Natural Boundaries

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Abstract

My understanding of modern physical discoveries that does not modify the existing equations. Only the values become bounded, to avoid infinities and singularities: "the sand a boundary for the sea, an everlasting barrier it cannot cross. The waves may roll, but they cannot prevail; they may roar, but they cannot cross it." Jeremiah 5:22 NIV

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In Zeno's paradox of Achilles and the tortoise, Achilles is in a footrace with the tortoise. Achilles allows the tortoise a head start of 100 meters, for example. Suppose that each racer starts running at some constant speed, one faster than the other. After some finite time, Achilles will have run 100 meters, bringing him to the tortoise's starting point. During this time, the tortoise has run a much shorter distance, say 2 meters. It will then take Achilles some further time to run that distance, by which time the tortoise will have advanced farther; and then more time still to reach this third point, while the tortoise moves ahead. Thus, whenever Achilles arrives somewhere the tortoise has been, he still has some distance to go before he can even reach the tortoise. An infinite sum of distances appears. But the infinite amount cannot be counted; and nature is, what is countable. After an infinite amount of moves, Achilles would be in contact with the tortoise, the distance would vanish. But as this infinite amount is excluded by nature, there is the minimum possible length, called Planck's length.

First of all, we see the boundary in the calculation of vacuum energy: we use Planck's energy as an upper boundary of virtual pair fluctuations [1].

Secondly, because any massive particle can not be a particle moving with the speed of light, there is a maximal possible speed W for particles with mass: $v < W < c$. Then there are special coordinates (of a special metric), where this law can be calculated. And the infinitely fast propagation of quantum entanglement also points to the existence of such a coordinate system. [2] The existence of such a system does not require the modification of the current mathematical formulas. However, this system enables additional effects of nature.

For example: vanishing. Anything with a velocity larger than W vanishes, making an exception to the energy conservation law. Note that a recent paper in Physical Review Letters hypotheses on such violations [4].

But consider a cloud of dust and an astronaut floating in weightlessness near the edge of this cloud, but inside the cloud. The gravity shrinks the cloud in size, and so the astronaut must be able to measure a slight compression of his body during the fall towards the center of the cloud: due to the gravitational collapse the astronaut is being compressed together with the cloud.

However, in Newton's worldview, the gravity at the feet of the astronaut is stronger than the gravity at the head, so the astronaut is being spaghettified. The spaghettification was

indeed observed recently [5]. But according to my own calculations, this spaghettification happens only halfway down. After that, size-shrinking happens and the astronaut vanishes. Hereby the vanishing happens even outside the curvature singularity, which is at the center.

But the astronaut will vanish even before reaching the event horizon: the astronaut penetrates the ergosphere at the speed of light. You can relatively easily calculate it using Ref. [3]. However, the above law $v < W < c$ "deletes" the astronaut during the fall towards the ergosphere.

The way to falsify the $v < W < c$ law is to find out whether the black hole looks like a black sphere at any angle of aspect and any rotational speed. Note in comparison that the Earth rotates, and the forces have deformed the planet into an ellipsoid. The faster it rotates, the less spherical is its shape. The same should be happening in the black hole case.

The M87 black hole rotational axis is directed towards the Earth, so my theory cannot be confirmed yet from the shape of the image of the black hole. But there should be a discrepancy in its mass determination. And indeed, two publications disagree by a factor of two on the mass issue [7, 8]. And indeed, the ergosphere is two times larger than the event horizon (for fast rotation); the astronomers see not black event horizon, but black ergosphere surface.

Due to vanishing, Einstein's equations have to be mathematically fixed. This is the role of Dark Matter which is not actual physical matter but a mathematical term put "by hand" to the right-hand side of Einstein's Equations. I called it Virtual Matter. Hereby Dark Energy is a special form of Virtual Matter.

I. MASS OF NEUTRINO

Calculated from extreme-energy cosmic ray data, the fastest particle that has hit Solar System has the speed $v_m = c\,(1-\epsilon)$, $\epsilon = (1.745 \pm 0.015)\,\mathrm{x}10^{-22}$. Thus, it can be expected that $W = c\,(1-10^{-22})$.

However, there was also the detection of a tau-neutrino with very high energy 2 PeV. [10] This means, that it moves with the speed of light, as the maximum mass of a neutrino must be less than 0.120 eV. Thus, having zero mass, this neutrino does not transform into other neutrinos. But electron neutrino and muon neutrino must have a non-vanishing mass because they oscillate.

II. QUANTUM MECHANICS IS THE EFFECT OF METROLOGY

Reality is like a story, the story which is built upon definitions. That is demanded by Aristotle's logic laws, which are not a human construct, but objective laws of life. Life closely follows the correct definitions, and this word by word: it is like a PC follows a program. Nature is what the instruments are measuring, and instruments are what measures nature: it is a circular definition. As Einstein has said: "Time is what the clock shows", which is intuitively true. The clock shows the time with measurement uncertainty. Therefore, the time itself is discrete: there is a minimal possible time: Planck's time interval. The same applies to any kind of measurement, e.g. the spin of a particle.

Because instruments do measure with non-vanishing error precision, and nature is what the instruments measure, nature itself contains the uncertainties, including the uncertainty of space measure – Planck's length, and time measure – Planck's time.

One cannot calculate an infinite large volume, and so the size of our Universe is finite. It includes finiteness in past time, in future time, and the spatial directions.

The finiteness of velocity demands the existence of a lightspeed barrier.

The finiteness of temperature demands the Absolute Zero of the temperature.

Instruments placed in an area of different physical laws will not measure correctly. Therefore, all laws are universal, they are the same in all times and places. This means that even the fine structure constant must be the same throughout the cosmos. So far, most experimental data are consistent with it being constant [6]. Parallel Universes in the Multiverse cannot have alien values of the fundamental constants.

The bounded spacetime curvature comes with cutting off the singular areas [of our universe], including the Big Bang. This means that the world began not in the moment of the Big Bang, but later. Prior to the existence of the actual world, there was a Virtual World, Virtual Reality. Remnants of this totally virtual World are Dark Matter and Dark Energy.

A. Vacuum decay: the ultimate catastrophe

The Higgs field can become unstable in the phenomenon called the decay of the vacuum [9]. As instruments placed into the area of "true vacuum" will be modified [so they can not measure correctly being there], such areas can not occur. But there is a certain

probability for their occurrence. We came to a paradox.

The following text holds for a finite spacetime volume of our Universe.

The obvious solution which does not modify the formulas is luck. Luck exists, it prevents such a catastrophe. Recall how the Prophet Jesus Christ was extremely lucky to survive the three years of his popularity without bodyguards. Note, that the "bad luck" comes from satan.

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[1] Ronald J. Adler, Brendan Casey, Ovid C. Jacob, "Vacuum catastrophe: An elementary exposition of the cosmological constant problem". American Journal of Physics. 63 (7): 620–626 (1995).

[2] Jim Holt, "When Einstein Walked With Godel: Excursions to the Edge of Thought," Farrar, Straus and Giroux. 2018; Jack Markoff, "Sorry, Einstein. Quantum Study Suggests 'Spooky Action' Is Real". The New York Times. 21 October 2015.

[3] A. P. Lightman, W. H. Press, R. H. Price, S. A. Teukolsky, "Problem Book in Relativity and Gravitation," Princeton University Press, Princeton, 1975.

[4] Thibaut Josset, Alejandro Perez, and Daniel Sudarsky, "Dark Energy from Violation of Energy Conservation", Phys. Rev. Lett. 118, 021102 (2017).

[5] M. Nicholl, et.al. "An outflow powers the optical rise of the nearby, fast-evolving tidal disruption event AT2019qiz," Mon. Not. R. Astr. Soc. 499, 482–504 (2020).

[6] K. Olive, Y.-Z. Qian, "Were Fundamental Constants Different in the Past?". Physics Today. 57 (10): 40–45 (2003); J.-P. Uzan, "Variation of the Constants in the Late and Early Universe". AIP Conference Proceedings. 736: 3–20 (2004), arXiv:astro-ph/0409424

[7] The Event Horizon Telescope Collaboration et al., "First M87 Event Horizon Telescope Results. VI. The Shadow and Mass of the Central Black Hole," Astrophys. J. Lett. **875** L6 (44pp), 2019.

[8] Jonelle L. Walsh, Aaron J. Barth, Luis C. Ho, and Marc Sarzi, "The M87 Black Hole mass from gas-dynamical models of space telescope imaging spectrograph observations," Astrophys. J. **770** 86 (11pp), 2013.

[9] Katie Mack, Vacuum decay: the ultimate catastrophe, Cosmos, 14 September 2015.

[10] The Big Bird neutrino event was detected by IceCube on Tuesday, December 4, 2012, ice-

cube.wisc.edu/news/view/292