Gauge Symmetry ... and 3. Supersymmetry ..." —Edward Witten

http://www.sns.ias.edu/~witten/papers/mmm.pdf "Magic, Mystery, and Matrix", 1998

In the 30 year period ending in the year 2010 C.E., Witten was the fourth most cited physicist.

http://tulane.edu/sse/pep/news-and-events/upload/most-cited-physicists-1981-2010.pdf "40 Most Cited Physicists 1981-2010"

If Witten is wrong about superpartners then is something likely to be wrong with the infinite nature interpretation of string theory? Do superpartners occur in nature if and only if nature is infinite? If superpartners do not occur in nature, then is there likely to be some profound reason for such nonoccurrence? Is the concept of infinity incompatible with measurements that occur in physical reality?

“Was nun Ihren Beweis anbelangt, so protestiere ich zuvörderst gegen den Gebrauch einer unendlichen Größe als einer Vollendeten, welcher in der Mathematik niemals erlaubt ist. Das Unendliche ist nur eine façon de parler, indem man eigentlich von Grenzen spricht, denen gewisse Verhältnisse so nahe kommen als man will, während anderen ohne Einschränkung zu wachsen gestattet ist.” (Now as for your proof, first of all I protest against the use of an infinite quantity as a completed entity, which in mathematics is never allowed. The infinite is only a manner of speaking, in which one actually speaks of limits, which in some situations one can come as close to as one wants, while in other situations there is growth without restriction.) C. F. Gauß, Briefwechsel mit Schumacher, (1831)

Are string theorists wrong in accepting infinity and wrong in rejecting MOND?

ARE MOND SUPPORTERS DELUDED BY A PET THEORY?

Sometimes scientists become deluded by a pet theory — they begin with some beloved idea or set of ideas and somehow interpret experiments in the deluded light of their preconceptions. Does Kroupa fit this paradigm of delusion?

I quote Prof. Dr. Pavel Kroupa from a (Nov. 1, 2011) e-mail,
“My criticism is not based on me not liking dark matter, but is a result of rigorous hypothesis testing such that, from a strictly logical and scientific point of view, LCDM is definitely not a viable model of cosmological reality. I do not write such statements because I do not like LCDM and its ingredients, but because every test I have been involved with falsifies LCDM. At the same time, the tests of MOND we performed were done on the same footing as the LCDM tests. The MOND tests yield consistency so

far. I am not more "fond" of MOND or any other alternative, but the scientific evidence and the logical conclusions cannot be avoided. And it is true, I must concede, that MOND has an inherent beauty which must be pointing at a deeper description of space time and possibly associated quantum mechanical effects which we do not yet understand (compare with Kepler laws and the later Newtonian dynamics).”