

# Hypersphere World-Universe Model – Natural Extension of Classical Physics

## Digest

Vladimir S. Netchitailo  
[netchitailov@gmail.com](mailto:netchitailov@gmail.com)

### Abstract

Today, a growing number of researchers share a sense of stagnation in the field of Physics. In many ways, this situation is reminiscent of the late 19th century when it was widely believed that the body of Physics was nearly complete. It may be an opportune moment to propose new fundamental models that are not only simpler than the current state of the art but also open up new areas of research. Several ideas presented in this Digest are not new, and we do not claim credit for them. In fact, many of these ideas, originally proposed by classical scientists, are revisited here with fresh insights. This Digest aims to describe the World by unifying and simplifying existing models and results in Cosmology into a single coherent picture.

Hypersphere World—Universe Model (WUM) is radically different from the prevailing Big Bang Model. The main advantage of WUM is its elimination of the "Initial Singularity" and "Inflation," providing explanations for many unresolved problems in Cosmology. This Digest offers an overview of WUM covering the period from 2013 to 2024 and explores various themes of the World. It concludes a [Series of 38 articles](#) published in the Journal of High Energy Physics, Gravitation and Cosmology. Interested readers are encouraged to consult the published articles for more details.

WUM is a classical model and should be described using classical notions, which define emergent phenomena. An Emergent Phenomenon is a property that is a result of simple interactions that work cooperatively to create a more complex interaction. These simple interactions occur at the microscopic level, while their collective outcomes can be observed at the macroscopic level. WUM introduces classical notions from the moment a first ensemble of particles was created ( $\cong 10^{-18} c$ ).

**Classical Physics deals with ensembles of quantum objects!**

## 1. Hypotheses Revisited by WUM

### 1.1. Aether

Physical Aether was suggested by I. Newton in 1675. Following the work of T. Young (1804) and A-J. Fresnel (1816), it was believed that light propagates as a transverse wave within an elastic medium called Luminiferous Aether. At that time, it was realized that Aether could not be an elastic matter of an ordinary type that can only transmit longitudinal waves.

Unique properties of Aether were discussed by J. McCullagh in 1846 who proposed a theory of a rotationally elastic medium. The potential energy of deformation in such a medium depends only on the rotation of the volume elements and not on their compression or general distortion. This theory produces equations analogous to Maxwell's equations. Aether with these properties can

transmit transverse waves. He has this to say about the Aether: “*The constitution of the aether, if it ever would be discovered, will be found to be quite different from anything that we are in the habit of conceiving, though at the same time very simple and very beautiful. An elastic medium composed of points acting on each other in the way supposed by Poisson and others will not answer.*”

Luminiferous Aether was abandoned in 1905 by Special Relativity. In later years there have been classical physicists who advocated the existence of Aether:

- N. Tesla declared in 1937 in “Prepared Statement on the 81st birthday observance”: *All attempts to explain the workings of the universe without recognizing the existence of the aether and the indispensable function it plays in the phenomena are futile and destined to oblivion.*
- P. Dirac stated in 1951 in the article in Nature, titled "Is there an Aether?" that *we are rather forced to have an aether.*

**WUM** is based on Maxwell’s equations, and McCullagh’s theory is a good fit for description of the Medium. The Model introduces the Medium of the World that is some kind of “Aether” composed of stable elementary particles. The existence of the Medium is a principal point of WUM. It follows from the observations of Intergalactic plasma, confirmed by Fast Radio Bursts; Cosmic Microwave Background Radiation; Far-Infrared Background Radiation. According to WUM, Intergalactic voids discussed by astronomers are, in fact, examples of the Medium in its purest. The Medium is the absolute frame of reference. The energy density of the Medium is 2/3 of the total energy density of the World in all cosmological times. All Macroobjects (MOs) are built from the same particles. The energy density of MOs adds up to 1/3 of the total energy density throughout the World’s evolution.

**The Medium is the Savior of Classical Physics! Don't throw the baby out with the bathwater.**

## 1.2. Le Sage’s Theory of Gravitation

Wikipedia summarizes this unique theory as follows: “*the Sage's theory of gravitation is a kinetic theory of gravity was originally proposed by Nicolas Fatio de Duillier in 1690 and later by Georges-Louis Le Sage in 1748. The theory proposed a mechanical explanation for Newton's gravitational force in terms of streams of tiny unseen particles (which Le Sage called ultra-mundane corpuscles) impacting all material objects from all directions. According to this model, any two material bodies partially shield each other from the impinging corpuscles, resulting in a net imbalance in the pressure exerted by the impact of corpuscles on the bodies, tending to drive the bodies together.*”

Le Sage proposed quantitative estimates for some of the theory's parameters:

- He called the gravitational particles ultramundane corpuscles because he supposed them to originate **beyond our known universe**. It was a genius prediction of **Universe-Created Particles XIONS** in WUM! The distribution of the ultramundane flux is isotropic, and the laws of its propagation are very similar to that of light.
- To maintain mass proportionality, ordinary matter consists of cage-like structures, in which their diameter is only the  $10^7$ th part of their mutual distance, so the particles can travel through them nearly unhindered.

In **WUM**, a time-varying Gravitational parameter  $G \propto \tau^{-1}$  is proportional to the energy density of the Medium  $\rho_M \propto \tau^{-1}$  ( $\tau$  is a Cosmological time). It is not constant. That is why WUM aligns

gravity with Le Sage's theory of gravitation. The gravity is a result of Weak interactions of Universe-Created (UC) Bosons "XIONS" with Matter that work cooperatively to create a more complex interaction. The total XIONS energy density is about 64% of the total energy density of the World. Particles XIONS are responsible for the Le Sage's mechanism of the gravitation (see Section 3.3).

**To summarize:**

- Gravity is not an interaction but a manifestation of the Medium.
- The proposed mechanism of Gravitation resembles Le Sage's theory.

**Le Sage's theory is the very first theory which defines the Gravity as an emergent phenomenon.**

### 1.3. Dark (invisible) Stars

J. Michell was an English natural philosopher and clergyman who provided pioneering insights into a wide range of scientific fields including astronomy, geology, optics, and gravitation. Considered "*one of the greatest unsung scientists of all time*", he is the first person known to have proposed in 1783 the existence of "**Dark Stars**" and the first to have suggested that earthquakes travelled in (seismic) waves. The American Physical Society described Michell as being "*so far ahead of his scientific contemporaries that his ideas languished in obscurity, until they were re-invented more than a century later*". The Society stated that while "*he was one of the most brilliant and original scientists of his time, Michell remains virtually unknown today, in part because he did little to develop and promote his own path-breaking ideas*".

Michell suggested that there might be many "dark stars" in the universe and proposed that astronomers could detect "dark stars" by looking for star systems which behaved gravitationally like two stars, but where only one star could be seen. He argued that this would show the presence of a "dark star". It was an extraordinarily accurate prediction of binary systems, in which a "dark star" and a normal star orbit around their center of mass. In the Milky Way (MW) galaxy there are a dozen such binary systems emitting X-rays. Please pay tribute to this genius physicist!

The first known binary system was Cygnus X-1, identified independently by several researchers in 1971 (188 years later). It remains among the most studied astronomical objects in its class. The compact object is now estimated to have a mass  $\sim 21.2 M_{\odot}$ . Cygnus X-1 is about 5 million years old. Though highly and erratically variable, Cygnus X-1 is typically the brightest persistent source of hard X-rays with energies up to 60 keV.

According to **WUM**, **Cores of all Macroobjects are, in fact, "Dark Stars"**.

### 1.4. Hypersphere Universe

In 1854, G. Riemann proposed the Hypersphere as a model of a finite universe. The hypersphere is the surface of a 4-dimensional ball, which is the **Nucleus of the World** in WUM.

**WUM** follows this idea, albeit proposing that the World is evenly stretched as the result of the expansion of the Nucleus along its fourth spatial dimension. **The Medium and MOs, composed of stable elementary particles, are the primary components of the World.**

### 1.5. Gravitoelectromagnetism

Gravitoelectromagnetism (GEM) is a gravitational analog of Electromagnetism. GEM equations, differing from Maxwell's equations by some constants were first published by O. Heaviside in 1893

as a separate theory expanding Newton's law. GEM approximates the Einstein's gravity equations in the weak field limit. H. Thirring pointed out this analogy in his "*On the formal analogy between the basic electromagnetic equations and Einstein's gravity equations in first approximation*" paper published in 1918. It allows us to use formal analogies between the electromagnetism and relativistic gravity. In case of the strong field limit, we should use the Einstein's gravity equations.

In 2021, G. Ludwig in the article "Galactic rotation curve and dark matter according to gravitomagnetism" made the conclusion that "*the effects attributed to dark matter can be simply explained by the gravitomagnetic field produced by the mass currents*".

In accordance with **WUM**, Universe-Created Matter (UCM), that was named "Dark Matter" earlier in our publications, is concentrated in Cores of all MOs. There are no Supermassive Black Holes. Instead, there are UCM Cores of galaxies. WUM is based on the Gravitomagnetism. **The explanation of galactic rotation curve made by G. Ludwig is in good agreement with the approach of WUM.**

## 1.6. Rotational Fission

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. Solar fission theory was proposed by Louis Jacot in 1951 who stated that "*The planets were expelled from the Sun one by one from the equatorial bulge caused by rotation; the moons and rings of planets were formed from the similar expulsion of material from their parent planets*". Tom Van Flandern extended this theory in 1993.

**WUM** follows this idea, albeit proposing that **the origin of all MOs is due to Rotational Fission of Overspinning UCM Supercluster's Cores and self-annihilation of Universe-Created Particles (UCPs).**

## 1.7. Dirac Large Number Hypothesis

In 1937, P. Dirac proposed a Large Number Hypothesis and Hypothesis of Variable Gravitational Constant, later incorporating a concept of Continuous Creation of Matter in universe. WUM builds upon these ideas, introducing a distinct mechanism for Matter creation. Dirac Large Number Hypothesis is an observation made by P. Dirac relating ratios of size scales in the Universe to that of force scales. The ratios constitute very large, dimensionless numbers, some 40 orders of magnitude in the present cosmological epoch. According to Dirac's hypothesis, the apparent equivalence of these ratios might not to be a mere coincidence but instead could imply a cosmology where the strength of gravity, as represented by the gravitational "constant"  $G$ , is inversely proportional to the cosmological time  $\tau$ :  $G \propto \tau^{-1}$ .

**WUM** follows the idea of time-varying  $G$  and introduces a dimensionless time-varying quantity  $Q$ , which is a measure of the Size  $R$  and Age  $A_\tau$  of the World and is, in fact, Dirac Large Number:

$$Q = \frac{R}{a} = \frac{A_\tau}{t_0}$$

where  $t_0 = a/c$  is a basic time unit (see Section 2.1). In the present Epoch,  $Q = 0.759972 \times 10^{40}$ .

## 1.8. Emergent Gravity, Space and Time

C. Barcelo, *et al.* have this to say about emergent gravity: *One of the more fascinating approaches to "quantum gravity" is the suggestion, typically attributed to Sakharov that gravity itself may not*

be “fundamental physics”. Indeed, it is now a relatively common opinion, that gravity (and in particular the whole notion of spacetime and spacetime geometry) might be no more “fundamental” than is fluid dynamics. The word “fundamental” is here used in a rather technical sense – fluid mechanics is not fundamental because there is a known underlying microphysics that of molecular dynamics, of which fluid mechanics is only the low-energy low-momentum limit.

**WUM:** Time and Space are closely connected with Mediums’ Impedance and Gravitomagnetic parameter. It follows that neither Time nor Space could be discussed in absence of the Medium. The gravitational parameter  $G$  that is proportional to the Mediums’ energy density can be introduced only for the Medium filled with Matter. In this regard, it is worth recalling the Einstein’s quote: *When forced to summarize the theory of relativity in one sentence: time and space and gravitation have no separate existence from matter.*

**Space, Time, Gravity, Gravitational mass are all emergent phenomena.**

## 2. Classical Physics before Special Relativity

### 2.1. Fundamental Physical Constants

**Kinetic Theory of Gases** explains macroscopic properties of gases, such as pressure, viscosity, temperature, thermal conductivity, and volume, by considering their molecular composition and motion. In 1859, J. C. Maxwell formulated the Maxwell distribution of molecular velocities, which gave the proportion of molecules having a certain velocity in a specific range. This was the first-ever statistical law in Physics that defines macroscopic properties of gases as **emergent phenomena**.

**Maxwell’s Equations** were published by J. C. Maxwell in 1861. He calculated the velocity of electromagnetic waves from the value of the **electrodynamic constant**  $c$  measured by Weber and Kohlrausch in 1857 and noticed that the calculated velocity was very close to the velocity of light measured by Fizeau in 1849. This observation made him suggest that light is an electromagnetic phenomenon.

**Rydberg Constant**  $R_\infty$  is a physical constant relating to atomic spectra. The constant first arose in 1888 as an empirical fitting parameter in the Rydberg formula for the hydrogen spectral series. As of 2018,  $R_\infty$  is the most accurately measured Fundamental physical constant.

**Electron Charge-to-Mass Ratio**  $e/m_e$  is a Quantity in experimental physics. It bears significance because the electron mass  $m_e$  cannot be measured directly. The  $e/m_e$  ratio of an electron was successfully calculated by J. J. Thomson in 1897. We define it after Thomson  $R_T \equiv e/m_e$ .

**Planck Constant** was suggested by M. Planck as the result of the investigations into a problem of black-body radiation. He used Boltzmann's famous equation from Statistical Thermodynamics:  $S = k_B \ln W$  that shows the relationship between entropy  $S$  and the number of ways the atoms or molecules of a thermodynamic system can be arranged ( $k_B$  is the Boltzmann constant). As the result of his analysis, Planck found that the average resonator entropy must be described by a function which depends on the ratios  $U/\nu$  and  $U/E$  at the same time ( $U$  is vibrational energy of vibrating resonator). Planck reconciled those two requirements through  $E = h\nu$  in which  **$h$  represents a factor that converts units of frequency  $\nu$  into units of energy  $E$** . In 1901, Planck calculated the value of  $h$  from experimental data:  $h = 6.55 \times 10^{-34} \text{ J} \cdot \text{s}$ , that is within 1.2% of the currently

accepted value. We emphasize that Planck constant, which is generally associated with the behavior of microscopically small systems, was introduced by Planck based on **Statistical Thermodynamics** before Quantum Physics.

**WUM.** Based on the experimentally measured values of the constants  $R_\infty, R_T, c, h$ , and the value of the permeability of free space:  $\mu_0 = 4\pi \times 10^{-7} H/m$  we calculate the most important Fundamental constants as follows:

- Basic size unit  $a$  :

$$a = 0.5[(2\mu_0 h/c)^3 R_\infty R_T^6]^{1/5} = 1.7705641 \times 10^{-14} m$$

- Dimensionless Rydberg constant  $\alpha$  :

$$\alpha = (2aR_\infty)^{1/3}$$

It is worth noting that the constant  $\alpha$  was later named “Fine-structure constant”.

- Electron rest energy  $E_e$  :

$$E_e = \alpha hc/a$$

- Elementary charge  $e$  :

$$e^2 = 2\alpha h/\mu_0 c$$

**All these constants, including classical electron radius  $a_0 = a/2\pi$ , were measured and could be calculated before Special Relativity and Quantum Physics.**

## 2.2. History of Dark (invisible) Matter. Early Ideas

The history of Dark Matter (DM) can be traced back to at least the end of the 18th century.

G. Bertone and D. Hooper (2018) provide an excellent review of its history:

- In 1844, F. Bessel argued that the observed proper motion of the stars Sirius and Procyon could only be explained by the presence of faint companion stars influencing the observed stars through their gravitational pull.
- In 1904, Lord Kelvin was among the first to attempt a dynamical estimate of the amount of dark matter in MW. His argument was simple yet powerful: if stars in MW can be described as a gas of particles, acting under the influence of gravity, then one can establish a relationship between the size of the system and the velocity dispersion of the stars.
- H. Poincare was impressed by Lord Kelvin’s idea of applying the “theory of gases” to the stellar system of MW. In 1906, he explicitly mentioned “dark matter” and argued that since the velocity dispersion predicted in Kelvin’s estimate is of the same order of magnitude as that observed, the amount of dark matter was likely to be less than or similar to that of visible matter.

## 3. Hypersphere World-Universe Model

### 3.1. Assumptions

WUM is based on the following primary assumptions:

- World is a Finite Boundless Hypersphere of a 4D Nucleus of the World that is expanding along the fourth spatial dimension of the Nucleus with speed equals to a gravitodynamic constant  $c$ .
- Eternal Universe is a Creator of Universe-Created (UC) Matter (UCM), which is continuously created in the Nucleus. Ordinary Matter is a byproduct of UC Particles (UCPs) self-annihilation.

- Medium of the World is an active agent in all physical phenomena in the World.
- Two fundamental parameters in various rational exponents define all macro and micro features of the World: dimensionless Rydberg constant  $\alpha = (2aR_\infty)^{1/3}$  and dimensionless time-varying quantity  $Q$  that is, in fact, the Dirac's Large Number.

### 3.2. Principal Points

WUM is based on the following principal points:

- **Beginning.** The World was started by a Fluctuation in the Eternal Universe, and the Nucleus of the World, which is a 4D ball, was born. An extrapolated Nucleus radius at the Beginning was equal to the basic size unit of  $a$ . All points of the Hypersphere are equivalent; there are no preferred centers or boundaries of the World.
- **Stretching of the World.** The 4D Nucleus is expanding along Its imperceptible fourth spatial dimension so that the radius of the Nucleus  $R$  is increasing with speed  $c$ . Its surface, the Hypersphere, is evenly stretched.
- **Creation of Matter.** The surface of the Nucleus is created in a process analogous to sublimation. Continuous creation of matter is the result of this process. Sublimation is a well-known process that happens when surfaces are intrinsically more energetically favorable than the bulk of a material, and hence there is a driving force for surfaces to be created. The Universe creates UCM in 4D Nucleus. UCPs carry new UCM into the World. Ordinary Matter is a byproduct of UCPs self-annihilation. The proposed 4D process is responsible for 4D Nucleus Expansion, the World Stretching, Creation of Matter, and Arrow of Time, which does not depend on any physical phenomenon in the Medium. It is the result of the Nucleus expansion due to the driving force for surfaces to be created. Creation of UCM occurs homogeneously in all points of the World.
- **Content of the World.** The World consists of the Medium and MOs. Total energy density of the World equals to the critical energy density throughout the World's evolution. The energy density of the Medium is two-thirds of the total energy density and MOs – one-third in all cosmological times. The relative energy density of UCPs is about 92.8% and Ordinary particles (protons, electrons, photons, and neutrinos) – about 4.8% in the Medium of the World and 2.4% in MOs.
- **Homogeneous and Isotropic Medium**, consisting of protons, electrons, photons, neutrinos, and UCPs, is an active agent in all physical phenomena in the World. WUM is a classical model, therefore classical notions can be introduced only when the very first ensemble of particles was created at the cosmological time  $\tau \cong 10^{-18} s$ . 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 Albert Einstein: "*When forced to summarize the theory of relativity in one sentence: time and space and gravitation have no separate existence from matter*". **There is no Medium – there is Nothing!**
- WUM is 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 Cosmological Parameters, which are inversely proportional to  $\tau$ . Therefore, there is no problem with time equals zero.

- **Rotational Fission.** The mechanism that can provide Angular Momenta to MOs is a Rotational Fission of overspinning (surface speed at equator exceeding escape velocity) Prime Objects. From the point of view of Fission model, the prime object is transferring some of its rotational angular momentum to orbital and rotational momenta of satellites. It follows that the rotational momentum of the prime object should exceed the orbital momentum of its satellite. In WUM, prime objects are UCM Cores of Superclusters, which must accumulate tremendous rotational angular momenta before the Birth of a Luminous World. It means that it must be some long enough time in the history of the World, which we named “Dark (invisible) Epoch.”
- **Dark (invisible) Epoch** spans from the Beginning of the World 14.22 Byr ago to 0.45 Byr (for Laniakea Supercluster that is a home to Milky Way (MW)) when only UCM Macroobjects existed.
- **Luminous Epoch** has lasted ever since 13.77 Byr when Luminous MOs emerged due to Explosive Volcanic Rotational Fission of Overspinning UCM Supercluster’s Cores that looks like a Firework of UCM cores of satellites at the same time, so that the direction of the sum of satellites angular momentum coincides with the angular momentum of Prime Object. There are no preferences of directions of satellites rotations at any level: galaxy, extrasolar system (ESS) vs random rotation direction. UCM Cores of Prime Objects detonate at critical points of their stability.
- **Macroobjects Shell Model.** MOs of the World possess the following properties: their Cores are made up of UCPs; they contain other particles, including UCPs and Ordinary particles, in shells surrounding the Cores. Introduced **Weak Interaction** between UCPs and Ordinary particles provides integrity of all shells.
- **UC Matter Reactors.** MOs’ cores are UCM Reactors fueled by UCPs. All chemical elements, compositions, radiation are produced by MOs themselves as the result of UCPs self-annihilation in their UCM cores. **Nucleosynthesis of all elements** occurs inside of MOs during their evolution.
- **Macroobjects Formation.** Superclusters are principal objects of the World. MOs (Superclusters, Galaxies, and ESS) form in parallel around different Cores made up of different UCPs. The Finite Boundless World presents a Patchwork Quilt of different main Luminous Superclusters ( $\geq 10^3$ ), which emerged in various places of the World at different Cosmological times. The distribution of MOs is spatially inhomogeneous and anisotropic and temporally non-simultaneous. Macrostructures of the World form from the top (superclusters) down to galaxies and ESS.
- **Macroobjects Evolution.** The formation of galaxies and stars is not a process that concluded ages ago; instead, it is ongoing. Assuming the Eternal Universe, numbers of cosmological structures on all levels will increase; new superclusters will form; existing clusters will obtain new galaxies; new stars will be born inside existing galaxies; sizes of individual stars will increase. The temperature of the Medium will asymptotically approach absolute zero.
- Thanks to the revealed by WUM **Inter-Connectivity of Primary Cosmological Parameters**, we show that Gravitational parameter  $G$  that can be measured directly makes measurable all Cosmological parameters (including the absolute Age of the World), which cannot be measured directly.



### 3.3. Universe-Created Matter

In our previous articles, we followed the standard paradigm "Dark Matter" that is not quite right for WUM, in which the World consists of particles of Ordinary Matter: protons, electrons, photons, and neutrinos. On the other hand, there are particles created by the Universe –UCPs of a new kind of "Universe- Created Matter" (UCM). In 2024, we introduced a new term – UCPs, which have following characteristics: **UC Fermions (UCF)** or **Bosons, Rest Energies** of them (see **Table 1**), **Weak Interaction**, and **Self-annihilation**. Ordinary particles are a byproduct of UCPs self-annihilation. It is easy to switch from Dark (D) Matter to Universe-Created (UC) Matter.

**Table 1.** Universe-Created Particles.

Fermion			Boson		
Particle	Rest Energy	Value	Particle	Rest Energy	Value
UCF1	$\alpha^{-2}E_0$	1.3149948 <i>TeV</i>	DIRAC	$\alpha^0E_0$	70.025252 <i>MeV</i>
UCF2	$\alpha^{-1}E_0$	9.5959804 <i>GeV</i>	ELOP	$2/3\alpha^1E_0$	340.66596 <i>keV</i>
UCF3	$\alpha^2E_0$	3.7289394 <i>keV</i>	XION	$1/2 \alpha^6E_0$	5.2870895 $\mu eV$
UCF4	$\alpha^4E_0$	0.19857107 <i>eV</i>			

In this Table, a Basic Energy Unit  $E_0$  equals to:

$$E_0 = hc/a = 70.025252 \text{ MeV}$$

where  $h$  is the Planck constant and  $c$  is the Gravitodynamic constant. These particles are "dark", **optically invisible**, when astronomers observe the World with telescopes only.

A contemporary Astronomy allows us to observe the World on wavelengths from radio waves up to gamma rays! Then, they are not "dark" at all. The first known binary system was Cygnus X-1 that is the brightest persistent source of hard X-rays with energies up to 60 keV . In 2000, R. Minchin, *et al.* discovered binary galaxy system VIRGOHI 21 with NGC 4254, which has the 21-cm emission.

These two kinds of Matter have different origin of radiations:

- Ordinary Matter radiates **Electromagnetic waves** from Radio waves up to X-rays by electrons outside nuclei. Lawrence Livermore scientists probed nitrogen gas at X-ray energies of up to 8 keV, the highest X-ray energy ever used at an X-ray free electron laser.
- UC Matter radiates **Gamma rays**, which are emitted by nuclei, as a result of self-annihilation of UCPs with rest energies, covering eighteen orders of magnitude (see **Table 1**).

WUM proposes multicomponent UCM system consisting of two couples of co-annihilating UCPs: a heavy fermion UCF1 (1.3 TeV) and a light spin-0 boson – DIRAC (70 MeV) that is a dipole of Dirac's monopoles with charge  $\mu = e/2\alpha$  ; a heavy fermion UCF2 (9.6 GeV) and a light spin-0 boson – ELOP (340 keV) that is a dipole of preons with electrical charge  $e/3$ ; fermions UCF3 (3.7 keV) and UCF4 (0.2 eV), and boson XION (5.3  $\mu eV$ ).

The reason for this multicomponent UCM system was to explain:

- The diversity of Very High Energy gamma-ray sources in the World.
- The diversity of UCM Cores of Macroobjects of the World (Superclusters, Galaxies, and ESS), which are Fermion Compact Objects and UCM Reactors in WUM.

UCPs do not possess an electric charge. Their masses cannot be directly measured by mass spectrometry. Hence, they can be observed only indirectly. The signatures of UCPs self-annihilation with expected rest energies of 1.3 TeV; 9.6 GeV; 70 MeV; 340 keV; 3.7 keV; 0.2 eV;  $5.3 \mu eV$  are found in spectra of diffuse gamma-ray background and the emissions of various MOs in the World. We connect observed gamma-ray spectra with the structure of MOs (nuclei and shells composition). Self-annihilation of those UCPs can give rise to any combination of gamma-ray lines. Thus, the diversity of Very High Energy gamma-ray sources in the World has a clear explanation.

### 3.4. Most Direct Observational Evidence of Validity of WUM

1) Microwave Background Radiation (MBR), Intergalactic Plasma, and Far-Infrared Background Radiation speak in favor of existence of the **Medium of the World**.

2) Laniakea Supercluster (LS) with binding mass  $\sim 10^{17} M_{\odot}$  is home to MW and  $\sim 10^5$  other nearby galaxies, which did not start their movement from Initial Singularity. Neighboring superclusters Shapley, Coma, and Perseus-Pisces have the same structure (**Patchwork Quilt**).

3) MW is gravitationally bounded with the Virgo Supercluster and has an orbital Angular Momentum calculated based on distance of 65 *Mly* from the Virgo Supercluster and the orbital speed of  $\sim 400 \text{ km s}^{-1}$ , which far exceeds rotational Angular Momentum of MW. To the best of our knowledge, WUM is the only cosmological model that aligns with the **Law of Creation and Conservation of Angular Momentum**.

4) Mass-to-light ratio of the Virgo Supercluster is  $\sim 300$  times larger than that of Solar ratio. Similar ratios are obtained for other superclusters. These ratios are main arguments in favor of the presence of significant amounts of **UC Matter** in the World.

5) Astronomers discovered the most distant galaxies HD1 and JADES-GS-z14-0, which are  $\sim 13.5 \text{ Bly}$  away, and a candidate galaxy F200DB-045 that is  $\sim 13.7 \text{ Bly}$  away. These distant galaxies are the main arguments in the existence of "**Dark (invisible) Epoch**".

The presented view of the World represents a fundamental change in the field of Cosmology.

**Medium of the World, UC Matter, and Angular Momentum are the main Three Pillars of WUM.**

## 4. Main Results of WUM

### 4.1. Predictions

In 2013, WUM revealed a self-consistent set of time-varying values of Primary Cosmological Parameters of the World: Gravitational parameter, Hubble's parameter, Age of the World, Temperature of Microwave Background Radiation, and concentration of Intergalactic plasma. Based on the inter-connectivity of these parameters, WUM solved the Missing Baryon problem and predicted the values of the following Cosmological parameters: gravitational G, concentration of Intergalactic plasma, and the minimum energy of photons, which were experimentally confirmed in 2015 – 2018. "*The Discovery of a Supermassive Compact Object at the Centre of Our Galaxy*" (Nobel Prize in Physics 2020) made by R. Genzel and A. Ghez confirms one of the most important predictions of WUM in 2013: "*Macroobjects of the World have cores made up of the discussed DM particles. Other particles, including DM and baryonic matter, form shells surrounding the cores.*"

Summary of the calculated by WUM in 2013 cosmological parameters and experimentally measured parameters are presented in the following **Table 2**.

**Table 2.** Calculated and measured cosmological parameters.

Parameter	Calculated (2013)	Measured	Year
Gravitational	$6.67420 \times 10^{-11} m^3 kg^{-1} s^{-2}$	$6.674184 \times 10^{-11} m^3 kg^{-1} s^{-2}$	2018
Hubble's	$68.733 km s^{-1} Mpc^{-1}$	$68.7 \pm 1.3 km s^{-1} Mpc^{-1}$	2021
Ionized Baryons	4.8 %	$4.9 \pm 1.3 %$	2016
Minimum Photon Energy	$1.87433 \times 10^{-14} eV$	$\lesssim 2.2 \times 10^{-14} eV$	2017
MBR Temperature	2.725245 K	$2.72548 \pm 0.00057 K$	2009
FIRB Temperature Peak	28.955 K	29 K	1998
Absolute Age of the World	14.226 Byr		

We emphasize that WUM allows precise calculation of values that were only experimentally measured earlier and makes verifiable predictions.

**JWST discoveries** (2022) confirm the most important predictions of WUM in 2018: 1) Absolute Age of the World is 14.226 Byr; 2) “Dark (invisible) Epoch” (spanning for Laniakea Supercluster (LSC) from the Beginning of the World for 0.45 Byr) when only UC Matter MOs form and evolve; 3) Luminous Epoch (ever since, 13.77 Byr for LSC) when Luminous MOs (superclusters, galaxies, ESS, etc.) emerge; 4) Transition from “Dark Epoch” to Luminous Epoch is due to Explosive Rotational Fission of Overspinning (surface speed at equator exceeding escape velocity) UCM Supercluster’s Cores and self-annihilation of UCPs; 5) MOs of the World form from the top (Superclusters) down to Galaxies and ESS in parallel around different Cores made up of different UCPs; 6) The Finite Boundless World presents a Patchwork Quilt of different Luminous Superclusters, which emerged in different places of World at different Cosmological times.

## 4.2. Explained Problems

WUM solves a number of physical problems in contemporary Cosmology and Astrophysics through UCPs and their interactions:

- **Angular Momentum problem** in birth and subsequent evolution of Galaxies and ESS explained by Volcanic Rotational Fission of Overspinning UCM Supercluster’s Cores.
- **Hubble Tension** explained by observations of Galaxies, which belong to different Superclusters. The value of Hubble’s parameter should be measured based on Cosmic Microwave Background Radiation data only.
- **Missing Baryon problem**, related to the fact that the observed amount of baryonic matter did not match theoretical predictions, solved by the calculation of the concentration of Intergalactic plasma.
- **Fermi Bubbles**—two large structures in gamma-rays above and below Galactic center—are stable clouds of UCPs (UCF1, UCF2, and UCF3) containing uniformly distributed UCM Objects, in which UCPs self-annihilate and radiate gamma rays.
- **Galaxies are ellipticals and spirals** due to Explosive Rotational Fission of their Overspinning UCM Cores.

- **Coronal Heating Problem** relates to a question of why the temperature of the Solar corona is millions of degrees higher than that of the photosphere. According to WUM, the origin of the Solar corona plasma is not coronal heating. Plasma particles (electrons, protons, multi-charged ions) are so far apart that plasma temperature in the usual sense is not very meaningful. Plasma is the result of the self-annihilation of UCPs. The Solar corona made up of UCPs resembles a honeycomb filled with plasma.
- **Cores of Sun and Earth rotate faster than their surfaces** despite high viscosity of the internal medium. WUM explains the phenomenon through absorption of UCPs by Cores. UCPs supply not only additional mass ( $\propto \tau^{3/2}$ ), but also additional angular momentum ( $\propto \tau^2$ ). Cores irradiate products of self-annihilation, which carry away excessive angular momentum. Solar wind is the result of this mechanism.
- **Internal Heating** of Gravitationally-Rounded Objects in SS is explained by UCM Reactors inside of all MOs fueled by UCPs. Internal Heating is due to UCPs self-annihilation.
- **Diversity of Gravitationally-Rounded Objects** in SS is explained by UCM Reactors inside of MOs fueled by UCPs. All chemical elements, compositions, and radiation are produced by MOs themselves as the result of UCPs self-annihilation in their different UCM cores.
- **Plutonium-244** with half-life of 80 million years exists in Nature. It is not produced 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. In WUM, all chemical products of the Earth including isotopes K-40, U-238, Th-232, and Pu-244, are produced within the Earth as the result of UCF1 self-annihilation. They 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.
- **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% as intense during that epoch as it is during the modern epoch. In WUM, all MOs of the World were fainter in the past. As their UCM cores absorb new UCPs, the sizes of MOs and thus their luminosity are increasing in time  $\propto \tau$ . Considering 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 Sun's output was 67.6% of what it is today.
- **Matter-Antimatter Asymmetry problem.** Ordinary Matter is byproduct of UCPs self-annihilation. This problem does not arise, since antimatter is not created by UCPs self-annihilation.
- **Black-body spectrum of Microwave Background Radiation** is due to thermodynamic equilibrium of photons with Intergalactic plasma.
- **Solar Corona, Geocorona and Planetary Coronas** made up of UCPs resemble honeycombs filled with plasma particles (electrons, protons, multi-charged ions), which are the result of UCPs self-annihilation.
- **Wave-Particle Duality problem.** In physics, the Observer Effect refers to the disturbance of a system caused by the act of observing it. A well-known example of this occurs in the double-slit experiment. Physicists have observed that when detectors are used to monitor quantum phenomena in this experiment, the very act of observation alters the outcome. When detectors

are placed at the slits, they find that each photon passes through only one slit, behaving like a classical particle, rather than through both slits, which would indicate wave-like behavior. Crucially, when the path of the particle is observed, the characteristic interference pattern—typical of wave behavior—does not form, illustrating the principle of wave-particle duality. R. Feynman famously noted that the wave-particle duality in the double-slit experiment is "*impossible, absolutely impossible, to explain in any classical way*" and that this mystery lies at the heart of quantum mechanics.

However, according to WUM, the concept of wavelength is classical, not quantum. Wavelength, in this view, is a property of an ensemble of quantum objects (such as photons or electrons), all of which possess four-momenta but no individual wavelength. When the gravitostatic charge of particles is equal to their momentum  $p_{DB}$ , the gravitomagnetic flux  $\phi_{DB}$  is defined as:

$$\phi_{DB} = \frac{h}{p_{DB}} = \lambda_{DB}$$

This is known as the de Broglie wavelength. Thus, in WUM, wavelength is considered a macroscopic phenomenon, representing the gravitomagnetic flux of particles characterized solely by their four-momenta. This implies there is no wave-particle duality in WUM, as wavelength is an emergent phenomenon. The act of observation (through detectors) disturbs the observed system (an ensemble of particles), causing the emergent wavelength to disappear. Consequently, the interference pattern no longer forms.

- **The “Axis of Evil”** refers to a controversial correlation between a plane of SS and certain anomalies in MBR. This correlation suggests that the plane of SS, and by extension Earth’s position, may have greater cosmological significance than expected by random chance. Specifically, the motion and orientation of the Solar System’s ecliptic plane appear to align with certain features observed in MBR.

In WUM, the black-body spectrum of MBR is explained by the thermodynamic equilibrium between photons and the intergalactic plasma, the existence of which has been experimentally supported by observations of Fast Radio Bursts. The solar wind, which consists of charged particles (primarily protons and electrons) emitted from the Sun, has a plasma density distribution that varies with distance from the Sun:

#### 1) Radial Distribution

Close to the Sun (~0.1 AU): The particle density is high, ranging from 100 to 1000 particles/cm<sup>3</sup>.

On Earth’s orbit (1 AU): The density averages between 5 to 10 particles/cm<sup>3</sup>.

Beyond 1 AU: The density decreases with the inverse square of the distance, reaching as low as 0.001 - 0.005 particles/cm<sup>3</sup> between 80 to 120 AU, before rapidly increasing near the heliopause to 0.05 - 0.2 particles/cm<sup>3</sup>.

#### 2) Latitude Distribution

Near the solar equator: The solar wind is denser and slower, known as the “slow solar wind,” with speeds of 300 - 500 km/s.

At higher latitudes (near the Sun’s poles): The solar wind is faster and less dense, referred to as the “fast solar wind,” with speeds ranging from 700 - 800 km/s.

This distribution of solar wind plasma exhibits cylindrical symmetry relative to the plane of the ecliptic. The interaction of photons from MBR with this plasma may account for some of the anomalies associated with the “Axis of Evil.”

## 5. Primary Notions of Classical Physics.

**Principle of Relativity** is the requirement that the equations describing the laws of physics have the same form in all admissible frames of reference.

In **WUM**, this Principle is valid because the Medium of the World is an absolute frame of reference. We can use the well-known equations considering time-varying physical parameters.

**Universality of Physical Laws** is the notion that the spatial distribution of matter in the universe is homogeneous and isotropic when viewed on a large enough scale.

In **WUM**, this Principle is valid at the cosmological times  $\tau \geq \tau_M \cong 10^{-18} s$ , because Physical Laws are determined by the Medium of the World, which is Homogeneous and Isotropic.

**Conservation Law** states that a particular measurable property of an isolated physical system does not change as the system evolves over time. **Exact Conservation Laws** include conservation of mass and energy, linear and angular momentum, and electric charge. Angular Momentum is a problem of all existent cosmological models including Big Bang Model that should be solved.

In **WUM**, Conservation Laws are not Exact Conservation Laws because the World is not an isolated physical system and is continuously getting UCM from the Universe.

**The proposed new Primary Notions represent a transformative change in Classical Physics.**

## 6. Conclusion

We demonstrate that WUM is a natural extension of Classical Physics and has the potential to catalyze a change in basic assumptions in both Cosmology and Classical Physics. It does not attempt to explain all available cosmological data, as that is an impossible feat for any one article. Nor does WUM pretend to have built an all-encompassing theory that can be accepted as is. The Model needs significant further elaboration by the entire physical community, but in its present shape, it can already serve as a basis for a New Cosmology proposed by Paul Dirac in 1937. Considering JWST’s discoveries, successes of WUM, and 87 years of Dirac’s proposals, it is high time to initiate a fundamental transformation in Astronomy, Cosmology, and Classical Physics.

**A Transformative New Cosmology Invites Recognition.**

## Acknowledgements

I am deeply grateful to Academician A. Prokhorov and Prof. A. Manenkov for their decisive influence on my scientific journey. My eternal gratitude goes to my Scientific Father, P. Dirac, whose genius foresaw the future of Physics in a new Cosmology. I am also profoundly thankful to N. Tesla, another extraordinary genius. I extend my sincere thanks to Prof. C. Corda for publishing my manuscripts in the Journal of High Energy Physics, Gravitation and Cosmology. I appreciate R. Kuhn, N. Percival, and H. Ricker for their valuable comments and suggestions, which have significantly improved my publications. Special thanks to my son, I. Netchitailo, for helping me clarify the Model and enhance its understanding.