

# Earth. Review Article

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## Abstract

Every year on 22 April, we have celebrated **Earth Day** and the beautiful planet we call home. Earth Day, established in 1970, has been used to highlight our planet's environmental challenges and raise awareness of the importance of protecting our world for future generations [1]. To provide the protection of our planet, we should explain Earth's environmental challenges to the best of our knowledge in frames of contemporary Geophysics.

This paper gives a short overview of the developed Hypersphere World-Universe Model (WUM) and pay particular attention to the principal role of Dark Matter (DM) in the Earth's life. In this manuscript, we discuss different aspects of the Earth: a condition of Early Earth before the Beginning of life on It; Internal Structure; "The 660-km Boundary" that we named Geoplasma; Random Variations of Earth's Rotational Speed on a daily basis; Origin of Moon; Expanding Earth; Internal Heating; Faint Young Sun paradox; Geocorona and Planetary Coronas; High-Energy Atmospheric Physics. WUM proposed principally different way to solve the problems of Internal Heating, Origin of the Moon, and Faint Young Sun paradox based on DM core of the Earth. The Model revealed the fact that the Sun Activity causes the Geoplasma Activity and, as a consequence, Random Variations of Earth's Rotational Speed by the varying Sun's magnetic field.

## 1. Introduction

About 22 years ago, I developed an interest in Cosmology. For 12 years, I have been elaborating a model I dubbed World-Universe Model (WUM), and then in 2013, I uploaded the first papers on viXra [2], [3], which were, in fact, the beginning of a New Paradigm for Cosmology. From 2015, I published a series of articles on WUM in the "*Journal of High Energy Physics, Gravitation and Cosmology*". The manuscript "*Review Article: Cosmology and Classical Physics*" [4] is a synthesis of my approach to Cosmology and the article "*JWST Discoveries—Confirmation of World-Universe Model Predictions*" [5] is a quintessence of the Model. WUM is a natural continuation of Classical Physics, and it can already serve as a basis for a New Cosmology proposed by Paul Dirac in 1937. Considering the JWST discoveries, successes of WUM, and 86 years of Dirac's ideas, it is high time to make a Paradigm Shift for Cosmology and Classical Physics.

Results obtained in WUM are quoted in the current work without a full justification; an interested reader is encouraged to view the referenced papers [2]-[12] (and references therein) in such cases.

## 2. Essence of WUM

**Principal Points** of WUM are as follows [2]-[12]:

- The Finite World is a 3D Hypersphere of the 4D Nucleus of the World, which is 4D ball expanding in the fourth spatial dimension. All points of the Hypersphere are equivalent; there are no preferred centers or boundaries of the World;
- The Universe is responsible for the creation of Dark Matter (DM) in the 4D Nucleus of the World. Dark Matter Particles (DMPs) carry new DM into the World. Luminous Matter is a byproduct of DMPs self-annihilation. DM plays a central role in creation and evolution of all Macroobjects (MOs);
- WUM introduces Dark Epoch (spanning from the Beginning of the World 14.22 Byr ago for 0.45 Byr) and Luminous Epoch (ever since, 13.77 Byr). We emphasize that absolute Age of the World  $A_{\tau} = 14.22 \text{ Byr}$

is determined by the experimentally measured value of Gravitational parameter  $G$  [6]. Transition from Dark Epoch to Luminous Epoch is due to an Explosive Volcanic Rotational Fission of Overspinning DM Supercluster's Cores (surface speed at equator exceeding escape velocity) and self-annihilation of DMPs;

- The Medium of the World, consisting of protons, electrons, photons, neutrinos, and DMPs [12], is an active agent in all physical phenomena in the World. Time, Space and Gravitation are closely connected with the Impedance, Gravitomagnetic parameter, and Energy density of the Medium, respectively. It follows that neither Time, Space nor Gravitation could be discussed in absence of the Medium. WUM confirms the Supremacy of Matter postulated by A. Einstein: "*When forced to summarize the theory of relativity in one sentence: time and space and gravitation have no separate existence from matter*";
- WUM based on Cosmological Time  $\tau$  that marches on at the constant pace from the Beginning of the World up to the present Epoch along with time-varying Principal Cosmological Parameters;
- MOs of the World possess the following properties: their Cores are made up of DMPs; they contain other particles, including DMPs and Ordinary particles, in shells surrounding the Cores. Macroobjects' cores are essentially DM Reactors fueled by DMPs. All chemical elements, compositions, substances, rocks, *etc.* are produced by MOs themselves as the result of DMPs self-annihilation in their DM Cores;
- WUM is the only cosmological model in existence that is consistent with the Fundamental Law of Conservation of Angular Momentum;
- Thanks to the revealed by WUM Inter-Connectivity of Primary Cosmological Parameters, we show that  $G$  that can be measured directly makes measurable all Cosmological parameters, which cannot be measured directly;
- 3D Finite Boundless World (Hypersphere of 4D Nucleus) presents Patchwork Quilt of main Luminous Superclusters ( $\gtrsim 10^3$ ), which emerged in different places of the World at different Cosmological times. The Medium of the World is Homogeneous and Isotropic. Distribution of MOs is spatially Inhomogeneous and Anisotropic and temporally Non-simultaneous. Physical Laws are determined by the Medium;
- The Medium, Multicomponent Dark Matter, and Angular Momentum are Main Pillars of WUM;
- WUM is based on two parameters only: dimensionless Rydberg constant  $\alpha$  (later named Fine-structure constant) and time-varying Quantity  $Q$  that is, in fact, the Dirac Large Number and a measure of the Worlds' curvature in the fourth spatial dimension and the Age of the World. In our opinion, constant  $\alpha$  and quantity  $Q$  should be named "Universe Constant" and "World Parameter" respectively.

### 3. Early Earth [7]

**Formation of Earth.** The oldest material found in SS is dated to 4.568 Byr ago [13]. In the article "*The age of the Earth in the twentieth century: a problem (mostly) solved*" G. B. Dalrymple said: *Whether this age represents the age of the Earth's accretion, of core formation, or of the material from which the Earth formed is not yet known, but recent evidence suggests it may approximate the latter* [14].

In **WUM**, DM core of the Earth with a radius of  $R_E = 3.52 \times 10^3 \text{ km}$  was born as a result of an Explosive Volcanic Rotational Fission of the Sun's DM Core with the radius of  $R_S = 487 \times 10^3 \text{ km}$  4.57 Byr ago [8].

**Origin of the Moon** is usually explained by a Mars-sized body striking the Earth, making a debris ring that eventually collected into a single natural satellite, the Moon, but there are a number of variations on this giant-impact hypothesis, as well as alternative explanations, and research continues into how the Moon came to be. Other proposed scenarios include captured body, fission, formed together (condensation theory, Synestia), planetesimal collisions (formed from asteroid-like bodies), and collision theories. The standard giant-impact hypothesis suggests that a Mars-sized body, called Theia, impacted the proto-Earth, creating a large debris ring around Earth, which then accreted to form the Moon [15].

Establishing the age of the Moon is critical to understanding solar system evolution and the formation of rocky planets, including Earth. However, despite its importance, the age of the Moon has never been accurately determined. M. Barboni, *et al.* “*present uranium-lead dating of Apollo 14 zircon fragments that yield highly precise, concordant ages, demonstrating that they are robust against post crystallization isotopic disturbances. Hafnium isotopic analyses of the same fragments show extremely low initial  $^{176}\text{Hf}/^{177}\text{Hf}$  ratios corrected for cosmic ray exposure that are near the solar system initial value. Our data indicate differentiation of the lunar crust by 4.51 billion years, indicating the formation of the Moon within the first ~60 million years after the birth of the solar system*” [16].

Following the prevailing giant-impact hypothesis, planetary geophysicists at the German Aerospace Center, led by M. Maurice, have used a new **numerical model** to reconstruct the time at which the event occurred. They report that the Moon formed  $4.425 \pm 0.025$  billion years ago, and that it hosted an **ocean of magma** for substantially longer time than previously thought (for ~200 million years) [17].

In **WUM**, DM core of the Moon with the radius of  $R_M = 0.381 \times 10^3 \text{ km}$  was born as the result of the Explosive Volcanic Rotational Fission of the Earth’s DM Core  $\lesssim 4.57 \text{ Byr}$  [7].

**Continental crust of Earth.** The long-favored paradigm for a development of continental crust is one of progressive growth beginning at ~4 billion years ago. To test this hypothesis, T. M. Harrison, *et al.* measured **initial  $^{176}\text{Hf}/^{177}\text{Hf}$  values** of 4.01 – 4.37 *Gyr* detrital zircons from Western Australia. They obtained results that support the view that crust had formed by 4.4 – 4.5 *Gyr* and was rapidly recycled into the mantle [18].

**Earth’s Atmosphere and Oceans** were formed by volcanic activity and outgassing. Most of the gas was carbon dioxide and water vapor that condensed into oceans. In this model, atmospheric greenhouse gases kept the oceans from freezing when the newly forming Sun had only 70% of its current luminosity.

According to a “Lumen Learning. Earth Science” [19]: *Scientists have developed a number of hypotheses about how the oceans formed. Though these hypotheses have changed over time, one idea now has the wide support of Earth scientists, called the volcanic outgassing theory. This means that water vapor given off by volcanoes erupting over millions or billions of years, cooled and condensed to form Earth’s oceans.*

According to the “National Ocean Service” [20]: *Most scientists agree that the atmosphere and the ocean accumulated gradually over millions and millions of years with the continual ‘degassing’ of the Earth’s interior. According to this theory, the ocean formed from the escape of water vapor and other gases from the molten rocks of the Earth to the atmosphere surrounding the cooling planet. After the Earth’s surface had cooled to a temperature below the boiling point of water, rain began to fall—and continued to fall for centuries. As the water drained into the great hollows in the Earth’s surface, the primeval ocean came into existence. The forces of gravity prevented the water from leaving the planet.*

In paper “Uncovering Mysteries of Earth’s Primeval Atmosphere 4.5 Billion Years Ago and Emergence of Life” ETH Zurich (a leading scientist P. Sossi) wrote [21]: *Four-and-a-half billion years ago, Earth would have been hard to recognize. Instead of the forests, mountains, and oceans that we know today, the surface of our planet was covered entirely by magma – the molten rocky material that emerges when volcanoes erupt. This much the scientific community agrees on. What is less clear is what the atmosphere at the time was like.*

In the paper “Redox state of Earth’s magma ocean and its Venus-like early atmosphere” [22], P. A. Sossi, *et al.* found that *after cooling down from the magma state, the young Earth had an atmosphere that was slightly oxidizing, with carbon dioxide as its main constituent, as well as nitrogen and some water. The surface pressure was also much higher, almost one hundred times that of today and the temperature was much higher, due to the hot surface. These characteristics made it more similar to the atmosphere of today’s Venus than to that of today’s Earth.* Based on their results, the authors made a conclusion that a

*popular theory on the emergence of life on Earth, in which lightning strikes interact with certain gases (notably ammonia and methane) to create amino acids – the building blocks of life – seems much less likely. The necessary gases were simply not sufficiently abundant.*

**Origin of Life.** M. Dodd, *et al.* in the article “Evidence for early life in Earth’s oldest hydrothermal vent precipitates” wrote [23]: *Although it is not known when or where life on Earth began, some of the earliest habitable environments may have been submarine-hydrothermal vents. Here we describe putative fossilized microorganisms that are at least 3,770 million and possibly 4,280 million years old in ferruginous sedimentary rocks, interpreted as **seafloor-hydrothermal vent-related precipitates**. These structures occur as micrometre-scale haematite tubes and filaments with morphologies and mineral assemblages similar to those of filamentous microorganisms from modern hydrothermal vent precipitates and analogous microfossils in younger rocks. Collectively, these observations are consistent with an oxidized biomass and provide evidence for biological activity in submarine-hydrothermal environments more than 3,770 million years ago* [21].

The proposed concept of **Dark Matter Reactors** in DM Cores of all gravitationally-rounded Macroobjects successfully explains all these hypothesis and results for the Early Earth [7]:

- The Upper mantle with Crust are due to the DM core volcanic activity of the “homemade” compositions (including magma), which produced as the result of the self-annihilation of DMPs in the core. It explains the result that continental crust had formed by 4.4 – 4.5 Gyr ;
- Earth's Atmosphere and Oceans were formed by the volcanic activity and outgassing of DM core;
- The thickness of the Upper mantle with Crust is growing in time: the Early Earth had a smaller thickness than it is in the present time. Hence, the temperature of the Earth’s surface was higher than its calculated temperature based on the Sun’s output at that time. It kept the oceans from freezing when the newly forming Sun had only 70% of its current luminosity;
- The *biological activity in submarine-hydrothermal environments more than 3,770 million years ago* can be explained by a generation of all kinds of chemical elements and compositions produced into the Earth’s DM core.

## 4. Modern Earth [9]

### 4.1. Internal Structure

Information about the Earth's structure mostly comes from the analysis of seismic waves. According to the standard model, the Earth has the following layers: an outer silicate solid Crust, solid Mantle, a liquid Outer core, and a solid Inner core. The Inner core is believed to be composed of an iron–nickel alloy with some other elements. The temperature at the Inner core's surface is estimated to be approximately 5,700 K. The liquid Outer core surrounds the Inner core and is believed to be composed of iron mixed with nickel and trace amounts of lighter elements.

Although seismic waves propagate through the core as if it was solid measurements cannot distinguish between a perfectly solid material from an extremely viscous one. Some scientists have therefore considered whether there may be **slow convection in the Inner Core as is believed to exist in the Mantle**. That could be an explanation for the anisotropy detected in seismic studies. In 2009, B. Buffett estimated the viscosity of the Inner core at  $10^{18} \text{ kg m}^{-1} \text{ s}^{-1}$  [24].

In our view, the Inner core, Outer core, and Lower mantle are the parts of the Earth’s liquid DM core, which have different viscosities from extremely high values for the Inner core going down to a 660-km

boundary between the Lower mantle and Upper mantle with Crust (see Section 4.2). The main characteristics of the Earth's layers are presented in **Table 1**.

**Table 1.** Density and Mass of Earth's Layers. Adapted from [25].

Depth, km	Component Layer	Outer Radius, Rel. to Earth Radius	Density, $kg/m^3 \times 10^3$	Mass, kg $\times 10^{22}$	Mass, Rel. to Earth Mass
0	Atmosphere		0.0012	0.0005	0.0000008
0 - 11	Oceans	1	1.02 - 1.05	0.14	0.0002
0 - 35	Crust	1	2.2 - 2.9	4	0.007
35 - 660	Upper Mantle	0.99	3.4 - 4.4	112	0.19
660 - 2900	Lower Mantle	0.9	3.4 - 5.6	265	0.44
2900 - 5100	Outer Core	0.55	9.9 - 12.2	183	0.31
5100 - 6400	Inner Core	0.2	12.8 - 13.1	12	0.02

Let us take a look at the structure of the Earth:

- An Inner core and an Outer core that extend from the Centre to about 55% of the Earth radius with density  $\rho_{max} = 13 \times 10^3 kg/m^3$  and  $\rho_{min} = 9.9 \times 10^3 kg/m^3$  ;
- Lower mantle, spanning from the Outer core to about 90% of the Earth radius (below 660 km) with density  $\rho_{max} = 5.6 \times 10^3 kg/m^3$  and  $\rho_{min} = 3.4 \times 10^3 kg/m^3$  ;
- Upper mantle, spanning from the Lower mantle to about 99% of the Earth radius (below 35 km) with density  $\rho_{max} = 4.4 \times 10^3 kg/m^3$  and  $\rho_{min} = 3.4 \times 10^3 kg/m^3$  ;
- Inner core, Outer core, and Lower mantle contain most of the Earth's mass [26].

## 4.2. The 660-km Boundary. Geoplasma

Very little is known about the Lower mantle apart from that there is a seismicity cutoff-660 (660-km discontinuity):  $\rho_{min} = 3.4 \times 10^3 kg/m^3$  for the Lower mantle is less than  $\rho_{max} = 4.4 \times 10^3 kg/m^3$  for the Upper mantle. In our view, Lower mantle is the part of the Earth's DM core.

W. Wu, S. Ni, and J. Irving investigated scattered seismic waves traveling inside the Earth to constrain the roughness of the Earth's 660-km boundary [27]. The researchers were surprised by just how rough that boundary is – rougher than the surface layer that we all live on. Their statistical model did not allow for precise height determinations, but there is a chance that these mountains are bigger than anything on the surface of the Earth. The roughness was not equally distributed, either; just as the Crust's surface has smooth ocean floors and massive mountains, the 660-km boundary has rough areas and smooth patches [28]. Lacking a formal name for this layer, the researchers simply call it "*the 660-km boundary*."

X. Markenscoff in the paper "*Volume collapse instabilities in deep-focus earthquakes: a shear source nucleated and driven by pressure*" explains "*the mystery of the long-standing observations in deep-focus earthquakes (400-700 km) by symmetry-breaking instabilities in high-pressure phase transformation, which produce the counterintuitive phenomenon of "volume collapse" producing only shear radiation, with little, or no, volumetric component, even under conditions of full isotropy*" [29].

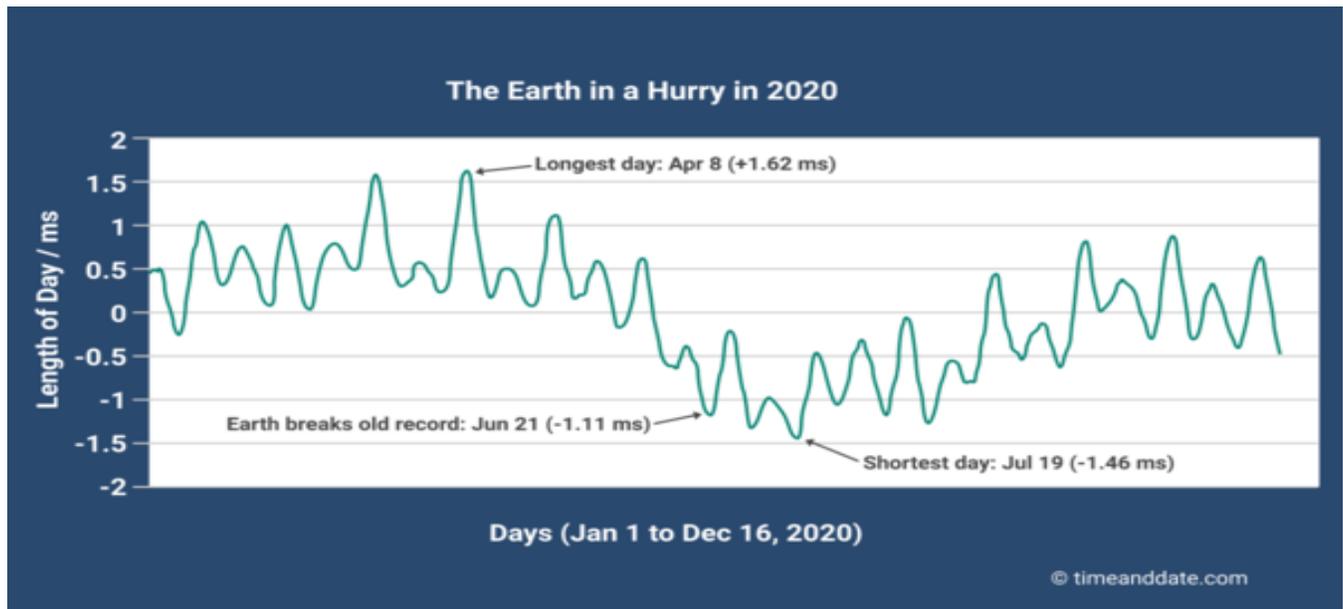
According to **WUM**, the 660-km boundary is a boundary between Earth's DM core and Upper mantle with Crust, which were produced by DM core during 4.57 billion years [9]. The deep-focus earthquakes are connected with random mass ejections happening at the 660-km boundary as the result of DMPs self-annihilation in the DM core.

In our opinion, all chemical elements, compositions, substances of the Earth including protons, electrons, multicharged ions, isotopes K-40, U-238, Th-232, Pu-244 (see Section 4.5), are produced within DM Reactor (DMR) inside of the Earth as the result of DMPs self-annihilation. They concentrate in "the 660-km boundary" and arrive in the Crust of the Earth due to convection currents in the mantle carrying heat and all chemical products from the interior to the planet's surface [30]. In our view, "the 660-km boundary" is a "Geoplasma", electrical currents of which define the Earth's magnetic field. Its random mass ejections are responsible for random variations of the Earth's rotational speed on a daily basis (see Section 4.3).

### 4.3. Random Variations of Earth's Rotational Speed

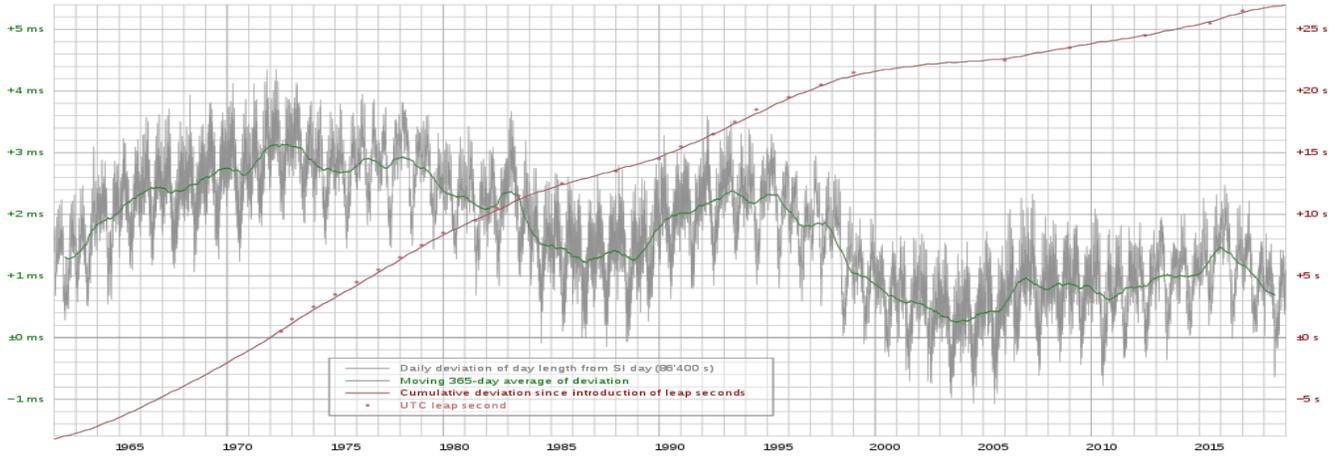
G. Jones and K. Bikos in the paper "Earth Is in a Hurry in 2020" wrote [31]:

*When highly accurate atomic clocks were developed, they showed that the length of a mean solar day can vary by milliseconds. These differences are obtained by measuring the Earth's rotation with respect to distant astronomical objects'. It turned out that the variations of the daylength throughout 2020 were in the range  $86400^{+1.62ms}_{-1.46ms}$  s . The speed of the Earth's rotation varies constantly because of the complex motion of its molten core, oceans and atmosphere, plus other effects (see Figure 1, Figure 2, and Figure 3).*

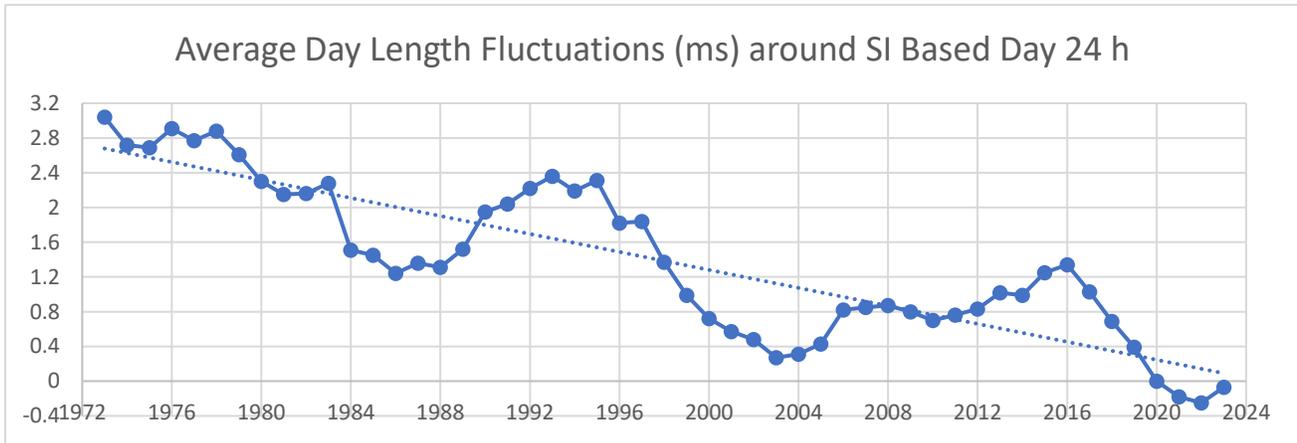


**Figure 1.** Variation of daylength throughout 2020. The length of day is shown as the difference in milliseconds (ms) between the Earth's rotation and 86,400 seconds. Adapted from [31].

In frames of **WUM**, **random variations of the Earth's rotational speed on a daily basis** can be explained by variations in the activity of the Earth's DMR and the 660-km layer that we named Geoplasma. As the result of DMPs self-annihilation, **random mass ejections** are happening. During a time of high DMR activity, the Earth's rotational speed is lower (long days) due to increase of the Earth's moment of inertia. When **random mass ejections** are less frequent, the Earth's moment of inertia is decreasing, we observe short days [8].



**Figure 2.** Deviation of day length from SI based day since 1962 to 2019. Adapted from [32].



**Figure 3.** Deviation of average day length from SI based day since 1973 to 2023. Adapted from [33].

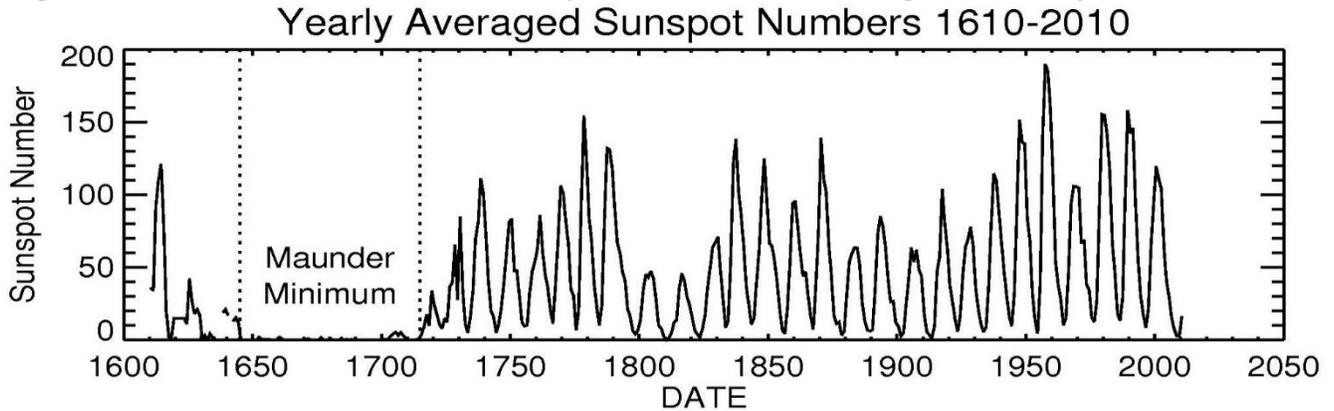
Let us analyze the proposed mechanism. The relative change of the daylength throughout 2020 was about  $2 \times 10^{-8}$ . Hence, the relative change of the Earth's moment of inertia must be about  $2 \times 10^{-8}$ . If a layer of a mass  $m$  at radius of  $r$  will shift on  $h$ , the relative change of the Earth's moment of inertia will be about  $\frac{m r h}{M R R} \sim 10^{-8}$ , where  $M$  and  $R$  are the mass and radius of the Earth, respectively. In case of the Atmosphere (see **Table 1**):  $\frac{m}{M} \sim 10^{-6}$ ,  $r \sim R$ , and  $\frac{h}{R} \sim 10^{-2}$ . It means that  $h \sim 64 \text{ km}$ . In case of the Oceans:  $\frac{m}{M} \sim 10^{-4}$ ,  $r \sim R$ , and  $\frac{h}{R} \sim 10^{-4}$ . It means that  $h \sim 640 \text{ m}$ . In case of the Geoplasma (boundary Lower mantle - Upper mantle):  $\frac{m}{M} \sim 10^{-5}$ ,  $r \sim R$ , and  $\frac{h}{R} \sim 10^{-3}$ . It means that  $h \sim 6.4 \text{ km}$ .

The estimated values of the masses and shifts show that

- There is no way to explain the random variations of the speed of the Earth's rotation by the complex motion of oceans and atmosphere as it was supposed in [31];
- They can be explained by random mass ejections in the Geoplasma;
- It is worth noting that since 1973 to 2023 (see **Figure 3**), the averaged deviation of the average day length dropped down from 2.7 ms to 0.1 ms;
- The maximum activity of DMR and Geoplasma and maximum of the average day lengths were observed at 2016, 2006, 1994, 1983, and 1972 (see **Figure 2**), which are about 11 years apart.

It is interesting that the full solar cycle is actually a 22-year phenomenon. The sunspot cycle happens because of this pole flip — north becomes south and south becomes north—approximately every 11 years. Some 11 years later, the poles reverse again back to where they started. **The sun behaves similarly over the course of each 11-year cycle** no matter which pole is on top, however, so this shorter cycle tends to receive more attention (see **Figure 4**).

Consider that the last minimum Sunspot number was at 2010 and the next one was at 2021. Hence, the next maximum Sunspot number was at 2016 that corresponds to the maximum of the Earth’s average day length. It means that the maximum Sun activity causes the maximum Geoplasma activity!



**Figure 4.** The yearly averaged sunspot number for a period of 400 years (1610-2010). SOURCE: Courtesy of NASA Marshall Space Flight Center. Adapted from [34].

By analyzing the minute changes in travel times and wave shapes for earthquake doublets, the authors article [35] concluded that the Earth's inner core is rotating faster than its surface by about 0.3-0.5 degrees per year. Researches article [36] found that *Earth's inner core, made up of solid iron, 'superrotates' in an eastward direction -- meaning it spins faster than the rest of the planet -- while the outer core, comprising mainly molten iron, spins westwards at a slower pace.*

The fact that Macroobject Cores rotate faster than surrounding envelopes, despite high viscosity of the internal medium, is intriguing. WUM explains this phenomenon through absorption of DMPs by Cores. DMPs supply additional angular momentum ( $\propto \tau^2$ ). Hence, a relative additional Earth’s angular momentum for  $\Delta t = 50 \text{ yr}$  is  $\Delta L_E/L_E = 2\Delta t/A_E = 100/4.6 \times 10^9 = 2.2 \times 10^{-8}$ , where  $A_E$  is the Earth’s age. It means that the average length of the day will be shorter by  $2.2 \times 10^{-8} \times 86400 = 1.9 \text{ ms}$ , which is in good agreement with experimentally observed  $2.6 \text{ ms}$  (see **Figure 3**). This result confirms the existence of Geoplasma.

## 4.4. Sun

Let us take a look at the internal structure of the Sun [37]:

- Core that extends from the center to about 20–25% of the solar radius, contains 34% of the Sun's mass with density  $\rho_{max} = 1.5 \times 10^5 \text{ kg/m}^3$  and  $\rho_{min} = 2 \times 10^4 \text{ kg/m}^3$ . It produces all of Sun’s energy;
- Radiative zone from the Core to about 70% of the solar radius with density  $\rho_{max} = 2 \times 10^4 \text{ kg/m}^3$  and  $\rho_{min} = 2 \times 10^2 \text{ kg/m}^3$  in which energy transfer occurs by means of radiation;
- Core and Radiative zone contain practically all Sun’s mass [38];
- Convection zone extends from 0.7 solar radii (500,000 km) to near the surface. The solar plasma is not dense enough or hot enough to transfer the heat energy of the interior outward via radiation;
- The visible surface of the Sun, the photosphere, is the layer below which the Sun becomes opaque to visible light.

The radiative zone and the convective zone are separated by a transition layer, the **tachocline**. This is a region where the sharp regime change between the uniform rotation of the radiative zone and the differential rotation of the convection zone results in a large shear between the two—a condition where successive horizontal layers slide past one another. Presently, it is hypothesized that a magnetic dynamo within this layer generates the Sun's magnetic field.

According to **WUM**, Core and Radiative zone are parts of DM Core of the Sun. The tachocline is an analog of Geoplasma introduced for the Earth. It consists of all chemical elements, compositions of the Sun including protons, electrons, multicharged ions, which are produced within the Sun's DM Reactor as the result of DMPs self-annihilation. We can name it "Solarplasma", electrical currents of which define the Sun's magnetic field.

It is worth noting that the large power output of the Sun is mainly due to the huge size and density of its Core (compared to the Earth), with only a fairly small amount of power being generated per cubic meter. Theoretical models of the Sun's interior indicate a maximum power density of approximately  $276.5 \text{ W/m}^3$  at the center of the Core [39], which is about the same power density inside a compost pile [40] and closer approximates reptile metabolism than a thermonuclear bomb.

The existence of the Sun's DM Core follows from experimental results obtained by E. Fossat, *et al.* who found that Solar Core rotates  $3.8 \pm 0.1$  faster than the surrounding envelope [41]. The fact that the Solar Core rotates faster than surrounding envelope, despite high viscosity of the internal medium, is intriguing. WUM explains this phenomenon through the absorption of DMPs by Solar Core over time  $\tau$ . DMPs supply not only additional mass ( $\propto \tau^{3/2}$ ), but also additional angular momentum ( $\propto \tau^2$ ). DM Core irradiates products of DMPs self-annihilation, which carry away excessive angular momentum. The Solar Wind is the result of this mechanism [8].

**As a conclusion:** all gravitationally-rounded Macroobjects (stars, planets, moons) have the same internal structure. They have a different size and composition of their DM Cores.

## 4.5. Origin of Moon

**Lunar origin fission hypothesis** was proposed by George Darwin in 1879 to explain the origin of the Moon by rapidly spinning Earth, on which equatorial gravitative attraction was nearly overcome by centrifugal force [42]. Donald U. Wise made a detailed analysis of this hypothesis in 1966 and concluded that "*it might seem prudent to include some modified form of rotational fission among our working hypothesis*" [43].

At present time, a rotational angular momentum of the Earth  $L_{rot}^E$  is substantially smaller than Moon's orbital momentum  $L_{orb}^M$ . In the article "*Solar System. Angular Momentum. New Physics*" [9], we performed a detailed analysis of the rotational angular momentum of the overspinning DM core of the Earth  $L_{rot}^{DME}$  and found that  $L_{rot}^{DME} = 2.2 \times L_{orb}^M$  at the Beginning of the Solar System. It means that the Moon could be created by the overspinning DM core of the Earth as the result of Its Explosive Volcanic Rotational Fission.

In our opinion, lower mantle is a part of the Earth's DM core. It could be significantly different 4.57 *Byr* ago. During this time it was gradually filled with all chemical elements produced by the Earth's DM core due to DM particles DMF1 (1.3 TeV) self-annihilation [12].

## 4.6. Expanding Earth

Expanding Earth hypothesis asserts that the position and relative movement of continents is at least partially due to the volume of the Earth increasing. In 1888, I. O. Yarkovsky suggested that some sort of aether is absorbed within Earth and transformed into new chemical elements, forcing the celestial bodies to expand.

The theses of O. C. Hilgenberg (1933) and N. Tesla (1935) were based on absorption and transformation of aether-energy into normal matter. In spite of the recognition of plate tectonics in the 1970s, scientific consensus has rejected any significant expansion or contraction of the Earth [44].

In **WUM**, the Earth's DM core absorbs new DMPs, and its size is increasing in time  $\propto \tau^{1/2}$ . There is an expansion of DM core, and hence, the Upper mantle with Crust is stretching out. Due to DMPs self-annihilation, new chemical elements are created inside of the Upper mantle with Crust. As a result, the relative movement of continents is happening. The Medium of the World with DMPs are, in fact, some sort of aether proposed by Yarkovsky, Hilgenberg, and Tesla.

## 4.7. Internal Heating

The analysis of the Sun's heat for planets in SS yields the effective temperature of the Earth of 255 K [45]. The actual mean surface temperature of Earth is 288 K [46]. The higher actual temperature of the Earth is due to the heat generated internally by the planet itself. According to the standard model, the Earth's internal heat is produced mostly through radioactive decay. The major heat-producing isotopes within the Earth are K-40, U-238, and Th-232. The mean global heat loss from Earth is  $44.2 \pm 1.0 \text{ TW}$  [47]. The Earth's Uranium has been thought to be produced in one or more supernovae over 6 Byr ago.

**Radiogenic decay** can be estimated from the flux of geoneutrinos that are emitted during radioactive decay. The KamLAND Collaboration combined precise measurements of the geoneutrino flux from the Kamioka Liquid-Scintillator Antineutrino Detector, Japan, with existing measurements from the Borexino detector, Italy. They found that decay of U-238 and Th-232 together contribute about 20 TW to the total heat flux from the Earth to space. The neutrinos emitted from the decay of K-40 contribute 4 TW. Based on the observations the KamLAND Collaboration made a conclusion that "*heat from radioactive decay contributes about half of Earth's total heat flux*" [48].

**Plutonium-244** with half-life of 80 million years is not produced in significant quantities by the nuclear fuel cycle because it needs very high neutron flux environments. Any Pu-244 present in the Earth's Crust should have decayed by now. Nevertheless, D. C. Hoffman, *et al.* in 1971 obtained the first indication of Pu-244 present existence in Nature [49].

In **WUM**, all chemical products of the Earth including isotopes K-40, U-238, Th-232, and Pu-244, are produced by Dark Matter Reactor inside of the Earth during 4.57 billion years and are, in fact, "Homemade". They are a result of the DMPs self-annihilation with the rest energy 1.3 TeV (compared to proton rest energy 938 MeV). The products arrive in the Crust of the Earth due to convection currents in the mantle carrying heat and isotopes from the interior to the planet's surface [30].

**As a conclusion:** the internal heating of all gravitationally-rounded Macroobjects of SS is due to DMPs self-annihilation in their DM cores made up of DMPs. The amount of energy produced due to this process is sufficiently high to heat up the Macroobjects. New DMPs freely penetrate through the entire Macroobjects' envelope, get absorbed into the DM cores, and continuously support DMPs self-annihilation.

## 4.8. Faint Young Sun paradox

"Faint young Sun" paradox describes the apparent contradiction between observations of liquid water early in Earth's history and the astrophysical expectation that the Sun's output would be only 70 percent as intense during that epoch as it is during the modern epoch. The early Earth would be expected to be completely frozen, but the early Earth seems to have had liquid water. The issue was raised by astronomers C. Sagan and G. Mullen in 1972 [50]. An unresolved question is how a climate suitable for life was maintained

on Earth over the long timescale despite the variable solar output and wide range of terrestrial conditions [51]. Proposed resolutions of this paradox have taken into account greenhouse effects, changes to planetary albedo, astrophysical influences, or combinations of these suggestions.

One of the consequences of **WUM** holds that all stars were fainter in the past. As their cores absorb new DM, size of macroobjects cores  $R_{MO}$  and their luminosity  $L_{MO}$  are increasing in time  $R_{MO} \propto \tau^{1/2}$  and  $L_{MO} \propto \tau$  respectively. Taking the age of the World  $\cong 14.2$  Byr and the age of SS  $\cong 4.6$  Byr, it is easy to find that the young Suns' output was 67% of what it is today. Literature commonly refers to the value of 70% [52].

In frames of WUM, the Upper mantle with Crust are due to DM core activity: the self-annihilation of DMPs in the DM core. As a result of this activity, the thickness of the Upper mantle with Crust is growing in time: the early Earth had a smaller thickness than it is in the present time. Hence, the temperature of the Earth's surface was higher than Its calculated temperature based on the Sun's output at that time.

## 4.9. Geocorona and Planetary Coronas [10]

The geocorona is the luminous part of the outermost region of the Earth's atmosphere that extends to at least 640,000 km from the Earth [53]. It is seen primarily via far-ultraviolet light (Lyman-alpha) from the Sun that is scattered by neutral hydrogen.

**Far-ultraviolet photons in Geocorona** have been observed out to a distance of approximately 100,000 km from the Earth in the article [54]. The first high-quality and wide-field-of-view image of Earth's corona of 243,000 km was obtained by Hisaki, the first interplanetary micro-spacecraft [55]. Hisaki acquires spectral images (52-148 nm) of the atmospheres of planets from Earth orbit and has provided quasi-continuous remote sensing observations of the geocorona since 2013 [56]. The most popular explanation of this geocoronal emission is the scattering of Solar Far-Ultraviolet (FUV) photons by exospheric hydrogen.

**X-rays from Earth's geocorona** were first detected by Chandra X-ray Observatory in 1999 [57]. X-rays were observed in the range of energies 0.08 – 10 keV [55]. The main mechanism explaining geocoronal X-rays is that they are caused by collisions between neutral atoms in the geocorona with carbon, oxygen and nitrogen ions that are streaming away from the Sun in the solar wind [57], [58], [59]. This process is called "charge exchange" since an electron is exchanged between neutral atoms in geocorona and ions in the solar wind.

**X-rays from Planets** were also observed by Chandra [57]. According to NASA:

- The X-rays from Venus and, to some extent, the Earth, are due to the fluorescence of solar X-rays striking the atmosphere;
- Fluorescent X-rays from oxygen atoms in the Martian atmosphere probe heights similar to those on Venus. A huge Martian dust storm was in progress when the Chandra observations were made. The intensity of the X-rays did not change during the dust storm;
- Jupiter has an environment capable of producing X-rays in a different manner because of its substantial magnetic field. X-rays are produced when high-energy particles from the Sun get trapped in its magnetic field and accelerated toward the polar regions where they collide with atoms in Jupiter's atmosphere;
- Like Jupiter, Saturn has a strong magnetic field, so it was expected that Saturn would also show a concentration of X-rays toward the poles. However, Chandra's observation revealed instead an increased X-ray brightness in the equatorial region. Furthermore, Saturn's X-ray spectrum was found to be similar to that of X-rays from the Sun.

In our opinion, the described picture of Geo and Planetary Coronas is similar to the picture of the Solar Corona:

- At the distance of 243,000 km from the Earth, atoms and molecules are so far apart that they can travel hundreds of kilometers without colliding with one another. Thus, the exosphere no longer behaves like a gas, and the particles constantly escape into space. In our view, FUV radiation and X-rays are the consequence of DMF3 (3.7 keV) self-annihilation [12];
- All planets and some observed satellites (Europa, Io, Io Plasma Torus, Titan) have X-rays in upper atmosphere of the planets, similar to the Solar Corona.

According to **WUM**, the characteristics of Geocorona are similar to characteristics of Solar Corona:

- The Geocorona made up of DMPs resembles a honeycomb filled with plasma including the ionosphere from about 60 km to 1,000 km altitude;
- The Geocorona is a stable Shell around the Earth with inner radius  $R_{in} \cong 6.4 \times 10^6 m$  and observed outer radius  $R_{out} \cong 6.4 \times 10^8 m$ . The total mass of this Shell  $\cong 4.1 \times 10^{18} kg$  ;
- At the distance of 640,000 km from the Earth, atoms and molecules are so far apart that the outermost region of the Earth's atmosphere no longer behaves like a gas;
- X-rays and gamma-rays are the consequence of DMPs self-annihilation;
- X-rays and gamma-rays are going not only up and out of the Earth, but also down to the Earth's surface;
- In case a source altitudes of gamma rays is below 20 km (within the altitude range of thunderstorms), they can reach the surface of the Earth (see Section 4.10).

## 4.10. High-Energy Atmospheric Physics [11]

**Lightning initiation problem.** Years of balloon, aircraft, and rocket observations have never found large enough electric fields inside thunderstorms to make a spark. And yet lightning strikes the Earth about 4 million times per day. This has led to the cosmic-ray model of lightning initiation [60], [61].

**Terrestrial Gamma-Ray Flashes (TGFs)** were first detected by chance by NASA's Earth-orbiting Compton gamma ray telescope that was searching for Gamma Ray Bursts from exploding stars, when it unexpectedly began detecting very strong bursts of high energy x-rays and gamma rays, coming from Earth [57].

There are two leading models of TGF formation: Lightning leader emission and Dark Lightning [60], but they still do not account for

- A bright TGF observed by a spacecraft in the middle of Sahara Desert on a nice day. The nearest thunderstorms were  $\sim 1000$  miles away [62];
- An ultraviolet telescope installed on the Russian satellite has registered several powerful explosions of light in the Earth's atmosphere at an altitude of several dozen kilometers in clear weather [63]. Additionally, in frames of existing models it is difficult to explain the following results [11]:
- Unusual surges of radiation at 511 keV when there were no thunderstorms;
- Beams of antimatter (positrons) produced above thunderstorms on Earth;
- A gamma-ray flash coming down from the overhead thundercloud;
- Some lightnings produce X-rays and others do not;
- Explosive production of energetic particles observed from space;
- The spectra of TGFs at very high energies (40–100 MeV).

According to **WUM**, the characteristics of Geocorona are similar to the characteristics of the Solar Corona. As the result of a large fluctuation of DMPs in Geocorona and their self-annihilation, X-rays and gamma-rays are going not only up and out of the Earth, but also down to the Earth's surface. In our view, TGFs are, in fact, well-known Gamma Ray Bursts. The spectra of TGFs at very high energies can be explained by DMF1 (1.3 TeV) and DMF2 (9.6 GeV) self-annihilation [12]. Lightning initiation problem can be solved by X-rays and

gamma-rays, which slam into the thunderclouds and carve a conductive path through a thunderstorm. From this point of view, it is easy to explain all experimental results summarized above.

## Conclusion

ALLATRA International Public Movement was founded in 2011 on the basis of Lagoda International Public Organization. Today, participants of the movement are implementing a vast number of large-scale projects in different areas. The projects are being accomplished by the world's best volunteer experts from various walks of life who are not indifferent to the future of our civilization and who develop their professional and creative potential for the benefit of the whole humanity [64].

Dr. Egon Cholakian, a distinguished scientist renowned for his work in climate research and national security, has directly addressed world leaders Mr. Joe Biden, Mr. Xi Jinping, and Mr. Vladimir Putin, highlighting the gravity of the ongoing destructive climate events that threaten the future of our planet and humanity. He said “*This is a matter of supranational security and a matter that affects every country and every individual citizen*” [65].

We hope that WUM that explains Earth’s environmental challenges to the best of our knowledge today, will help ALLATRA to analyze their experimental results through the prism of WUM, perform new targeted experiments, and make reliable forecast for the future of our Planet. In our opinion, we should concentrate our efforts on investigations of the Oceans and Volcanoes, which are responsible for the climate changes.

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