Some strange astrophysical and cosmological findings from the TGD point of view

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Abstract

In this article some of the most recent cosmological and astrophysical anomalies are discussed. The astrophysical anomalies relate closely also to the TGD view of biology and consciousness: there is evidence that Earth had a ring before the Cambrian Explosion; astronauts report what is called the scent of space and there is evidence that the position of Mars correlates strongly with the stock market crashes.

The surplus of deuterium nuclei and deuterium-antideuterium and helium-antihelium pairs in the cosmic ray spectrum and the evidence galaxies rotating in different directions relative to the Milky Way are the cosmological anomalies considered. These anomalies are highly interesting from the point of view of the TGD inspired cosmology and of the model of stars based on the new physics predicted by TGD.

Contents

1 Introduction

Anomalies in both astrophysics and cosmology have been rapidly accumulating during the last years. The most recent astrophysical anomalies that I have encountered relate closely also to the TGD view of biology and consciousness.

1. There is evidence that Earth had a ring before the Cambrian Explosion [E13]. The proposed explanation based on the TGD variant of the Expanding Earth hypothesis [L6]. The ring would have existed already before the Cambrian Explosion along the equator but the rapid expansion of the Earth (radius was doubled) implied that Earth catched the ring resulting in a large number of meteor craters along the equator and a temporary cooling of the climate caused by the shadow of the ring.

2. The scent of space (see this)is a strange phenomenon reported by astronauts. It is now known that olfaction involves at the fundamental level infrared light. The scent could relate to so called PAHs [I1, I2], which are aromatic molecules with several rings. PAH are known to produce the so called unidentified infrared bands (UIBs) for a radiation arriving from the interstellar space, even from regions containing no stars or involving no star formation. The mechanism could be non-chemical and involve the generalization of Pollack effect transferring ordinary protons to dark protons at the magnetic body and their dropping back back and in this way producing the infrared photons.

3. The surprisingly strong evidence that the position of Mars (see this correlates strongly with the stock market crashes is in conflict with the basic beliefs of physicalist. During the crashes the distance of Mars tends to be at the other side of the Sun than Earth. The TGD based explanation would rely on the loss of the predicted quantum coherence in astrophysical scales due the splitting of the monopole flux tubes connecting Earth and Mars (this mechanism might be at work although Mars has no large scale magnetic field). This would lead to a partial loss of quantum control at the level of collective consciousness and lead to panic reactions.

There are also numerous cosmological anomalies.

1. The surplus of deuterium nuclei in the cosmic ray spectrum [E4] (see this) is difficult to understand in the standard physics framework. There is also evidence for pairs of deuterium-anti-deuterium nuclei and even helium-antihelium nuclei [E15] (see this).

   The TGD inspired model of stars discussed in [L13] deviates dramatically from the standard model and proposes that M_{89} hadron physics with mass scale 512 times that for the ordinary hadron physics might be involved. There is some evidence for M_{89} mesons from LHC. The decay of the monopole flux tubes carrying dark M_{89} nuclei as analogs of ordinary nuclei along the solar surface would produce solar energy and solar wind. The flux of M_{89} nuclei arriving along monopole flux tubes from the Milky Way giant blackhole would provide the energy and serve also as a metabolic energy source of dark nuclei in the solar interior forming a state analogous to a cell.

   The decay of M_{89} mesons could produce nucleon-antinucleon pairs but the production of deuterium-anti-deuterium pairs and even Helium-anti-Helium pairs is not so plausible. An alternative explanation is the decay of monopole flux tubes containing sequences of ordinary or M_{89} anti-nuclei.

2. There is evidence that galaxies rotating in different directions relative to the Milky Way have different redshifts and that the difference increases with distance: the explanation in terms of tired light [E8] does not seem plausible. This suggests that they have slightly different Hubble constants. TGD suggests explanation in terms of the variation of slightly different values of effective Planck constant h_{eff} near to h in both cases: also the fluctuations of CMB temperature and accelerated expansion could be understood in this way [L12].

2 Strange astrophysical findings

The first section discusses some strange findings challenging the astrophysics.

2.1 Did Earth have a ring before the Cambrian Expolosion and did the rapidly expanding Earth catch the ring?

I encountered a link to a very interesting popular article "Did Earth have a ring like Saturnus?" (see this) telling about the article "Evidence suggesting that earth had a ring in the Ordovician" of Tomkins et al published in Earth and Planetary Science Letters [E13].

The proposal is that the ring would have formed as a large asteroid was caught by the Earth. The tidal forces of Earth would have destroyed the asteroid so that it became a ring along the equator of the Earth. The ring created a shadow. If it formed along the equator, it could have initiated global cooling about 465 years ago: the so-called Hirnantian Icehouse followed 20 million years later. There are as many as 21 meteor strikes along the equator and this is very implausible if the meteors would have arrived from random directions.

This is a highly interesting finding from the point of view of the Expanding Earth hypothesis inspired by TGD [L6, L5]. About 524 million years ago the so-called Cambrian Explosion occurred. Highly evolved multicellular life forms suddenly emerged. A possible explanation of this mystery could be a fast expansion of the Earth: radius would have increased by about factor 2: these fast expansions could be the TGD counterpart of smooth cosmic expansion. This would have led to the bursting of underground oceans containing the multicellular life to the surface of the Earth. It is not difficult to invent objections against the idea but the new physics predicted by TGD allows to circumvent them and the model explains a large number of anomalies to the evolution of Earth.

The ring would have formed about 60 million years later and existed for a time measured 10 million years as a natural unit. Could one think that Earth had already before this time a ring and the Expanding Earth caught the ring? This could explain why the ring was along the equator, something not obvious if the ring was formed by the asteroid rotating around the Earth. This would have produced the 21 meteor strikes along the equator, a phenomenon which is extremely implausible if the meteors did not originate from the same source. The expansion of the Earth would have gradually increased the width of the shadow and the collision with the ring would have generated dust in the atmosphere and caused an additional shadowing effect causing the cooling of the climate.

2.2 Scent of space

Heikki Hirvonen sent a link to a FB post about the scent of space (see this). He is the content of the FB post.

"Astronauts say that space smells like gunpowder and burnt steak. It being a vacuum and all, space isn't often thought of as having a scent of its own. And while no one has directly smelled outer space, exposure without a helmet would be fatal. Many astronauts have reported that it smells like a mix of gunpowder and burnt steak. The odor is most noticeable after an astronaut returns to their spacecraft through the airlock and removes their helmet, at which point the lingering scent can be detected by both the astronaut who had been outside the ship and their crewmates who remained aboard.

It has been theorized that the source of space's scent is dying stars, which release molecules called polycyclic aromatic hydrocarbons, a chemical compound also found in coal, oil, and food as they near the end of their existence.

There's even a cologne named Eau de Space based on the smell, which was originally synthesized by biochemist Steve Pearce at NASA's behest to better prepare astronauts for every aspect of the job. Based on his interviews with astronauts who had been to space, Pearce described the aroma as hot metal, burnt meat, burnt cakes, spent gunpowder, and welding of metal."

PAHs (polycyclic aromatic compounds) look like a possible explanation. They would produce IR radiation assigned with unidentified infrared bands (UIBs) and since the odour sensation at the fundamental level is based on IR light, UIBs could produce the sensation.

Consider first PAHs. I have considered PAHs several times while developing TGD view of quantum biology.

1. PAHs are obtained by fusing together organic molecules involving aromatic rings and are produced in burning and are often poisonous. The list of the basic properties of PAHs [I1, I2] (see `http://tinyurl.com/atx4t9a`) can be found for instance in [K1].

The properties of PAHs have led to the PAH world hypothesis stating that PAHs are predecessors of the recent basic organic molecules. For instance, the distances of aromatic molecules appearing as basic building bricks are the same as distances of DNA base pairs.

2. So called Unidentified Infrared Bands (UIBs) of radiation around IR energies $E \in \{.11, .20, .375\}$ eV arriving from the interstellar space are proposed to be produced by PAHs. The UIBs can be mimicked in the laboratory in reactions associated with photosynthesis producing PAHs [I1, I2].

3. PAHs are detected in interstellar space. James Webb telescope found that PAHs exist in the very early cosmology 1 billion years before they should be possible in the standard cosmology! Furthermore, PAHs exist in regions, where there are no stars and no star formation [E9].

The interpretation of the findings in the TGD framework is discussed in [L11] [K3]!

1. In the TGD framework, a possible explanation would be that the nuclei involved are not produced by hot fusion in stars but by dark fusion occurring at rather low temperatures. PAH world as a predecessor of recent chemical life would have developed in interstellar space.

2. The original TGD inspired proposal was that dark fusion preceded "cold fusion" associated with prestellar objects preceded ordinary nuclear and ignited hot fusion leading to the formation of the stellar core [L7]. The numerous anomalies related to the standard model of the Sun assuming that the energy is produced in the core of the Sun suggest that something in the nuclear physics of the Sun is badly misunderstood. The analysis of the anomalies in the TGD framework leads to a rather radical proposal assuming that also the interior of the Sun is at a rather low temperature and dark fusion prevails in this region. The core would be a quantum system analogous to the cell interior or even cell nucleus [L13]. Needless to say this would completely change our views about the Sun and of life and consciousness.

   Sun would be in a well-defined sense a living system needing metabolic energy feed. Solar surface would contain a layer producing both solar wind and solar energy and would receive metabolic energy feed from outside, for instance from galactic black holes along monopole flux tubes. This view requires taking seriously the prediction of TGD that ordinary hadron physics is accompanied by several scaled variants of hadron physics. In particular, M_{89} hadron physics with a mass scale which is 512 times higher than for ordinary hadron physics [L13]. The transformation of M_{89} nuclei to ordinary nuclei would produce solar energy and also provide the Sun itself with metabolic energy.

3. In the TGD framework, this picture suggests that PAHs might have been created as an outcome of dark fusion in interstellar space. PAHs might have made possible a primitive form of metabolism and photosynthesis [K2, K4] at relatively low temperatures prevailing in interstellar space. This would have made it possible for plasmoids as primitive life forms to store metabolic energy chemically. The hypothesis about plasmoids as predecessors of the recent chemical life forms in the Earth's ionosphere is discussed in [L4].

4. Dark proton sequences, providing a universal representation of the genetic code, based on a completely unique hyperbolic tessellation known as icosa tetrahedral tessellation [L3], would have realized the genetic code for the plasmoids and the chemical code would have emerged later. Also the recent realization of the genetic code would involve sequences of dark protons, with genetic codons represented as dark protons triplets. The triplets of dark cyclotron photons forming quantal units would induce resonant transitions between the dark codons: 3-resonance would be in question. Genes with N codons would give rise to 3N-resonances and a universal addressing in the communications by dark 3N-photons with the message coded to frequency scale modulation.

This does not yet say anything about how PAHs and UIBs could relate to the scent of space.

1. Luca Turin (see this) discovered that the absorption of infrared light produces odour perception. The earlier view was that a purely chemical mechanism involving the attachment of

odorant molecules to the odour receptors is the mechanism of the odour perception. At the basic level the odour sensation would be however produced by infrared light. In particular, space odout might be produced by the infrared light emitted by PAHs. This makes possible remote odour perception.

2. In principle, also the solar radiation at infrared wavelengths could induce the sensation of odour. The odorant molecules could be present in the air inside the helmet. They would be excited by UIB light arriving from interstellar space and emit IR photons as they return to the ground state. This would generate the sensation of the scent of space. In the long run sensory adaptation would lead to the situation in which the scent of space is not perceived anymore. When the astronaut is outside the aircraft sensory adaptation takes care that the sensation is not felt. The sensation is most intense when the helmet is removed after the return to the spacecraft.

Whether the UIBs are produced by ordinary chemical transitions associated with photosynthesis or its predecessor or whether they involve new physics suggested by TGD, is an interesting question to ponder.

1. This relates interestingly also to the Pollack effect, which is most effectively induced by infrared light. Pollack effect is indeed central in the TGD inspired quantum biology and is a non-chemical transition in which photons provide the energy kicking protons to the "magnetic body" of the molecule. It is also essential in photosynthesis and in a temporary non-chemical storage of metabolic energy to the magnetic body of the system.

   In the Pollack effect and its TGD inspired generalizations, the photon would increase the value of effective Planck constant h_{eff} for the protons. This could make the Compton length of the radiation, emitted as a dark photon as the proton transforms to ordinary proton, very long.

2. Could the large value of h_{eff} make possible space scent even without the presence of PAHs in the nearby environment? Smell is usually regarded as a sense restricted to rather short scales. Basically it would be infrared vision. Could this make it possible to smell over astrophysical distances?!

   In fact, insects are known to be able to smell over distances measured in tens of kilometers. Could the real reason be that the smell sensation is also now mediated by (dark) infrared photons rather than by diffusing odorant molecules? I learned from my chemist friend that the odour of vanilla cannot be produced artificially. Could one understand this in terms of dark IR photons?

2.3 Could the position of Mars have effects on the stock market?

In the group Unifying Physics, Anthony Moore (see this sent an extremely interesting link to his article published in Academia.edu (see this). I glue below his own summary of his claimed findings. "Before reading the content, it is important to take into account a recent study published in Nature Communications in March of 2024, roughly 5 years after this idea was first introduced to the public. In that study published in March of 2024, researchers discovered that Mars is exerting a gravitational pull on earth's tilt, exposing earth to warmer temperatures and more sunlight, all within a 2.4 million year cycle. I assert that this allows us to surmise that, even within smaller timeframes, Mars is still exerting a gravitational pull on earth's axial tilt, enough to raise temperatures and affect human behavior, even investor sentiment. Citing the fact of numerous studies that link irritability and negative mood states to warmer temperatures, I can establish an axiom. This perspective should help the reader move beyond the preconceived notion of absurdity and realize that this has scientific merit This paper lays out the 25 major stock market crashes and downturns in US history. The data shows a 100 percent correlation between such events and Mars position in relation to earth. Every stock market crash and major stock downturn in US history has happened when Mars was orbiting behind the sun from earth's point of view. When Mars is going further out from earth, it is also when Mars's gravity is pulling Earth's axial tilt towards the sun, possibly bringing warmer temperatures, which should affect investor sentiment most negatively,

presuming that warmer temperatures relative to the mean affect cognitive function and trigger some variant of irritability or pessimism. There are studies that corroborate this dynamic between warmer temperatures and negative mood states. As Mars gets closer to earth, Mars's gravity is pulling earth's axial tilt away from the sun, bringing presumably cooler temperatures, and less negative mood outcomes, which may explain why major stock market crashes never happen during that phase of Mars's orbit."

These rather strong claims will be of course labelled as a mere astrology by the mainstream. A Google search using words such as "stock market and planets" provides a lot of support for this guess: there is a lot of pseudoscience claiming that one can become a millionaire by using astrology. But it is better to have an open but critical mind.

Let us first look at the data.

1. The article discusses 25 stock crashes including also short 1 day long events in the financial history of the US. The article gives the year, month and day of month for the events and also links to the tables containing the basic data about crashes. Besides this the data about the relative position of Mars and Earth are given for each case.

   In one case (March 12, 13, and 16, 2020) the are 3 mini crashes within few days and in another case 2 crashes within 2 months (October 9 and December 1, 2008) so that from the perspective of the hypothesis one must to them as a single event so that there are 22 rather than 25 crashes.

2. If the crashes occur randomly, half of them would occur when the planar angle ϕ for positions of Mars and Earth is larger than $\pi/2$: this means that the distance between Mars and Earth is above a critical value whose geometric interpretation is rather obvious. This criterion is applied in the examples discussed in the article and can be formulated as a condition for the distance of the Mars and Earth (1/4:th of the orbit length). The claim is that all the studied 25 crashes in the economic history of the US satisfy the claim. Professional statisticians should check the claimed correlations between the position of Mars relative to Earth and stock market crashes to find whether they are genuine.

3. The data used seems to cover the history rather well. Indeed, in the web one can find is a list of 12 contemporary stock market crashes in the US beginning from year 1929 (see this). The events have occurred 1929, 1937, 1962, 1987, 1989 (mini crash), 1990, 2999, 20008, 2010, 2011, 2015, 2020 (corona). The number of events studied in the article is 22 and roughly twice the number of events listed in the table.

   This page contains also a list of global events that also affected the US. This list contains 6 cases (1772, 1796-1797, 1873 and 2001, 2002, 2018) of which 3 have occurred after millenia.

4. In Wikipedia there is a list of 55 stock market crashes, which are fast events and bear markets, which are slow and long lasting (see this) starting from year 1637: this list contains also the events that have occurred outside US.

The reason for why I take these claims seriously is that there is a lot of earlier data about unexpected correlations between planetary physics and human collective behavior. For instance, Russian physicist Shnoll carried his entire life's work by charting this kind of correlations at molecular and even nuclear physics level [E5, E10, E11, E6, E12, E7]. In the standard physics framework, this kind of correlations in astrophysical scales are of course impossible. I have discussed the Shnoll effect in the TGD framework in [L9]: quantum gravitation in planetary scale is predicted to be crucial for understanding life and consciousness and could explain the claimed correlations.

Anyone can check whether the claims are indeed true and also check whether the claim holds true for a more extensive global data including 55 events. It is enough to consider the time evolution of the azimuthal angle difference defining the angular distance ϕ of Mars and Earth using a simple model assuming circular orbits in the same plane. Φ corresponds to the actual distance of Mars and Earth. From this model one can check whether the claim holds true for the events listed in the above mentioned tables.

1. One must first make clear the difference between sidereal and synodic periods. Sidereal period is defined in a system for which the rest system is defined by distant stars. In what

follows, the Sun is approximated as a system at rest so that an approximation to the sidereal period would be in question. I will use the term orbital period and keep in mind that an approximation is in question.

Synodic period is the time required for a body within the solar system, such as a planet, the Moon, or an artificial Earth satellite, to return to the same or approximately the same position relative to the Sun as seen by an observer on the Earth. Therefore the rest system is defined with respect to Earth-Mars system. For Earth-Mars system the synodic period is 780 days and 50 days longer than 2 years. For instance, the closest approach configuration repeats with the synodic period (Earth, Mars and Sun are at the same line). The synodic period is what matters in the recent case.

2. The orbital period of Mars is $T_M = 1.882$ years (687 days) and roughly twice the period $T_E = 1$ year of Earth (365 days): one has $T_E/T_M = .5313$. The eccentricities of the orbits of Mars *resp.* Earth are .093 *resp.* 0.017. If the crashes occur completely randomly and if the condition for the critical distance between Mars and Earth is $\phi \geq \pi/2$ is larger than $\pi/2$ then the number roughly 1/2 of all crashes should have $\phi \geq \pi/2$. Also the orbital planes fail to be quite identical.

   Mars comes closest to Earth every other year, around the time of its opposition, when Earth is sweeping between the Sun and Mars. The eccentricity of the orbit of Mars implies exceptionally close oppositions of Mars happen every 15 to 17 years, when we pass between Mars and the Sun around the time of its perihelion (closest point to the Sun in orbit). Also the situation in which the distance of Mars and Sun are largest from the Sun are especially interesting from the perspective of the hypothesis. Intriguingly, the time $t = 17T_M$ corresponds to $17 + 14.994 \simeq 32$ years and defines both sidereal and synodic period for the system if the approximation used is reliable. This sidereal periodicity might be visible in the time series for the crashes.

   According to Wikipedia (see this) there is a synodic periodicity of 79 years, which corresponds to the period for apparent closest approach with respect to Earth and Sun. This period is more than twice the might-be period of 32 years. This "period doubling" could reflect the fact that the orbit of Mars is ellipse and not quite coplanar with the orbit of Earth (angle of tilt is 1.850 degrees).

3. One can test the hypothesis by using an approximation Sun is at rest and Mars and Earth move along circular orbits in the same plane (this is not the case in reality). The azimuthal angles ϕ_M and ϕ_E for the positions of Mars in the plane with respect to Sun are in this approximation given by

$$\Phi_M = \omega_M t = 2\pi \frac{t}{T_M} \quad , \quad \Phi_E = \omega_E t = 2\pi \frac{t}{T_E}$$

   that these angles are defined modulo 2π.

4. The condition that the difference ϕ of these angles is larger than $\pi/2$ reads as

$$\phi = |\Phi_E - \phi_M| = 2\pi |\frac{t}{T_E} - \frac{t}{T_M}| \geq \frac{\pi}{2} \quad .$$

   This translates to the condition

$$\frac{t}{T_E}|1 - \frac{T_E}{T_M}| \geq \frac{1}{4} \quad .$$

5. It is useful to study the approximate situation in which one has $T_E = T_M/2$ In this case the situation is strictly periodic and synodic and sidereal periods are identical. In this case, the dynamics is periodic with period $T_M = 2T_E$ and one has

$$\frac{t}{T_E} \geq \frac{1}{2} \quad .$$

If Mars and the Earth are closest to each other in the initial situation ($\phi = 0$), the critical period for which the condition $\phi \geq pi/2$ corresponds to the range [1/2,3/2] year. These critical periods would repeat with 2-year periodicity. T_M is slightly smaller than $2T_E$ so that the growth of the angular distance between Mars and Earth is slower and the synodic period is larger than $2T_E$.

6. In the more general case the situation is not quite periodic and the points at which Mars and Earth are nearest to each other repeat with period $\tau = T_E/(1 - T_E/T_M) \geq 2T_E$. Earth catches Mars before it has rotated a full period. For a given value $t = n\tau$ the critical sidereal period is

$$\frac{1}{4(1-x)} \leq \frac{t_R}{t_E} \leq \frac{3}{4(1-x)} \quad , \quad x = \frac{T_E}{T_M} \simeq .5313 \ .$$

Here $t_R = t - n\tau$ refers to the reduced time coordinate having values in the interval $[0, \tau] = [0, T_E/(1 - T_E/T_M)]$. One can use τ as a unit of time and check whether the crashes tend to occur in the intervals $[\tau/4, 3\tau/4]$ for $t = n\tau$, $n = 1, 2....$

7. Assuming that orbital rather than synodic period matters and in the approximation considered, the period τ has length about $\tau = 780$ days and indeed corresponds to the synodic period.

The duration of the critical period is $t_{cr} = \tau/2 \simeq 1$ year 25 days. The critical period starts at $\tau_{cr}/4 =$ 6 months 12.5 days. The distance of Mars and Earth is largest for $t_R = \tau_{cr}/2 \simeq 1$ year 25 days. The closest approach of Mars and Earth will be January 12 2025. In the simple approximation used, one finds that the critical period starts 24 June, the distance between Mars and Earth will be maximal February 7 2026, the critical period ends at July 20 2026, and the next closest approach would be on March 2 2027.

8. One can find also a list of the closest approaches of Mars and Earth this) between April 14 2014 and February 20 2027. From the table one finds that the time intervals between the closest approaches correspond to the synodic period and are indeed longer than 2 years. The table allows to test the hypothesis for more general data about stock market crashes.

How could one understand the observations in the TGD framework?

1. In TGD, the notion of a field body (FB), which can be magnetic (MB) or electric (EB), changes the situation completely. Number theoretic view of TGD predicts that FB carries phases of the ordinary matter with very large values of effective Planck constant implying quantum coherence in astrophysical scales. Gravitational and electric fields in long scales are accompanied by a long length scale quantum coherence [L1, L2, L10, L4]. There is evidence that the FBs of the Sun, planets and even the FB of the galaxy have effects on the behavior of biological systems and humans as conscious entities.

2. A long list of numerical miracles involving the masses of astrophysical objects appear in fundamental biology, supporting this view. For instance, EEG would be responsible for the communications to and control by the magnetic body of Earth. It is indeed difficult to understand why the organisms as master energy savers would spend a very large amount of metabolic energy to send information to outer space without any receiver. Furthermore, resonant EEG frequencies correspond to cyclotron frequencies for the associated "endogenous" magnetic field.

If really true, the findings of Moore would provide a further support for findings of Shnoll and other researchers. They would fit very nicely with the TGD view of quantum biology, which predicts that the magnetic bodies of the Sun and planets, in particular Mars, can affect biology and consciousness.

1. Although Mars has no large-scale magnetic field, the monopole tubes of the dark gravitational magnetic body of Mars could connect Earth and Mars.

2. The gravitational magnetic bodies of the Sun and planets carrying large $h_{eff} = h_{gr}$ phases of ordinary particles behaving like dark matter, would control biomatter and receive information from it. The large distance of Mars when behind the Sun relative to Earth might reduce quantum coherence in turn weakening this control action.

3. The reconnection of U-shaped flux tubes is the fundamental interaction mechanism in all scales and plays a key role for instance in bio-catalysis. Also now this mechanism would be naturally involved and it would become less probable when the distance of Mars from the Earth increases (it is roughly 5AU at the backside of the Sun and 1 AU at the front side). Therefore the quantum coherence scale for the Mars-Earth system would be reduced and could affect even collective behavior of humans and of biology in general.

4. This explanation conforms with the intuition of Moore that the gravitational field of Mars is involved if gravitation is mediated by the radial U-shaped monopole flux tubes, for which the average density decreases as $1/r^2$, i.e. like gravitational flux. Now however the effect would be based on astrophysical quantum coherence of the gravitational field making possible effects on biology and consciousness.

3 Strange cosmological findings

This section is devoted to some cosmological findings challenging the standard cosmology.

3.1 Too much deuterium in cosmic rays and too anti-helium that should not exist

The newest twist in the mystery of cosmic rays emerges from the findings described in the popular article "Cosmic count exceeds expectation" (see this) describing the findins of AMS detected at International Space Station challenge the standard narrative of stellar nuclear physics and of the origin of cosmic rays. There is a Physics Letters article [E4] (see this about the findings.

There is also evidence from AMS-2 for antideuteron and antihelium events, even in the case of anti ^4He. The evidence has been reported already 2022 [E15](see this). The presence of anti ^4He in the cosmic ray spectrum is especially difficult to understand and forces us to ask whether astrophysical objects consisting of antimatter do exist.

The standard story about cosmic rays goes as follows. The abundance of primordial deuterons is very small. Cosmic rays are either primary or secondary. Primary cosmic rays, such as would be formed in supernova explosions. Secondary cosmic rays such as deuteron and ^3He are formed in collisions of primary cosmic rays, in particular ^4He nuclei, with the interstellar medium.

3.1.1 Surplus of deuterium nuclei

The surplus of deuterium nuclei in cosmic rays spectrum [E4] challenges this picture (there are also earlier findings of this kind). The flux of cosmic ray deuterons normalized to ^4He flux is larger than predicted at higher energies and at highest energies studied comparable to the proton flux. This is very strange since protons are primary cosmic rays.

This raises the question whether there is some other non-standard source of cosmic ray deuterons: arey these deuterons really secondary cosmic rays. This forces us to ask whether the nuclear physics of the Sun is what we believe it to be.

In fact, the mechanism producing nuclei heavier than Fe in supernova explosions is poorly understood and there are also anomalies in the abundances of the lighter nuclei. The standard narrative about the core of the Sun cannot be directly tested and indirect tests do not support it. Neutrino flux is too low and also the heat transfer by convection is quite too flow suggesting that the flux of nuclei from the core is much lower than predicted. There are many other anomalies challenging the idea that solar energy is produced in the core and the mechanism producing the solar wind. Is the solar interior what we believe it to be?

TGD leads to a radically new view of the physics of the Sun [L13]. In TGD view, the solar wind and solar energy would be produced in the decays of nuclear strings of predicted M_{89} nucleons

with mass 512 times the mass of the ordinary nucleon at the monopole flux tubes of the magnetic field of the Sun to ordinary nuclei.

The proposal is that the decay mechanism is based on p-adic cooling in which the mass of the nucleon decreases by factor 1/2 in each step and the p-adic mass scale is reduced octave by octave (period doubling). This would produce ordinary nuclei of the solar wind with reasonable energies heating the medium and creating solar corona. This model forces us to completely change our view of the Sun and its interior since the energy and solar wind and even cosmic rays would be produced at its surface.

These decays would produce a huge amount of energy liberated as scaled up variants of ordinary hadrons, in particular the mesons of M_{89} physics. The mesons and gammas would eventually decay to ordinary mesons and gamma rays and importantly, also to nucleon-antinucleon pairs, maybe even deuteron-antideuteron pairs, maybe even helium-antihelium pairs for which AMS also provides evidence [E15](see this). This could explain the mysterious gamma ray anomalies of the Sun, suggesting that two new hadron physics are involved: M_{89} hadron physics and $M_{G,79}$ hadron physics (here "G" refers to Gaussian integers).

The decay mechanism of M_{89} nuclei at the stellar surfaces would not distinguish between secondary and primary cosmic rays and would produce cosmic rays, in particular deuterons. Could these decays serve as the origin of the cosmic rays.

3.1.2 What about the surplus of anti-deuterium and anti-helium nuclei?

One can imagine several mechanisms.

1. Could also the mysterious anti-deuterium and anti-Helium nuclei be understood as resulting from the decays of mesons for scaled up variants of the ordinary hadron physics appearing as intermediate steps in the p-adic cooling. Naive scaling suggests that scaled up pions with mass scaled up by the ratio, which is larger than $2m(^4He)/m(pion) = 8m_p/m(pion) \simeq 112$ are required. The mass scale of the interediated nuclei would be about $2^7 = 128$. They could correspond to a p-adic prime $p \sim 2^{93}$.

   It is however difficult to understand why the decay products would not consist of only nucleon-anti nucleon pairs. A fusion of these antinucleons to antinuclei would be required after the decay. If the emitted nuclei, which are nuclear strings in the TGD framework, propagate along the same flux tube this might actually take place.

2. A more elegant option is that the antimatter nuclei correspond to M_{89} antinuclear flux tubes, which decay to ordinary antinuclear strings by reconnection. This gives also antinuclei heavier than nucleon.

3. An alternative TGD inspired explanation relies on the TGD view of the matter antimatter asymmetry. There would be no actual asymmetry but by the CP violation there is a surplus of antimatter inside some monopole flux tubes and a surplus of matter in their environments. The obvious objection is that the asymmetry should be universal so that very long monopole flux tubes should carry antimatter.

   (a) Suppose that the antimatter can reside in this kind of flux tubes, perhaps as dark matter in the TGD sense. This would make possible the entire spectrum of nuclei as decay products from the splitting of the antimatter flux tube to pieces. Mechanism would be very similar to that proposed at the surface of the Sun and forces us to ask whether antistars could exist. As special case the flux tube could correspond to antinucleus perhaps M_{89} antinucleus.

   (b) One can also imagine other realizations. For instance, I have considered the possibility that the long monopole flux tubes giving rise to linear structures along which galaxies are located, could contain antimatter, perhaps as M_{89} anti nuclei. Note that if the M_{89} nucleons arrive at the Sun along flux tubes emerging from the galactic BH, then galactic BH would naturally consist of matter and anti nuclei should have some other source.

3.2 Do galaxies with opposite direction of rotation relative to the Milky Way have different Hubble constants?

In his Youtube video, Anton Petrov (see this) talks about the notion of tired light proposed by Lior Shamir [E8] as an explanation for some strange findings about galactic redshifts. The observation that the redshifts of distant galaxies are different depending on whether they rotate in the same or opposite direction to the Milky Way is very interesting and unexpected. Asymmetry also increases with distance. Rotation affects the redshift, but the effect should be very small.

Tired light as a mechanism producing cosmological redshift is suggested as a possible explanation of the findings. As described by Anton Petrov, this mechanism leads to many long-known contradictions with cosmological observations, and in my opinion it can be safely forgotten. However, the effect may be real, even though it has been reported by only one researcher hitherto.

Redshift is real and in general relativity it would most naturally be interpreted as a direct evidence that energy is not conserved. In TGD, where spacetimes are surfaces, the explanation for the cosmological redshift is much simpler and consistent with conservation of energy. The 4-D tangent spaces of the 4-D surfaces related to the 3-surfaces corresponding to the detector and the source differ from each other by the Lorentz transformation and this produces an analogy of the Doppler effect. The energy of the photons is preserved, but one could say that they are perceived as if from systems in different states of motion. The projections of the three-surface tangent spaces M^4 to the sender and the receiver differ by the Lorentz transformation and this results in a redshift.

A possible TGD based explanation for the observed effect relies on many-sheeted spacetime. The galaxies rotating in opposite directions could correspond to space-time sheets for which Hubble constants are slightly different at the moment of the emission of the radiation. In the GRT framework this would mean that the density of matter is slightly different for these space-time regions.

I have proposed that the fluctuations of h_{eff} at quantum criticality induce fluctuations of density and temperature [L12]. If the regions of many-sheeted space-time tend to contain galaxies with the same direction of rotation, one can imagine that the h_{eff} depends on the direction of rotation. The CMB temperature behaves as $T(a) = T_0(a_0/a)$ and a naive dimensional guess for the dependence of h_{eff} is $T_0(h_{eff}) = (h_{eff}/h)T_0$. This would scale the energy density of radiation by a factor $(h_{eff}/h)^4$ and the following little calculations show that the value of H increases.

Using Einstein's equations, Hubble constant can be expressed as

$$H^2 \equiv \left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G}{3}\rho - \frac{k}{a^2} + \frac{\Lambda}{3},$$

and can be written as

$$H(a) = H_0\sqrt{\Omega_k a^{-2} + \Omega_m a^{-3} + \Omega_r a^{-4} + \Omega_{DE} a^{-3(1+w)}} \quad .$$

Here parameter w depends on the model of dark energy and $w = 1$ is a possible value. From this formula one sees that if the temperature of CMB background is proportional to h_{eff}, regions of larger h_{eff} have a large Hubble constant. Here the critical density and density parameter are defined as

$$\rho_c = \frac{3H^2}{8\pi G} \quad , \quad \Omega = \frac{\rho}{\rho_c} \quad .$$

The parameters Ω_k ($k \in \{0, -1, 1\}$), Ω_m, Ω_r, and Ω_{DE} refer to various contributions to the density corresponding to the curvature of 3-space ($k = 0$ corresponds to flat space), matter, radiation and dark energy. If dark energy corresponds to the cosmological constant, one obtains

$$\rho_c = \frac{3H_0^2}{8\pi G} \quad ,$$

$$\Omega_m \equiv \frac{\rho_{m_0}}{\rho_c} = \frac{8\pi G}{3H_0^2}\rho_{m_0} \quad , \quad \Omega_k \equiv \frac{-k}{a_0^2 H_0^2} \quad , \quad \Omega_\Lambda \equiv \frac{\Lambda}{3H_0^2} \quad .$$

The question is whether the measured two different values of H could reflect slightly different temperatures for the Hubble constant in some space-time regions induced by different values of h_{eff} and whether these regions could correspond to regions containing preferentially galaxies, which rotate in the same or opposite direction as the Milky Way. Some kind of parity violation in cosmic scales is suggestive.

This mechanism could also provide insights to two other cosmological problems.

1. The proposal might explain the observed two values of the Hubble constant. The two Hubble constants could correspond to stars of galaxies rotating in different directions as compared to the Milky Way.

   Note that TGD suggests the formula for G in terms of the fundamental length scale as $G = kR^2/h_{eff}$. This would induce factor $1/h_{eff}$ to Ω_m and Ω_r but the conclusions would not be changed in the radiation dominated phase.

2. Could the accelerated expansion of the Universe relate to the increase of h_{eff} suggested by the number theoretic evolution possibly explaining the apparent disappearance of the baryonic matter. One expects that the average value of h_{eff} increases and that this corresponds to the gradual transformation of the baryonic matter to dark matter in the TGD sense.

   From the formula for the Hubble constant one can write dH/dt as

   $$\frac{dH}{dt} = -H^2(1+q) \quad , \quad q \equiv -\frac{\ddot{a}a}{\dot{a}^2} \quad .$$

   From this one can estimate the change of the parameter q caused by the time evolution of h_{eff}. The additional term Δq in q due to $T_0 \propto h_eff$ dependence would be

   $$\Delta q = 4\frac{H_0^2}{H^2 T_0} \times \frac{dh_{eff}/dt}{h_{eff}} \times \Omega_r a^{-4} \quad .$$

   If h_{eff} increases, the sign of $\Delta q = -\ddot{a}a/\dot{a}^2$ is positive so that the acceleration is positive.

3.3 Why the dark energy density is inversely proportional to the surface area of the volume studied?

Sabine Hossenfelder commented in her posting "Surprise Comeback: Dark Energy Could Be Holographic After All" (see this) the idea that the mysterious dark energy might not be real but an outcome of holography and assignable to the 3-D surface which in holography contains the information determining the dynamic in the interior of the space-time. The comments were inspired the the article "Evolution of perturbations in the model of Tsallis holographic dark energy" [E1] (see this) by Astashenok and Tepliakov.

The starting point observation is that the dark energy density is in a good approximation found to be proportional to $1/S$, where S is the surface area of a large sphere surrounding the region studied. By the way, Sabine makes a little mistake here: she talks about dark energy rather than dark energy density. The reader can check this from the article of Artyom et al. The model of Tsallis [E2, E14] has been given up long ago but the authors represent an argument that since dark energy is not ordinary cosmic fluid, ordinary perturbation theoretic analysis does not apply.

TGD suggests however a much simpler explanation of the finding. In TGD, dark energy is identifiable as a galactic dark matter and consists of magnetic and volume energy assignable to very long monopole flux tubes with a huge string tension. No galactic dark matter halo nor exotic dark matter particles are needed. The galactic velocity spectrum is correctly predicted from the string tension which is also predicted.

To see whether TGD can explain the finding that dark energy density is proportional to $1/S$, one must estimate the average density of dark energy in a large cylindrical volume around a long cosmic string. The dark energy is proportional to the length L of the string: $T = TL$. The volume is roughly $V = SL$, where S is the surface area of the cross section of the cylinder. Therefore one has that dark energy density satisfied $E/V = TL/SL = T/S$. Just as has been found.

3.4 A TGD based resolution of the clumpiness paradox and resolution of the tension between neutrino mass scale deduced from neutrino mixing and from gravitational lensing

I learned about very interesting findings related to neutrinos reported by DESI collaboration [E3] (see this). The 3 neutrino families are known to mix and from various experiments, also from

those performed in the laboratory, one can deduce estimates for the analog of the CKM matrix describing the mixing. This also allows us to estimate the sum of the neutrino masses.

One can also deduce information about neutrino masses from cosmology. The information comes from gravitational lensing. The gravitational lensing increases with so called clumpiness which measures how the inhomogeneities of mass density are. If one assumes standard cosmology with cold dark matter, one expects that the larger the average neutrino mass scale is, the larger the effects of the neutrino mass density on the clumpiness of the universe is.

According to the popular article, DESI maps out cosmic structures to determine the expansion rate through an effect known as baryon acoustic oscillations, sound waves that imprinted circular patterns on the very early universe. By tracing those patterns at different points in the universe s history, scientists can track its growth, kind of cosmic tree rings are in question.

Combining the measurements of clumpiness from the cosmic microwave background and the expansion rate from DESI two things that neutrinos affect makes it possible for scientists to deduce estimates for the sum of neutrino masses. The upper limit turned out to be unexpectedly small, about .07 eV. This is very near to the lower bound for the sum, about .06 eV deduced from the neutrino mixing. There are even experiments suggesting an upper limit of .05 eV in conflict with neutrino mixing data.

The outcome suggests that something goes wrong with the standard cosmology. Could it be that neutrinos do not affect the clumpiness so much as believed? Could neutrinos be lighter in the early cosmology? Or is the view of how clumpiness is determined, entirely wrong? Could the mechanism behind the gravitational lensing be something different from what it is believed to be?

Clumpiness paradox is one of the many problems plaguing the cold dark matter scenario (see this). Clumpiness parameter (see this) is in principle deducible from the weak gravitational lensing caused by dark matter. In halo models it affects the annihilation rate of dark matter particles. Since the predicted rate is proportional to mass density squared, the annihilation rate increases for clumpy mass distribution.

If I understand correctly, the clumpiness paradox states that the clumpiness, which is determined by the size of dark matter clumps, depends on the scale in which observations are carried out. Clumpiness is smaller in long length scales, which means that the observed clumps are larger in long scales. In long scales, corresponding to recent cosmology, the sizes of clumps assignable are larger and the clumpiness parameter is .83. In shorter length scales corresponding to the age of the Universe about 380 thousand years the clumpiness parameter is smaller: .76.

In long length scales, a proposed explanation for the small value of clumpiness, i.e. a large size of clumps, is in terms of identification of dark matter as ultralight axions with very large Compton length determining the size scale of clumps.

This does not explain why the clumpiness depends on scale. Furthermore, clumps have been now observed in considerably smaller scales than earlier (see this). The strange looking conclusion is that cold dark matter is colder in short scales: the naive expectation would be just the opposite since it is the hot dark matter particles, which should form only small clumps. Something seems to go wrong.

The scale dependence of clumpiness suggests a fractal distribution of matter and dark matter. Indeed, in the TGD framework [L7, L8, L11], cosmic strings thickened to monopole flux tubes forming scale hierarchy would be responsible for the gravitational lensing and the thickness of the monopole flux tubes would characterize the lensing. The explanation for the large size of the clumps in long scales would be the large size of the Compton length proportional to effective Planck constant $h_{eff} = nh_0$. In the case of gravitational Planck constant $h_{eff} = h_{gr} = GMm/\beta_0$, β_0 a velocity parameter, assignable to the monopole flux tubes connecting pairs formed by a large mass M and small mass m, the gravitational Compton length is equal to $\Lambda_{gr} = GM/\beta_0 = r_s/2\beta_0$, r_s Schwartshild radius of mass M increasing with the size scale of structure (note that there is no dependence on m). The larger the scale of the studied astrophysical object, the larger Λ_{gr} as minimal gravitational quantum coherence length is, and the smaller the clumpiness in this scale.

This would predict the effect of neutrinos and also other particles on lumping and gravitational lensing is negligible. Cosmic strings would explain the lumping. The model would also explain why the upper bound for the sum of neutrino masses is inconsistent with the findings from neutrino mixing.

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