Development of Hypersphere World-Universe Model. Narrative. Part X. Paradigm Shift in Astronomy, Cosmology, Classical Physics

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Abstract

Four Spatial Dimension World-Universe Cosmology presents a fresh approach to understanding the Observable World and the science of Cosmology. It builds on the foundations of Classical Physics and has the potential to challenge core assumptions in both Cosmology and Classical Physics. Rather than claiming to explain all existing cosmological data or presenting a fully developed theory, WUC serves as a starting point for a New Cosmology envisioned by Paul Dirac in 1937. While further refinement by the global physics community is essential, World-Universe Cosmology's insights, combined with the groundbreaking discoveries of the JWST and the legacy of Dirac's ideas over 87 years, underscore the need for a Paradigm Shift in Astronomy, Cosmology, and Classical Physics.

JWST Discoveries and Hypersphere World-Universe Model:
Paradigm Shift in Astronomy, Cosmology, and Classical Physics

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Abstract

Twenty-six years ago, a small committee report built upon earlier studies to articulate a compelling and poetic vision for the future of astronomy. This vision called for an infrared-optimized space telescope with an aperture of at least four meters. With the support of their governments in the US, Europe, and Canada, 20,000 people brought this vision to life as the 6.5-meter James Webb Space Telescope (JWST). The telescope is working perfectly, delivering much better image quality than expected [1].

JWST is one hundred times more powerful than the Hubble Space Telescope and has already captured spectacular images of the distant universe. A view of a tiny part of the sky reveals many well-formed spiral galaxies, some over thirteen billion light-years away. These observations challenge the standard Big Bang Model (BBM), which posits that early galaxies should be small and lack well-formed spiral structures. JWST's findings are prompting scientists to reconsider the BBM in its current form. Throughout the history of science, technological advancements have led to new results that challenge established theories, sometimes necessitating their modification or even abandonment. This happened with the geocentric model four centuries ago, and the BBM may face a similar reevaluation as JWST provides more images of the distant universe.

In 1937, P. Dirac proposed the Large Number Hypothesis and the Hypothesis of Variable Gravitational Constant, later incorporating the concept of Continuous Creation of Matter in the universe. The Hypersphere World-Universe Model (WUM) builds on these ideas, introducing a distinct mechanism for matter creation. WUM is proposed as an alternative to the prevailing BBM. Its main advantage is the elimination of the "Initial Singularity" and "Inflation," offering explanations for many unresolved problems in Cosmology. WUM is presented as a natural extension of Classical Physics with the potential to catalyze a paradigm shift in both Cosmology and Classical Physics. Considering JWST's discoveries, WUM's successes, and 87 years of Dirac's proposals, it is high time to initiate a paradigm shift in Astronomy, Cosmology, and Classical Physics.

The present paper is a continuation of the published article "JWST Discoveries—Confirmation of World-Universe Model Predictions" [2] and a summary of the paper "Hypersphere World-Universe Model: Digest of Presentations John Chappell Natural Philosophy Society" [3]. Many results obtained there are quoted in the current work without full justification; interested readers are encouraged to view the referenced papers for detailed explanations

1. WUM vs BBM

It is well-known that any theory is based on certain hypotheses. WUM and BBM are fundamentally different models with fundamentally different hypotheses [3]:

Initial Conditions:

- **BBM:** Proposes an initial singularity with infinite energy density and extremely rapid expansion of spacetime (inflation). There is no center of expansion in the 3D universe.

- **WUM:** Suggests a fluctuation that created a 4D Nucleus of the World with an extrapolated radius equal to the basic size unit a. This Nucleus had a finite extrapolated energy density (about 10^4 times less than nuclear density) and expanded in the fourth spatial dimension at the speed c (a gravitodynamic constant), resulting in the even stretching of the World.

Structure of the World:

- **BBM:** Assumes an almost infinite homogeneous and isotropic universe around the initial singularity.
- **WUM:** Describes a 3D finite boundless World (a Hypersphere of the 4D Nucleus) as a Patchwork Quilt of various main luminous superclusters ($\gtrsim 10^3$), which emerged in different regions of the World at different cosmological times.

Medium of the Universe:

- **BBM:** Often implies a vacuum state in the early universe.
- **WUM:** Proposes that the World's Medium consists of protons, electrons, photons, neutrinos, and Universe-Created Particles (UCPs), previously referred to as "Dark Matter Particles." The Medium is homogeneous and isotropic, while the distribution of Macroobjects (MOs) is spatially inhomogeneous, anisotropic, and temporally non-simultaneous. The rejection of the luminiferous aether in 1905 was a significant moment for Classical Physics; however, the Medium proposed by WUM could be considered a revival of this concept, acting as a savior for Classical Physics.

Conservation Laws:

- **BBM:** Does not explicitly emphasize the creation and conservation of angular momentum in its foundational principles.
- **WUM:** Stands out as the only cosmological model that provides a mechanism for angular momentum creation and is consistent with the fundamental law of its conservation.

Macroobject Formation:

- **BBM:** MOs form from the bottom (extrasolar systems) up to galaxies and superclusters.
- **WUM:** MOs form from the top (superclusters) down to galaxies and extrasolar systems (ESS) due to an Explosive Rotational Fission of Superclusters' Overspinning Cores (made up of UCPs), which were created by the Universe during the Dark (invisible) Epoch for 0.45 Byr. The formation of galaxies and ESS is not a process that concluded ages ago; instead, it is ongoing.

In conclusion, WUM presents a radically different approach to understanding the World compared to BBM, challenging long-held assumptions, and offering new perspectives on the fundamental nature of Cosmology and Classical Physics. The hypotheses of BBM are mathematical, while those of WUM are more physical in nature. Both models may seem incredible, but there is a key difference: BBM fails to explain many of the experimental results observed by contemporary Astronomy, such as those from the JWST, whereas WUM does. The validity of hypotheses can only be confirmed through experimental results. As R. Feynman famously said, "*It doesn't make any difference how beautiful your guess is, it doesn't make any difference how smart you are, who made the guess, or what his name is. If it disagrees with experiment, it is wrong. That's all there is to it*."

2. JWST Discoveries

2.1. Early Experimental Findings (2022) [2]

The problem of ancient galaxies formation is a long-standing problem. The age of the Universe is $13.77 \pm 0.06\ Byr$, based on the cosmic microwave background data. Astronomers believe that our own Milky Way

(MW) galaxy is approximately 13.6 *Byr* old. MW is one of the two largest spiral galaxies in the Local Group (the other being the Andromeda Galaxy). Massive mature disk galaxies like MW cannot form so soon.

Distances to remote objects, other than those in nearby galaxies, are always inferred by measuring the cosmological redshift of their light. An important distinction is whether the distance is determined via spectroscopy or using a photometric redshift technique. The spectroscopic redshift is conventionally regarded as being necessary for an object's distance to be considered definitely known, whereas photometrically determined redshifts identify "candidate" distant sources. For comparisons with the light travel distance of the astronomical objects listed below, the age of the universe since the Big Bang (BB) is currently estimated as 13.787 ± 0.020 Byr.

In our article (2022) "JWST Discoveries – Confirmation of World-Universe Model Predictions" [2], we discussed Galaxies with $z > 10$ (see **Table 1** and **Table 2**, adapted from Wikipedia).

Table 1. Most distant galaxies with spectroscopic redshift determinations

Name	Redshift	Light travel distance, Bly
HD1	$z = 13.27$	13.579; 13.599; 13.477; 13.476
JADES-GS-z13-0	$z = 13.20^{+0.24}_{-0.07}$	13.576; 13.596; 13.474; 13.473
JADES-GS-z12-0	$z = 12.63^{+0.24}_{-0.08}$	13.556; 13.576; 13.454; 13.453
GLASS-z12	$z = 12.117^{+0.01}_{-0.01}$	13.536; 13.556; 13.434; 13.433
JADES-GS-z11-0	$z = 11.58^{+0.05}_{-0.05}$	13.512; 13.532; 13.410; 13.409
GN-z11	$z = 10.957^{+0.001}_{-0.001}$	13.481; 13.501; 13.380; 13.379
UDFj-39546284	$z = 10.38^{+0.07}_{-0.06}$	13.449; 13.469; 13.348; 13.347

Table 2. Notable candidates for most distant galaxies

Name	Redshift	Light travel distance, Bly
F200DB-045	$z = 20.4^{+0.3}_{-0.3}$	13.725; 13.745; 13.623; 13.621
CEERS-93316	$z = 16.39^{+0.32}_{-0.22}$	13.661; 13.681; 13.559; 13.558
F200DB-175	$z = 16.2^{+0.3}_{-0.0}$	13.657; 13.677; 13.555; 13.554
S5-z17-1	$z = 16.0089^{+0.0004}_{-0.0004}$	13.653; 13.673; 13.551; 13.550
F150DB-041	$z = 16.0^{+0.2}_{-0.2}$	13.653; 13.673; 13.551; 13.549
SMACS-z16a	$z = 15.92^{+0.17}_{-0.12}$	13.651; 13.671; 13.549; 13.548
F200DB-015	$z = 15.8^{+3.4}_{-0.1}$	13.648; 13.668; 13.546; 13.545

The presented experimental results show that:

- HD1 is one of the earliest and most distant known galaxies yet identified in the observable universe. HD1's unusually high brightness has been an open question for its discoverers; it has a significantly more luminous ultraviolet emission than similar galaxies at its redshift range [Pacucci, F., *et al.* (2022)].

- F200DB-045 is a candidate high-redshift galaxy, with an estimated redshift of z = 20.4. If confirmed, it would be one of the earliest and most distant known galaxies observed. F200DB-045 would have a light-travel distance (lookback time) of $> 13.7\ Byr$.

Detailed analysis of observations of the first batch of z ≈ 11–20 Candidate Objects revealed by JWST is done by H. Yan, *et al.* (2022). The summary of the JWST discoveries in the Early World is:

- The most secure oldest galaxy is GLASS-z13 ($z \approx 13$, light-travel distance of 13.4572 Byr) that has already built up $\sim 10^9\ M_\odot$ in stars.
- The search of eighty-eight candidate galaxies at $z > 11$ shows that some of them could be at redshifts as high as twenty. Some of those distant galaxies are strikingly massive**.**
- Most of the early galaxies are nicely shaped, disklike galaxies.
- A new redshift record obtained for galaxy candidate CEERS-93316 at $z = 16.7$ (light-travel distance of 13.5512 Byr) with a stellar mass about $\sim 10^9\ M_\odot$;
- Seven galaxies with $M^* > 10^{10}\ M_\odot$ and 7<z<11 were found in the survey area, including two galaxies with $M^* \sim 10^{11}\ M_\odot$. The stellar mass density in massive galaxies is much higher than anticipated from previous studies: a factor of more than three orders of magnitude at z∼10.
- Extremely Compact Bright Galaxies were found at z∼12−17.
- Super-early, massive, evolved galaxies with blue spectra, and exceedingly small dust attenuation.

2.2. Recent Experimental Findings (2023-2024)

JWST has made several intriguing and unexpected observations that challenge our current understanding of the universe. Here are some of the most interesting:

- C. Ilie, J. Paulin, and K. Freese (2023) in the article "Supermassive Dark Star candidates seen by JWST?" [4] wrote: "*The first generation of stars in the Universe is yet to be observed. There are two leading theories for those objects that mark the beginning of the cosmic dawn: hydrogen burning Population III stars and Dark Stars, made of hydrogen and helium but powered by Dark Matter heating. We show that each of the following three objects: JADES-GS-z13-0 , JADES-GS-z12-0 , and JADES-GS-z11-0 (at redshifts z ∈ [11, 14]) are consistent with a Supermassive Dark Star interpretation, thus identifying, for the first time, Dark Star candidates"* .
- *A new all-time record! JWST's discovery of JADES-GS-z14-0 pushes the earliest galaxy ever seen to just 290 million years after the Big Bang. This new record-holder is remarkably, unexpectedly bright. Five times brighter than the prior (JADES-GS-z13-0) record-holder, JADES-GS-z14-0 is even shockingly visible to MIRI's eyes. But this galaxy is extremely dust-poor. The lack of dust inside JADES-GS-z14-0 presents a novel puzzle* [5].
- **Abundance and Brightness of Early Galaxies**: Contrary to predictions, JWST has found that early galaxies, forming just a few hundred million years after BB, are more numerous and brighter than expected. This discovery implies that star formation in the early universe may have been more efficient or occurred in intense bursts. These findings challenge existing models of galaxy formation and evolution [6], [7].
- **Discovery of the Earliest and Most Distant Galaxies**: JWST has identified galaxies dating back three hundred Myr after BB. These galaxies, such as JADES-GS-z14-0 and JADES-GS-z14-1, are significantly more massive and luminous than anticipated, suggesting that large galaxies formed rapidly in the early universe [8].
- **Early Supermassive Black Holes**: Observations of galaxies like GN-z11 have revealed the presence of supermassive black holes much earlier in cosmic history than previously thought. These black holes are

actively accreting matter, contributing to the high luminosity of these early galaxies. This discovery is puzzling as it indicates rapid black hole growth soon after the universe's formation [9].

These unexpected observations by JWST are prompting astrophysicists to revisit and revise their models of the early universe, galaxy formation, and black hole growth [6]-[9].

JWST has spectroscopically confirmed numerous galaxies at z>10. J. M. Helton, *et al.* report photometric detection of the most distant spectroscopically confirmed galaxy JADES-GS-z14-0 at $z = 14.32^{+0.08}_{-0.2}$ .The most plausible solution for the stellar population properties is that this galaxy contains half a billion solar masses in stars with a strong burst of star formation in the most recent few million years. The inferred properties of JADES-GS-z14-0 suggest rapid mass assembly and metal enrichment during the earliest phases of galaxy formation [10].

F. D'Eugenio, *et al*. present the third data release of JADES. They measured 2,375 redshifts: their targets span the range from z=0.5 to z=13, including 404 at z>5. Together, these data provide the largest statistical sample to date to characterize the properties of galaxy populations in the first billion years after BB[11].

A. J. Bunker, *et al*. describe the NIRSpec component of JADES, and provide deep spectroscopy of 253 sources. Their low-dispersion and medium-dispersion spectra cover the wavelength range 0.6−5.3μm. They measure spectroscopic redshifts for 178 of the objects targeted extending up to z=13.2. Combined with the first JADES NIRCam data release, these public JADES spectroscopic and imaging datasets provide a new foundation for **discoveries of the infrared universe** by the worldwide scientific community [12].

M. Xiao, *et al*. present the first sample of 36 dust-obscured galaxies with robust spectroscopic redshifts at z=5−9 from the JWST FRESCO survey. The three most extreme sources at z∼5−6 are so massive that they would require, on average, about 50% of the baryons in their halos to be converted into stars. This population of ultra-massive galaxies accounts for 20% of the total cosmic star formation rate density at z∼5−6, suggesting a substantial proportion of extremely efficient star formation in the early Universe [13].

A substantial number of ultra-high redshift ($8 < z < 17$) galaxy candidates have been detected with JWST, posing the question: are these observational results surprising in the context of current galaxy formation models? Aaron Yung, L. Y., *et al*. address this question using their fiducial models. They present predictions for stellar mass functions, rest-frame UV luminosity functions, and various scaling relations and find that their (dust-free) models predict galaxy number densities at z∼11 (z∼13) that are a factor of ∼30 lower than the observational estimates [14].

With stunning clarity, JWST has revealed the Universe's first billion years. The scientific community is analyzing a wealth of JWST imaging and spectroscopic data from that era and is in the process of rewriting the astronomy textbooks. Here, 1.5 years into the JWST science mission, A. Adamo, *et al*. provide a snapshot of the great progress made towards understanding the initial chapters of our cosmic history. They highlight discoveries and breakthroughs, topics and issues that are not yet understood, and questions that will be addressed in the coming years, as JWST continues its revolutionary observations of the Early Universe [15].

Enceladus is a prime target in a search for life in our Solar System (SS), having an active plume connected to a **large liquid water subsurface ocean**. Using JWST, Villanueva, G. L., *et al.* searched for organic compounds and characterized the plume's composition and structure. The observations directly sample the fluorescence emissions of H_2O and reveal an extraordinarily extensive plume (up to 10,000 km or 40 Enceladus radii) at cryogenic temperatures (25 K) embedded in a large bath of emission originating from Enceladus' torus. Intriguingly, the observed outgassing rate (300 kg/s) is similar to that derived from close-up observations with Cassini 15 years ago, and the torus density is consistent with previous spatially unresolved

measurements with Herschel 13 years ago, suggesting that the vigor of gas eruption from Enceladus has been stable over decadal timescales [16].

These observations are just the beginning, and as JWST continues its mission, it is likely to uncover even more surprising and unexplained phenomena. The data it provides will help refine existing models and theories, leading to a deeper understanding of the universe.

3. Hypersphere World-Universe Model

3.1. Assumptions

WUM is based on the following primary assumptions:

- World is a Finite Boundless 3D Hypersphere of a 4D Nucleus of the World which is expanding along the fourth spatial dimension of the Nucleus with speed equals to the gravitodynamic constant c. The 3D World is curved in the fourth spatial dimension.
- Eternal Universe is a Creator of Universe-Created (UC) Matter (UCM), which is continuously created in the Nucleus of the World. 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 $\alpha = (2aR_\infty)^{1/3}$ (where R_∞ is a Rydberg constant and $a = 1.7705641 \times 10^{-14}\ m$ is a basic size unit) and dimensionless time-varying quantity Q that is, in fact, the Dirac's Large Number. α now named the Fine-structure constant.

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. The extrapolated energy density of the World at the Beginning ($Q = 1$) was four orders of magnitude smaller than the nuclear energy density. The World is a Finite Boundless 3D Hypersphere that is the surface of the 4D Nucleus. 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 fourth spatial dimension so that the radius of the Nucleus R is increasing with speed c. Its surface, the 3D Hypersphere, is evenly stretched. The stretching of the Hypersphere World can be understood through the analogy with expanding 3D balloon: imagine an ant residing on a two-dimensional surface of a balloon. As the balloon is blown up, its radius increases, and its surface grows. The distance between any two points on the surface increases. The ant sees her world expand but does not observe a preferred center. Unbeknown to ants, the center is not located on the surface, but instead, is removed along the inaccessible third dimension. It is in the center of the balloon. What does the balloon expand into? It expands in perpendicular "down/up" direction that is inaccessible to perception, and therefore from the surface of the balloon. One cannot point out the direction of the expansion.

  Likewise, 3D Hypersphere World expands along the imperceptible fourth dimension. The Center of the World is in the center of 4D Nucleus, in that very inaccessible fourth dimension. We do not know that our 3D space is curved. But we know that it is stretching without center of stretching. According to WUM, all parameters of the World depending on Q, which is a ratio of radius R to a: $Q = R/a$ are a manifestation of the Worlds' curvature in the fourth spatial dimension.

- **Creation of Matter.** The surface of 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 is responsible for the creation of UCM in 4D Nucleus of the World. UCPs carry new UCM into the World. Ordinary Matter is a byproduct of UCPs self-annihilation. By analogy with 3D ball, which has a 2D spherical surface (that has surface energy), we can imagine that 3D Hypersphere World has a "Surface Energy" of 4D Nucleus. The growth of the surface of 4D Nucleus means the increase of the World's so named "Surface Energy".
  The proposed 4D process is responsible for 4D Nucleus Expansion, 3D World Stretching, Creation of Matter, and Arrow of Time. It constitutes the **Main Hypothesis of WUM**. In my view, the arrow of the Cosmological Time does not depend on any physical phenomenon in the Medium of the World. It is the result of the Nucleus expansion due to the driving force for surfaces to be created.
  It is important to emphasize that Creation of Matter is a direct consequence of Nucleus expansion. Creation of UCM occurs homogeneously in all points of the Hypersphere World.
- **Content of the World.** The World consists of 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 (Superclusters, Galaxies, ESS, *etc.*) – 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.
- **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 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 MW) when only UCM Macroobjects existed.
- **Luminous Epoch** has lasted ever since 13.77 Byr when Luminous MOs emerged due to random **Explosive Volcanic Rotational Fission** of Overspinning UCM Supercluster's Cores, which looks like a Firework of UCM cores of satellite objects at the same time, so that the direction of the sum of satellites angular momentum coincides with the angular momentum of the Prime Object. There are no preferences of directions of satellites rotations at any level (supercluster, galaxy, solar system) 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 the principal objects of the World. MOs (Superclusters, Galaxies, and ESS) form in parallel around different Cores made up of different UCPs. 3D Finite Boundless

World presents a Patchwork Quilt of different main Luminous Superclusters ($\gtrsim 10^3$), which emerged in various places of the World at different Cosmological times. The distribution of MOs in the World is spatially inhomogeneous and anisotropic and temporally non-simultaneous. Macrostructures of the World form from the top (superclusters) down to galaxies, ESS, planets, and moons.

- **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.

3.3. 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 are Shapley, Coma, and Perseus-Pisces. Distance from the Earth to the Centre of LS is $\sim 250\ Mly$ (see **Figure 1** and **Figure 2**).

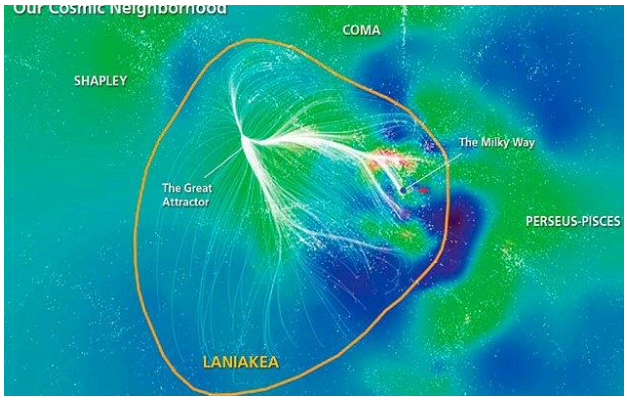

Figure 1. Laniakea Supercluster. Adapted from the article by Tully, R. B., *et al.* (2014)

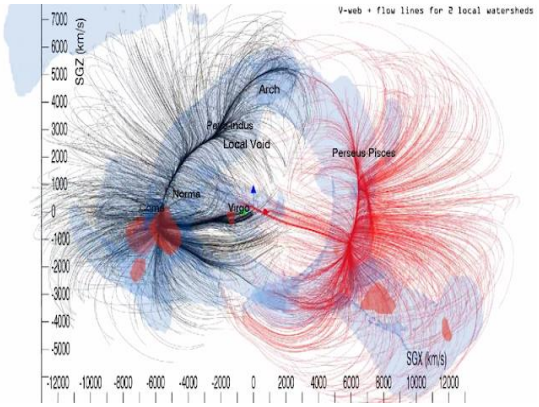

Figure 2. A representation of structure and flows due to mass within 6,000 km s−1 (~80 Mpc).

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 $\sim 400\ km\ s^{-1}$, which far exceeds rotational **Angular Momentum** of MW.

4) Mass-to-light ratio of the Virgo Supercluster is ~ 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 about 13.5 Bly away, and a candidate galaxy F200DB-045 that is 13.7 Bly away.

Medium of the World, UC Matter, and Angular Momentum are the main **Three Pillars** of WUM. To the best of our knowledge, WUM is the only one cosmological model in existence that is consistent with the **Law of Conservation of Angular Momentum**. The described picture of World is, in fact, a Paradigm Shift in Cosmology.

3.4. Medium of the World

WUM introduces the Medium of the World, which consists of stable elementary particles with lifetimes longer than the age of the World: protons, electrons, photons, neutrinos, and UCPs. The Medium is Homogeneous and Isotropic. The **existence of the Medium is a principal point of WUM**. There is no

Luminiferous Aether, Perfect fluid, and Vacuum in WUM. Inter-galactic voids discussed by astronomers are, in fact, examples of the Medium in its purest. MBR is part of the Medium; it then follows that the **Medium is the absolute frame of reference**. Relative to MBR rest frame the MW galaxy and the Sun are moving with the speed of 552 and 370 $km\ s^{-1}$, respectively.

Time, Space and Gravitation are connected with 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*. There is no Medium - there is Nothing!

WUM based on Cosmological time τ that marches on at the constant pace from the Beginning of the World up to the present Epoch along with time-varying Cosmological parameters. Gravity is not an interaction but a manifestation of the Medium.

3.5. Universe-Created Matter

In my previous articles, I followed the standard paradigm "**Dark Matter**" that is not 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 – Universe-Created (UC) Particles of a new kind of "**Universe- Created Matter**" (UCM). In 2024, I introduced a new term – UC Particles (UCPs), which have following characteristics: **UC Fermions (UCF)** or **Bosons**, **Rest Energies** (see **Table 3**), **Weak Interaction**, and **Self-annihilation**, like Majorana fermions**.** Ordinary particles are a byproduct of UCPs self-annihilation. It is easy to switch from Dark (**D**) Matter to Universe-Created (**UC**) Matter.

Table 3. Universe-Created Particles**.**

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

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

$$E_0 = hc/a = 70.025252\ MeV$$

where h is the Planck constant and c is a Gravitodynamic constant

These particles are "dark" , **optically invisible**, when astronomers observe the World with telescopes only. The contemporary Astronomy allows us to observe the World in wavelengths from radio waves up to gamma rays! Then, they are not "dark" at all. The first known binary system was Cygnus X-1(1971) that is typically the brightest persistent source of **hard X-rays with energies up to sixty 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 **eight 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 3**).

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 $\mu = e/2\alpha$ (e is elementary charge and α is dimensionless Rydberg constant); 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 μeV).

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 μeV 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.

3.6. Gravity

Le Sage's Theory of Gravitation is a kinetic theory of gravity originally proposed by Fatio in 1690 and later by Le Sage in 1748. The theory proposed mechanical explanation for Newton 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 ultra-mundane 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 ultramundane flux is isotropic, and laws of its propagation are similar to that of light.
- He suggested that the ultra-mundane corpuscles might move at the speed of light.
- To maintain mass proportionality, ordinary matter consists of cage-like structures, in which their diameter is only the 10^7th part of their mutual distance, so the particles can travel through them unhindered. In order to achieve exact mass proportionality as in Newton's theory, the ultra-mundane flux must be infinitely intense.

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

In **WUM**, the time-varying Gravitational parameter $G \propto \tau^{-1}$ is proportional to the energy density of the Medium $\rho_M \propto \tau^{-1}$. It is not a constant. That is why WUM aligns Gravity with Le Sage's theory of gravitation. WUM gives for Le Sage's theory the following parameters:

- XIONs (5.3 μeV) are ultra-relativistic UCPs (ultramundane corpuscles), which created by the Universe.
- Proposed Weak interaction between XIONs and Matter provides mass proportionality. Energy density of XIONs in the World is about 64% of the total energy density and provides high intensity of their flux.
- Gravitational mass m_g is a classical notion that defines Gravity – the emergent phenomenon. We emphasize that an inertial mass m_i that is a coefficient of proportionality between a force F and an acceleration a: $F = m_i a$, has nothing to do with m_g.

Albert Einstein developed his General theory of Relativity starting with the **assumption** that the inertial and passive gravitational masses are the same. This is known as the equivalence principle.

In WUM, **Gravity is not an interaction but a manifestation of the Medium.**

3.7. Principal Role of Maxwell's Equations

Maxwell's Equations form the foundation of Classical Electrodynamics and Gravitomagnetism. The value of Maxwell's Equations is even greater because J. Swain showed that *linearized general relativity admits a formulation in terms of gravitoelectric and gravitomagnetic fields that closely parallels the description of the electromagnetic field by Maxwell's equations.* We emphasize that **Gravitomagnetism considers not only interactions between masses but also between mass currents**.

G. Ludwig in a paper "Galactic rotation curve and dark matter according to gravitomagnetism" [17] wrote: *Most theories used to explain the rotation curve have been restricted to the Newtonian potential framework, disregarding the general relativistic corrections associated with mass currents.* ***The effects attributed to dark matter can be simply explained by the gravitomagnetic field produced by the mass currents.***

The explanation of galactic rotation curves made by G. Ludwig is in good agreement with WUM.

3.8. Inter-Connectivity of Primary Cosmological Parameters

The constancy of universe fundamental constants, including G, is now commonly accepted, although has never been firmly established as a fact. A commonly held opinion states that gravity has no established relation to other fundamental forces, so it does not appear possible to calculate it from other constants that can be measured more accurately, as is done in other areas of physics.

WUM holds that there indeed exist relations between all Cosmological parameters that depend on dimensionless time-varying quantity Q that is a measure of the Size R and Age A_τ of the World according to the equation:

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

where t_0 is a basic time unit: $t_0 = a/c$. Q in the present epoch equals to: $Q = 0.759972 \times 10^{40}$.

According to WUM, the following parameters of the World depend on Q :

- Newtonian parameter of gravitation G : $G = \frac{a^2 c^4}{8\pi hc} \times Q^{-1}$
- Hubble's parameter H : $H = \frac{c}{a} \times Q^{-1}$
- Age of the World A_τ : $A_\tau = \frac{a}{c} \times Q$
- The Worlds' Radius of curvature R : $R = a \times Q$
- Critical energy density ρ_{cr} : $\rho_{cr} = 3\frac{hc}{a^4} \times Q^{-1}$
- Concentration of Intergalactic plasma n_{IGP} : $n_{IGP} = \frac{2\pi^2}{a^3}\frac{m_e}{m_p} \times Q^{-1}$
- Minimum energy of photons E_{ph} : $E_{ph} = (\frac{m_e}{m_p})^{1/2} E_0 \times Q^{-1/2}$
- Temperature of MBR T_{MBR} : $T_{MBR} = \frac{E_0}{k_B}(\frac{15\alpha}{2\pi^3}\frac{m_e}{m_p})^{1/4} \times Q^{-1/4}$
- Temperature of Far-Infrared Background Radiation peak T_{FIRB} :

$$T_{FIRB} = \frac{E_0}{k_B}(\frac{15}{4\pi^5})^{1/4} \times Q^{-1/4}$$

In frames of WUM, all these Cosmological parameters are a manifestation of the Worlds' curvature in the fourth spatial dimension. They can be calculated based on experimentally measured value of G_{av} and Q_{av} (see Section 3.10).

3.9. Directly Measured Cosmological Parameters

There are only two directly measured Cosmological parameters: the Gravitational parameter G and the Temperature of the Cosmic MBR T_{MBR}. In 2018, Q. Li, *et al*. experimentally measured the most accurate values of G using two independent methods:

$$G(1) = 6.674184 \times 10^{-11} m^3 kg^{-1} s^{-2}\ (11.64\ ppm)$$
$$G(2) = 6.674484 \times 10^{-11} m^3 kg^{-1} s^{-2}\ (11.61\ ppm)$$

which are in excellent agreement with the value of $G = 6.67420 \times 10^{-11} m^3 kg^{-1} s^{-2}$ predicted by WUM in 2013. In 2009, D. J. Fixsen measured the value of MBR temperature T_{MBR}:

$$T_{MBR} = 2.725181\ K\ (30\ ppm)$$

It means that the most accurate parameter is G, and all other Cosmological parameters could be, in principle, calculated based on the value of G with the same accuracy.

Thanks to the revealed by WUM Inter-Connectivity of Cosmological parameters, we show that G that can be measured directly makes measurable all Cosmological parameters, which cannot be measured directly.

3.10. Gravitational Parameter G and Dirac Large Number Q

Considering equations in Section 3.8, we have the following equation for G:

$$G = \frac{a^2 c^4}{8\pi hc} \times Q^{-1}$$

An average value of Gravitational parameter G_{av} of experimentally measured values by Q. Li, *et al*.

$$G_{av} = \frac{G(1) + G(2)}{2} = 6.674334 \times 10^{-11} m^3 kg^{-1} s^{-2}$$

allows us to calculate the value of Q_{av} based on the value of G_{av}:

$$Q_{av} = \frac{a^2 c^4}{8\pi hc} \times G_{av}^{-1} = 0.759944 \times 10^{40}$$

Below, we will use this value of Q_{av} for the calculation of all Cosmological parameters.

3.11. Intergalactic Plasma

In WUM, the World consists of stable elementary particles. Protons with mass m_p and electrons with mass m_e have identical concentrations: $n_p = n_e$. According to Plasma Physics, Intergalactic plasma consisting of protons and electrons has plasma frequency ω_{pl}:

$$\omega_{pl}^2 = \frac{4\pi n_e e^2}{4\pi\varepsilon_0 m_e} = 2 n_e a c^2$$

We substitute the following equation $\omega_{pl}^2 = \frac{m_e}{m_p}(2\pi\nu_0 \times Q^{-1/2})^2$ into this equation (where ν_0 is a basic frequency unit $\nu_0 = c/a$) and calculate concentrations n_p and n_e:

$$n_p = n_e = \frac{2\pi^2}{a^3}\frac{m_e}{m_p} \times Q^{-1} = 0.255\ m^{-3}$$

$\rho_p = n_p E_p$ is the energy density of protons in the Medium. The relative energy density of protons in the Medium Ω_p is then the ratio of ρ_p/ρ_{cr}, which equals to:

$$\Omega_p = 2\pi^2\alpha/3 = 4.8\%$$

According to WUM, the relative energy density of baryons in Macroobjects Ω_{MO} is:

$$\Omega_{MO} = 0.5\,\Omega_p = \pi^2\alpha/3 = 2.4\%$$

Measurements of Intergalactic plasma parameters can be done by investigations of Fast Radio Bursts, which are millisecond duration radio signals originating from distant galaxies. These signals are dispersed according to precise physical law and this dispersion is a key observable quantity that in tandem with a redshift measurement, can be used for physical investigations.

The dispersion measure and redshift, conducted by E. F. Keane, *et al.* in 2016, provide the measurement of the cosmic density of ionized baryons in the intergalactic medium Ω_{IGM} that equals to:

$$\Omega_{IGM} = 4.9 \pm 1.3\%$$

that is in excellent agreement with the predicted WUM in 2013 value of $\Omega_p = 4.8\%$. Using the equation for electrons' concentration n_e, we calculated the value of photons' time delay:

$$\Delta t_{ph}^{cal} = 2.189 \times (\frac{\nu}{1GHz})^{-2}$$

which is in good agreement with experimentally measured value by E. F. Keane, *et al.*, :

$$\Delta t_{ph}^{exp} = 2.438 \times (\frac{\nu}{1GHz})^{-2}$$

3.12. Minimum Energy of Photons

Analysis of Intergalactic plasma shows that the value of the lowest plasma frequency ν_{min} is :

$$\nu_{min} = \nu_0(\frac{m_e}{m_p})^{1/2} \times Q^{-1/2} = 4.53228\ Hz$$

Photons with energy smaller than $E_{ph} = h\nu_{min}$ cannot propagate in plasma. Thus $h\nu_{min}$ is the smallest amount of energy a photon may possess, which equals to the value:

$$E_{ph} = (\frac{m_e}{m_p})^{1/2} E_0 \times Q^{-1/2} = 1.87433 \times 10^{-14}\ eV$$

This value, predicted by WUM in 2013, is in good agreement with a value obtained by L. Bonetti, *et al.* in 2017:

$$E_{ph} \lesssim 2.2 \times 10^{-14}\ eV$$

3.13. Origin of Cosmic Microwave Background Radiation (MBR)

According to BBM, the photons that existed at the time of photon decoupling (380,000 years after BB) have been propagating ever since, though growing fainter and less energetic, since the expansion of space causes their wavelength to increase over time. These photons are the same photons that we see in MBR now. But then, why is MBR perfect black-body? What is the mechanism of photons wavelength increasing over time and growing fainter and less energetic?

According to WUM, wavelength is a classical notion. Photons, which are quantum objects, have only four-momenta. They do not have wavelengths. By definition, *Black-body radiation is the thermal electromagnetic radiation within or surrounding a body in thermodynamic equilibrium with its environment*. In WUM, the black-body spectrum of MBR is due to thermodynamic equilibrium of photons with Intergalactic plasma, the existence of which is experimentally proved by Fast Radio Bursts. It explains why MBR is a perfect black-body radiation.

$\rho_e = n_e E_e$ is the energy density of electrons in the Medium. We assume that the energy density of MBR ρ_{MBR} equals to twice the value of ρ_e (due to two polarizations of photons) and consider the Stefan–Boltzmann law:

$$\rho_{MBR} = 2\rho_e = 4\pi^2\alpha\frac{m_e}{m_p}\rho_0 \times Q^{-1} = \frac{8\pi^5}{15}\frac{k_B^4}{(hc)^3}T_{MBR}^4$$

where k_B is the Boltzmann constant. The calculated value of T_{MBR} is:

$$T_{MBR} = \frac{E_0}{k_B}\left(\frac{15\alpha}{2\pi^3}\frac{m_e}{m_p}\right)^{1/4} \times Q^{-1/4} = 2.725245\ K$$

which is in excellent agreement with experimentally measured value of $2.72548 \pm 0.00057\ K$ by D. J. Fixsen in 2009.

Let us proceed to calculate the value of T_{MBR} at different Ages of the World A_τ (see **Table 4**).

Table 4. The value of T_{MBR} at different Ages of the World.

Age	T_{MBR}
0.45 Byr (Beginning of Luminous Epoch)	6.47747 K
9.6 Byr (Birth of SS)	3.01403 K
14.22 Byr (Present Epoch)	2.725245 K

Observe that all Macroobjects – galaxies, stars, planets, moons – have arisen in the cold World. Our SS, for instance, was created when the temperature of MBR was about $3\ K$. Therefore, any Model describing creation of Macroobjects must hold true in the cold World conditions.

3.14. Far-Infrared Background Radiation

The cosmic Far-Infrared Background Radiation, which was announced in 1998, is part of the Cosmic Infrared Background with wavelengths near one hundred microns that is the peak power wavelength of the black-body radiation at temperature 29 K. We calculate the temperature of its peak T_{FIRB} :

$$T_{FIRB} = \left(15/4\pi^5\right)^{1/4} E_0/k_B \times Q^{-1/4} = 28.955\ K$$

that is in an excellent agreement with experimentally measured value of $29\ K$.

3.15. Hubble's Parameter and Age of the World

The most important parameters in Cosmology are the Hubble's parameter H_0 and Age of the World A_τ , which we can calculate by the following equations:

$$H_0 = \frac{8\pi hc}{a^3c^3} \times G_{av} = 68.73\ km\ s^{-1}Mpc^{-1}$$

$$A_\tau = \frac{1}{H_0} = \frac{a^3c^3}{8\pi hc} \times G_{av}^{-1} = 14.22\ Byr$$

We emphasize that the Hubble's parameter H_0 and absolute Age of the World A_τ are determined by the experimentally measured value of G_{av} !

3.16. Hubble Tension

The results of measurements of the Hubble's constant H_0 , which characterizes the expansion rate of the universe, shows that the values of H_0 vary significantly depending on Methodology. The disagreement in the values of H_0 obtained by the various teams far exceeds the standard uncertainties provided with the values. This discrepancy is called the **Hubble Tension**.

In frames of WUM, the Hubble tension can be explained in the following way:

- Hubble's law in Standard Cosmology is valid for BBM only when all galaxies start their movement from a single point named "Initial Singularity" that is not the case in WUM. The main conjecture of BBM: "*Projecting galaxy trajectories backwards in time means that they converge to the Initial Singularity at t=0 that is an infinite energy density state*" is wrong because all Galaxies are gravitationally bound with their Superclusters.
- In WUM, the 3D Finite Boundless World presents a Patchwork Quilt of different Luminous Superclusters, which emerged at various places and Cosmological times.

- The redshift of the Centre of the Laniakea Supercluster is 0.0708. But it does not mean that it is moving away from MW. On the contrary, MW is moving away from the Centre of Supercluster. Some galaxies are moving toward MW, and the others are moving away (see **Figure 1**). Then redshift depends on the position and movement of a particular galaxy in the Supercluster against MW.

The more complicated situation with redshift is when galaxies belong to neighboring superclusters (see **Figure 2**). No wonder that according to S. Gupta, over 8300 blue-shifted galaxies have been discovered beyond the Local Group in 2009. The Andromeda Galaxy is the nearest major galaxy to MW which is blue-shifted. How to explain all these results in standard cosmology?

According to WUM, the value of H should be measured based on MBR only. The calculated value of the Hubble's parameter in 2013: $H_0 = 68.73\ km\ s^{-1}Mpc^{-1}$ is in excellent agreement with the most recent measured value in 2021: $H_0 = 68.7 \pm 1.3\ km\ s^{-1}Mpc^{-1}$ using only MBR data.

4. WUM Explanation of JWST Discoveries

These latest observations by JWST of the World can be explained in frames of WUM only:

- **It is a question of time!** The Beginning of the World was 14.22 Byr ago! Dark Epoch, when only UCM Macroobjects existed, lasted for 0.45 Byr. Luminous Epoch has existed ever since 13.77 Byr.
- Early-galaxies formed in near present configuration as the result of transition from Dark Epoch to Luminous Epoch due to the Explosive Volcanic Rotational Fission of Overspinning UCM Supercluster's Cores and self-annihilation of UCPs. Ordinary Matter is a byproduct of UCPs self- annihilation. There are no protogalaxies in the World. That is why JWST did not see their images.
- Compact Disk Galaxies emerged as a result of the Rotational Fission of the overspinning UCM Core of Superclusters. Each of them have one UCM Core. There were no frequent mergers of galaxies in the early epoch.
- According to Standard Cosmology, massive mature disk galaxies with mass up to $M^* \sim 10^{11} M_\odot$ cannot form for the amount of time $(100 - 400)\ Myr$, because it takes billions of years to form them. So, they should not be there at all at the 'beginning.'
- I hope that oldest candidate galaxies with high-redshifts up to $z > 20.4$ (light-travel distance $> 13.7\ Byr$) will be confirmed. It depends on their spectroscopical confirmation.

I emphasize that now with JWST we are looking for the earliest and most distant galaxies, and at the same time, **we live in one of the earliest galaxies –Milky Way!**

Contrary to C. Ilie, J. Paulin, and K. Freese who consider JADES-GS-z13-0 , JADES-GS-z12-0 , and JADES-GS-z11-0 (at redshifts z ∈ [11, 14]) as Supermassive Dark Stars made of hydrogen and helium but powered by Dark Matter heating [4], we see them as Galaxies with UCM Cores, which are UCM Reactors providing heating of them. In WUM, there are no Black Holes, which were discussed by Roberto Maiolino, *et al.* [9].

In our view, the unique observations of galaxy JADES-GS-z14-0 :

- Lack of dust inside [5].
- Star formation in the early universe may have been more efficient or occurred in intense bursts [6], [7].
- Significantly more massive and luminous than anticipated [8].
- Rapid mass assembly and metal enrichment during the earliest phases of galaxy formation [10].
- Properties of galaxy populations (2,375 redshifts in the range from z=0.5 up to z=13, including 404 at z>5) in the first billion years after BB [11].
- Spectroscopic redshifts for 178 of the objects targeted extending up to z=13.2 [12].

- Extremely massive galaxy candidates have been identified at z>7, in much larger numbers than expected.

Population of ultra-massive galaxies accounts for 20% of the total cosmic star formation rate density [13]. can be explained by Macroobjects formation process proposed by WUM (see Section 3.2).

The observations of Enceladus plume's composition and structure (the fluorescence emissions of H_2O at cryogenic temperatures (25 K) and the stable observed outgassing rate (300 kg/s) in 15 years) [16] can be explained by continuously working of UCM Reactor inside of Enceladus.

5. Classical Physics. Primary Notions

Principle of Relativity is the requirement that the equations describing the laws of physics have the same form in all admissible frames of reference (including inertial forces). For example, in the framework of Special Relativity the Maxwell equations have the same form in all inertial frames of reference. In the framework of General Relativity, Einstein's field equations have the same form in arbitrary frames of reference.

In **WUM**, this Principle is valid because the Medium of the World is an absolute frame of reference. Then, there is no need to discuss Special Relativity and General Relativity, which abandoned the Aether in 1905. 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, since the forces are expected to act uniformly throughout the universe, and should, therefore, produce no observable irregularities in the large-scale structuring over the course of evolution of the matter field that was initially laid down by BBM.

In **WUM**, this Principal 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 and consist of elementary particles with two-thirds of the total Matter. The distribution of MOs with one-third of the total Matter is spatially Inhomogeneous and Anisotropic and temporally Non-simultaneous, and therefore, this Principal is not viable for the entire World.

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, conservation of linear momentum and angular momentum, and conservation of electric charge. One particularly important result concerning conservation laws is **Noether theorem**, which states that there is a one-to-one correspondence between each one of them and a differentiable symmetry of nature:

- Conservation of energy follows from the time-invariance of physical systems.
- Conservation of linear momentum follows from the space-translation invariance (translation along x, y, z directions).
- Conservation of angular momentum follows from the rotation invariance (rotation about x, y, z axes).

Angular Momentum problem is the killer of all existent cosmological models including BBM. Old-timers of Cosmology should solve this problem.

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 Eternal Universe.

The proposed new Primary Notions are, in fact, a Paradigm Shift in Classical Physics

6. Main Results of WUM

6.1. Predictions

Summary of the calculated by WUM in 2013 cosmological parameters and experimentally measured parameters are presented in the following **Table 5**.

Table 5. 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 ± 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 for precise calculation of values that were only measured experimentally earlier and makes verifiable predictions.

"*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 is a confirmation of one of the most important predictions of WUM in 2013: "*Macroobjects of the World have cores made up of the discussed DM (UCM) particles. Other particles, including DM (UCM) and baryonic matter, form shells surrounding the cores*."

JWST discoveries confirm the most important predictions of WUM in 2018:

- Absolute Age of World is 14.22 Byr.
- Dark (invisible) Epoch (spanning for Laniakea Supercluster (LSC) from the Beginning of the World for 0.45 Byr) when only UCM Macroobjects (MOs) form and evolve.
- Luminous Epoch (ever since, 13.77 Byr for LSC) when Luminous MOs (superclusters, galaxies, ESS, etc.) emerge.
- 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.
- MOs of the World form from top (Superclusters) down to Galaxies and ESS in parallel around different Cores made up of different UCPs.
- 3D Finite Boundless World presents a Patchwork Quilt of different Luminous Superclusters, which emerged in various places of World at different Cosmological times.

6.2. Explained Problems

WUM solves a number of problems in contemporary Cosmology 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 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 eighty million years exists in Nature. It is not produced by the nuclear fuel cycle, because it needs extremely 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.
- Expanding Earth hypothesis asserts that the position and relative movement of continents is at least partially due to the volume of Earth increasing. In WUM, the Earth's UCM core absorbs new UCPs, and its size is increasing in time $\propto \tau^{1/2}$. Hence, there is an expansion of UCM core, and its surface (the Upper mantle with Crust) is stretching. Due to UCPs self-annihilation, new chemical elements are created inside of the Upper mantle with Crust. As a result, the relative movement of continents is happening.
- 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 a byproduct of UCPs self-annihilation. This problem does not arise since antimatter does not get created by UCPs self-annihilation.
- Black-body spectrum of Microwave Background Radiation is due to thermodynamic equilibrium of photons with Intergalactic plasma.
- Unidentified Infrared Discrete Emission Bands with peaks 3.3, 6.2, 7.7, 8.6, 11.2, and 12.7 μm explained by a self-annihilation of UC particles UCF4 (0.2 eV).
- 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.
- Lightning Initiation problem and Terrestrial Gamma-Ray Flashes are explained by the self-annihilation of UCPs in Geocorona.
- Ball Lightnings are objects that have cores made up of UCPs surrounded by electron-positron plasma shells contaminated by chemical elements of soil and air as the result of Terrestrial Gamma-Ray Flash

strikes of the ground. WUM predicts a new phenomenon—a generation of BLs according to the proposed model of them. Once we master the creation of BLs in a controlled environment, we can concentrate our efforts on harvesting that energy from an infinite Source—the Medium of the World with UCPs.

7. Why is Infrared Radiation Important to Astronomy?

According to "An ESA Mission with Participation from NASA," there are three basic reasons for this [18]:

1. **It is cold out there.** Most of the light in the Universe is in infrared and longer wavelengths.
2. **It is dusty out there.** A number of things of great interest to astronomy are hidden within or behind vast clouds of gas and dust. Our view is blocked in visible light because the dust grains are about the same size as optical wavelengths, about one micron or less, and so are highly effective at scattering or absorbing that light. But longer infrared wavelengths undulate around the dust. And the longer the wavelength, the thicker the layer of dust can penetrate. So Far-IR and submillimeter radiation can move freely through the Universe, unobstructed by dust.
3. **The Universe is expanding**. Galaxies outside our own group are traveling away from us with the expansion of the universe, and the more distant they are, the faster they are receding. As they speed away, their light is "redshifted" to longer wavelengths. Light that starts out at optical wavelengths may be stretched into infrared.

Optical astronomy has been around since the first humans looked up and started to chart the motions of the heavens. We have boosted our powers of observation with instruments since 1609, when Galileo pointed a telescope at the moon. But it is only within the last half-century that we have begun to explore the Universe in the infrared. And the results were astonishing.

The first infrared survey of the sky, published in 1965, revealed ten objects that optical telescopes could not see. By 1969, thousands of new objects had been discovered in the infrared.

More recently, infrared astronomy made the surprising discovery that **Jupiter, Saturn, and Neptune have internal sources of heat**. In WUM, it means that they have UCM Reactors inside of them.

It found a hundred thousand red giant stars in the central bulge of MW, and ices of water, methane, carbon dioxide, formaldehyde, and carbon monoxide in interstellar space.

Infrared observations of galaxies 10 Bly away found star-formation at a rate three to four times greater than optical surveys had indicated, dramatically changing our understanding of the early Universe.

The infrared part of the spectrum spans from about 0.75 μm to a few hundred micrometers :

- JWST's four instruments provide wavelength coverage from 0.6 to 28.5 μm (Mid-Infrared). $z_{max} = 46.5$.
- Herschel Space Observatory covered wavelengths from 55 to 672 μm (Far-Infrared – Submillimeter). This is also the best part of the electromagnetic spectrum for observing key chemicals in space. About 130 kinds of chemicals have been detected so far in the interstellar medium, and most have rotational spectra - the photon emissions induced by the rotation of the molecules - with wavelengths that peak in the submillimeter range. These include the many forms of water, and the organic molecules thought to be necessary for life.

The Primeval Structure Telescope (PaST), also called 21-cm Array, is a Chinese radio telescope array designed to detect the earliest luminous objects in the universe. This wavelength falls within the microwave radio region of the electromagnetic spectrum, and it is observed frequently in radio astronomy, since those radio waves can penetrate the large clouds of interstellar cosmic dust that are opaque to visible light.

According to WUM, **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 MW) when only UCM MOs existed. They have UCM Nuclei made up of UCF1 and UCF2 (1.3 TeV, 9.6 GeV) surrounded by shells of UCF3 and UCF4 (3.7 keV, 0.2 eV).

In WUM:

- Unidentified Infrared emission bands around peaks at 3.3, 6.2, 7.7, 8.6, 11.2, 12.7 μm, which are the fingerprints of all galaxies, explained by a self-annihilation of UCF4 (0.2 eV).
- 21-cm Emission with the broad line-width ($\sim$ 200 km s^{-1}) explained by the self-annihilation of an **ensemble** of ultra-relativistic UCPs **XIONs** (5.3 μeV).

It means that Far-Infrared and Radio observatories can observe UCM Macroobjects existing in Dark (invisible) Epoch before Luminous Epoch! These observations would provide further confirmation of WUM and deepen our understanding of the World's fundamental structure.

WUM predicts the existence of Universe-Created Particles (UCPs) with rest energies of 1.3 TeV, 9.6 GeV, 70 MeV, 340 keV, 3.7 keV, 0.2 eV, and 5.3 μeV . Future efforts should focus on observing cosmic gamma-rays with spectral lines corresponding to these predicted UCPs rest energies.

Conclusion

Hypersphere World-Universe Model is consistent with all Concepts of the World. The Model successfully describes primary cosmological parameters and their relationships. WUM allows for precise calculation of values that were only measured experimentally earlier and makes verifiable predictions. The remarkable agreement of calculated values with the observational data gives us considerable confidence in the Model. Great experimental results and observations achieved by Astronomy in last decades should be analyzed through the prism of WUM. Considering the JWST discoveries, successes of WUM, and 87 years of Dirac's proposals, it is high time to make a Paradigm Shift in Astronomy, Cosmology and Classical Physics.

Acknowledgments

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.

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JWST Discoveries and the Hypersphere World-Universe Model: Transformative New Cosmology

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Abstract

Twenty-six years ago, a small committee report was built upon earlier studies to articulate a compelling and poetic vision for the future of astronomy. This vision called for an infrared-optimized space telescope with an aperture of at least four meters. With the support of their governments in the US, Europe, and Canada, 20,000 people brought this vision to life as the 6.5-meter James Webb Space Telescope (JWST). The telescope is working perfectly, delivering much better image quality than expected [1].

JWST is one hundred times more powerful than the Hubble Space Telescope and has already captured spectacular images of the distant universe. A view of a tiny part of the sky reveals many well-formed spiral galaxies, some over thirteen billion light-years away. These observations challenge the standard Big Bang Model (BBM), which posits that early galaxies should be small and lack well-formed spiral structures. JWST's findings are prompting scientists to reconsider the BBM in its current form. Throughout the history of science, technological advancements have led to new results that challenge established theories, sometimes necessitating their modification or even abandonment. This happened with the geocentric model four centuries ago, and the BBM may face a similar reevaluation as JWST provides more images of the distant universe.

In 1937, P. Dirac proposed the Large Number Hypothesis and the Hypothesis of Variable Gravitational Constant, later incorporating the concept of Continuous Creation of Matter in the universe. The Hypersphere World-Universe Model (WUM) builds on these ideas, introducing a distinct mechanism for matter creation. WUM is proposed as an alternative to the prevailing BBM. Its main advantage is the elimination of the "Initial Singularity" and "Inflation," offering explanations for many unresolved problems in Cosmology. WUM is presented as a natural extension of Classical Physics with the potential to bring about a significant transformation in both Cosmology and Classical Physics. Considering JWST's discoveries, WUM's achievements, and 87 years of Dirac's proposals, it is time to initiate a fundamental transformation in Astronomy, Cosmology, and Classical Physics.

The present paper is a continuation of the published article "JWST Discoveries—Confirmation of World-Universe Model Predictions" [2] and a summary of the paper "Hypersphere World-Universe Model: Digest of Presentations John Chappell Natural Philosophy Society" [3]. Many results obtained there are quoted in the current work without full justification; interested readers are encouraged to view the referenced papers for detailed explanations.

1. WUM vs BBM

It is well-known that any theory is based on certain hypotheses. WUM and BBM are principally different models with fundamentally different hypotheses [3]:

Initial Conditions:

- **BBM:** Proposes an initial singularity with infinite energy density and extremely rapid expansion of spacetime (inflation). There is no center of expansion in the 3D universe.

- **WUM:** Suggests a fluctuation in the Universe that created a 4D Nucleus of the World with an extrapolated radius equal to the basic size unit a. This Nucleus had a finite extrapolated energy density (about 10^4 times less than nuclear density) and expanded in the fourth spatial dimension at the speed c (a gravitodynamic constant), resulting in the even stretching of the World.

Structure of the World:

- **BBM:** Assumes an almost infinite homogeneous and isotropic universe around the initial singularity.
- **WUM:** Describes a Finite Boundless World (a Hypersphere of the 4D Nucleus) as a Patchwork Quilt of various main luminous superclusters ($\gtrsim 10^3$), which emerged in different regions of the World at different cosmological times.

Medium of the World:

- **BBM:** Often implies a vacuum state in the early universe.
- **WUM:** Proposes that the World's Medium consists of protons, electrons, photons, neutrinos, and Universe-Created Particles (UCPs), previously referred to as "Dark Matter Particles." The Medium is homogeneous and isotropic, while the distribution of Macroobjects (MOs) is spatially inhomogeneous, anisotropic, and temporally non-simultaneous. The rejection of the luminiferous aether in 1905 was a significant moment for Classical Physics; however, the Medium proposed by WUM could be considered a revival of this concept, acting as a savior for Classical Physics.

Conservation Laws:

- **BBM:** Does not explicitly emphasize the creation and conservation of angular momentum in its foundational principles.
- **WUM:** Stands out as the only cosmological model that provides a mechanism for angular momentum creation and is consistent with the fundamental law of its conservation.

Macroobject Formation:

- **BBM:** MOs form from the bottom (extrasolar systems) up to galaxies and superclusters.
- **WUM:** MOs form from the top (superclusters) down to galaxies and extrasolar systems (ESS) due to an Explosive Volcanic Rotational Fission of Superclusters' Overspinning Cores (made up of UCPs), which were created by the Universe during the Dark (invisible) Epoch for 0.45 Byr. The formation of galaxies and ESS is not a process that concluded ages ago; instead, it is ongoing.

In conclusion, WUM presents a radically different approach to understanding the World compared to BBM, challenging long-held assumptions, and offering new perspectives on the fundamental nature of Cosmology and Classical Physics. The hypotheses of BBM are mathematical, while those of WUM are more physical in nature. Both models may seem incredible, but there is a key difference: BBM fails to explain many of the experimental results observed by contemporary Astronomy, such as those from the JWST, whereas WUM does! The validity of hypotheses can only be confirmed through experimental results. As R. Feynman famously said, "*It doesn't make any difference how beautiful your guess is, it doesn't make any difference how smart you are, who made the guess, or what his name is. If it disagrees with experiment, it is wrong. That's all there is to it.*"

2. JWST Discoveries

2.1. Early Experimental Findings (2022) [2]

The problem of ancient galaxies formation is a long-standing problem. The age of the Universe is

$13.77 \pm 0.06\ Byr$, based on the cosmic microwave background data. Astronomers believe that Milky Way (MW) galaxy is approximately 13.6 Byr old. MW is one of the two largest spiral galaxies in the Local Group (the other being the Andromeda Galaxy). Massive mature disk galaxies like MW cannot form so soon.

Distances to remote objects, other than those in nearby galaxies, are always inferred by measuring the cosmological redshift of their light. An important distinction is whether the distance is determined via spectroscopy or using a photometric redshift technique. The spectroscopic redshift is conventionally regarded as being necessary for an object's distance to be considered definitely known, whereas photometrically determined redshifts identify "candidate" distant sources. For comparisons with the light travel distance of the astronomical objects listed below, the age of the universe since the Big Bang (BB) is currently estimated as 13.787 ± 0.020 Byr.

In the article "JWST Discoveries – Confirmation of World-Universe Model Predictions" [2], we discussed Galaxies with $z > 10$ (**Table 1** and **Table 2**, adapted from Wikipedia).

Table 1. Most distant galaxies with spectroscopic redshift determinations.

Name	Redshift	Light travel distance, Bly
HD1	$z = 13.27$	13.579; 13.599; 13.477; 13.476
JADES-GS-z13-0	$z = 13.20^{+0.24}_{-0.07}$	13.576; 13.596; 13.474; 13.473
JADES-GS-z12-0	$z = 12.63^{+0.24}_{-0.08}$	13.556; 13.576; 13.454; 13.453
GLASS-z12	$z = 12.117^{+0.01}_{-0.01}$	13.536; 13.556; 13.434; 13.433
JADES-GS-z11-0	$z = 11.58^{+0.05}_{-0.05}$	13.512; 13.532; 13.410; 13.409
GN-z11	$z = 10.957^{+0.001}_{-0.001}$	13.481; 13.501; 13.380; 13.379
UDFj-39546284	$z = 10.38^{+0.07}_{-0.06}$	13.449; 13.469; 13.348; 13.347

Table 2. Notable candidates for most distant galaxies

Name	Redshift	Light travel distance, Bly
F200DB-045	$z = 20.4^{+0.3}_{-0.3}$	13.725; 13.745; 13.623; 13.621
CEERS-93316	$z = 16.39^{+0.32}_{-0.22}$	13.661; 13.681; 13.559; 13.558
F200DB-175	$z = 16.2^{+0.3}_{-0.0}$	13.657; 13.677; 13.555; 13.554
S5-z17-1	$z = 16.0089^{+0.0004}_{-0.0004}$	13.653; 13.673; 13.551; 13.550
F150DB-041	$z = 16.0^{+0.2}_{-0.2}$	13.653; 13.673; 13.551; 13.549
SMACS-z16a	$z = 15.92^{+0.17}_{-0.12}$	13.651; 13.671; 13.549; 13.548
F200DB-015	$z = 15.8^{+3.4}_{-0.1}$	13.648; 13.668; 13.546; 13.545

The presented experimental results show that:

- HD1 is one of the earliest and most distant known galaxies yet identified in the observable universe. HD1's unusually high brightness has been an open question for its discoverers; it has a significantly more luminous ultraviolet emission than similar galaxies at its redshift range [Pacucci, F., *et al.* (2022)].
- F200DB-045 is a candidate high-redshift galaxy, with an estimated redshift of z = 20.4. If confirmed, it would be one of the earliest and most distant known galaxies observed. F200DB-045 would have a light-travel distance (lookback time) of > 13.7 Byr .

Detailed analysis of observations of the first batch of z ≈ 11–20 Candidate Objects revealed by JWST is done by H. Yan, *et al.* (2022). The summary of the JWST discoveries in the Early World is:

- The most secure oldest galaxy is GLASS-z13 ($z \approx 13$, light-travel distance of 13.4572 Byr) that has already built up $\sim 10^9\ M_\odot$ in stars.
- The search of eighty-eight candidate galaxies at $z > 11$ shows that some of them could be at redshifts as high as twenty. Some of those distant galaxies are strikingly massive**.**
- Most of the early galaxies are nicely shaped, disklike galaxies.
- A new redshift record obtained for galaxy candidate CEERS-93316 at $z = 16.7$ (light-travel distance of 13.5512 Byr) with a stellar mass about $\sim 10^9\ M_\odot$;
- Seven galaxies with $M^* > 10^{10}\ M_\odot$ and 7<z<11 were found in the survey area, including two galaxies with $M^* \sim 10^{11}\ M_\odot$. The stellar mass density in massive galaxies is much higher than anticipated from previous studies: a factor of more than three orders of magnitude at z∼10.
- Extremely Compact Bright Galaxies were found at z∼12−17.
- Super-early, massive, evolved galaxies with blue spectra, and exceedingly small dust attenuation.

2.2. Recent Experimental Findings (2023-2024)

JWST has made several intriguing and unexpected observations that challenge our current understanding of the universe. Here are some of the most interesting:

- C. Ilie, J. Paulin, and K. Freese in the article "Supermassive Dark Star candidates seen by JWST?" [4] wrote: "*The first generation of stars in the Universe is yet to be observed. There are two leading theories for those objects that mark the beginning of the cosmic dawn: hydrogen burning Population III stars and Dark Stars, made of hydrogen and helium but powered by Dark Matter heating. We show that each of the following three objects: JADES-GS-z13-0 , JADES-GS-z12-0 , and JADES-GS-z11-0 (at redshifts z ∈ [11, 14]) are consistent with a Supermassive Dark Star interpretation, thus identifying, for the first time, Dark Star candidates"* .
- *A new all-time record! JWST's discovery of JADES-GS-z14-0 pushes the earliest galaxy ever seen to just 290 million years after the Big Bang. This new record-holder is remarkably, unexpectedly bright. Five times brighter than the prior (JADES-GS-z13-0) record-holder, JADES-GS-z14-0 is even shockingly visible to MIRI's eyes. But this galaxy is extremely dust-poor. The lack of dust inside JADES-GS-z14-0 presents a novel puzzle* [5].
- **Abundance and Brightness of Early Galaxies**: Contrary to predictions, JWST has found that early galaxies, forming just a few hundred million years after BB, are more numerous and brighter than expected. This discovery implies that star formation in the early universe may have been more efficient or occurred in intense bursts. These findings challenge existing models of galaxy

formation and evolution [6], [7].

- **Discovery of the Earliest and Most Distant Galaxies**: JWST has identified galaxies dating back three hundred Myr after BB. These galaxies, such as JADES-GS-z14-0 and JADES-GS-z14-1, are significantly more massive and luminous than anticipated, suggesting that large galaxies formed rapidly in the early universe [8].
- **Early Supermassive Black Holes**: Observations of galaxies like GN-z11 have revealed the presence of supermassive black holes much earlier in cosmic history than previously thought. These black holes are actively accreting matter, contributing to the high luminosity of these early galaxies. This discovery is puzzling as it indicates rapid black hole growth soon after the universe's formation [9].

These unexpected observations by JWST are prompting astrophysicists to revise their models of the early universe, galaxy formation, and black hole growth [6]-[9].

JWST has spectroscopically confirmed numerous galaxies at z>10. J. M. Helton, *et al.* report photometric detection of the most distant spectroscopically confirmed galaxy JADES-GS-z14-0 at $z = 14.32^{+0.08}_{-0.2}$. The most plausible solution for the stellar population properties is that this galaxy contains half a billion solar masses in stars with a strong burst of star formation in the most recent few million years. The inferred properties of JADES-GS-z14-0 suggest rapid mass assembly and metal enrichment during the earliest phases of galaxy formation [10].

F. D'Eugenio, *et al*. present the third data release of JADES. They measured 2,375 redshifts: their targets span the range from z=0.5 to z=13, including 404 at z>5. Together, these data provide the largest statistical sample to date to characterize the properties of galaxy populations in the first billion years after BB[11].

A. J. Bunker, *et al*. describe the NIRSpec component of JADES, and provide deep spectroscopy of 253 sources. Their low-dispersion and medium-dispersion spectra cover the wavelength range 0.6−5.3μm. They measure spectroscopic redshifts for 178 of the objects targeted extending up to z=13.2. Combined with the first JADES NIRCam data release, these public JADES spectroscopic and imaging datasets provide a new foundation for discoveries of the infrared universe by the worldwide scientific community [12].

M. Xiao, *et al*. present the first sample of 36 dust-obscured galaxies with robust spectroscopic redshifts at z=5−9 from the JWST FRESCO survey. The three most extreme sources at z∼5−6 are so massive that they would require, on average, about 50% of the baryons in their halos to be converted into stars. This population of ultra-massive galaxies accounts for 20% of the total cosmic star formation rate density at z∼5−6, suggesting a substantial proportion of extremely efficient star formation in the early Universe [13].

A substantial number of ultra-high redshift ($8 < z < 17$) galaxy candidates have been detected with JWST, posing the question: are these observational results surprising in the context of current galaxy formation models? Aaron Yung, L. Y., *et al*. address this question using their fiducial models. They present predictions for stellar mass functions, rest-frame UV luminosity functions, and various scaling relations and find that their (dust-free) models predict galaxy number densities at z∼11 (z∼13) that are a factor of ∼30 lower than the observational estimates [14].

With stunning clarity, JWST has revealed the Universe's first billion years. The scientific community is analyzing a wealth of JWST imaging and spectroscopic data from that era and is in the process of rewriting the astronomy textbooks. Here, 1.5 years into the JWST science mission, A. Adamo, *et al*.

provide a snapshot of the great progress made towards understanding the initial chapters of our cosmic history. They highlight discoveries and breakthroughs, topics and issues that are not yet understood, and questions that will be addressed in the coming years, as JWST continues its revolutionary observations of the Early Universe [15].

Enceladus is a prime target in a search for life in our Solar System (SS), having an active plume connected to a **large liquid water subsurface ocean**. Using JWST, G. L. Villanueva, *et al.* searched for organic compounds and characterized the plume's composition and structure. The observations directly sample the fluorescence emissions of H_2O and reveal an extraordinarily extensive plume (up to 10,000 km or 40 Enceladus radii) at cryogenic temperatures (25 K) embedded in a large bath of emission originating from Enceladus' torus. Intriguingly, the observed outgassing rate (300 kg/s) is similar to that derived from close-up observations with Cassini 15 years ago, and the torus density is consistent with previous spatially unresolved measurements with Herschel 13 years ago, suggesting that the vigor of gas eruption from Enceladus has been stable over decadal timescales [16].

These observations are just the beginning, and as JWST continues its mission, it is likely to uncover even more surprising and unexplained phenomena. The data it provides will help refine existing models and theories, leading to a deeper understanding of the universe.

3. Hypersphere World-Universe Model

3.1. Assumptions

WUM is based on the following primary assumptions:

- World is a Finite Boundless three-dimensional Hypersphere of a 4D Nucleus of the World that is expanding along the fourth spatial dimension of the Nucleus with speed equals to the gravitodynamic constant c. The three-dimensional World is curved in the fourth spatial dimension.
- Eternal Universe is a Creator of Universe-Created (UC) Matter (UCM), which is continuously created in the Nucleus of the World. 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 $\alpha = (2aR_\infty)^{1/3}$ (where R_∞ is the Rydberg constant and $a = 1.7705641 \times 10^{-14}\ m$ is a basic size unit) and dimensionless time-varying quantity Q that is, in fact, the Dirac's Large Number. α now named the Fine-structure constant.

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. The extrapolated energy density of the World at the Beginning ($Q = 1$) was four orders of magnitude smaller than the nuclear energy density. The World is a

Finite Boundless Hypersphere that is the surface of the 4D Nucleus. 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 fourth spatial dimension so that the radius of the Nucleus R is increasing with speed c . Its surface, the Hypersphere, is evenly stretched. The stretching of the Hypersphere World can be understood through the analogy with expanding 3D balloon: imagine an ant residing on a two-dimensional surface of a balloon. As the balloon is blown up, its radius increases, and its surface grows. The distance between any two points on the surface increases. The ant sees her world expand but does not observe a preferred center. Unbeknown to ants, the center is not located on the surface, but instead, is removed along the inaccessible third dimension. It is in the center of the balloon. What does the balloon expand into? It expands in perpendicular "down/up" direction that is inaccessible to perception, and therefore from the surface of the balloon. One cannot point out the direction of the expansion.
  Likewise, the three-dimensional Hypersphere World expands along the imperceptible fourth dimension. The Center of the World is in the center of 4D Nucleus, in that very inaccessible fourth dimension. We do not know that our three-dimensional space is curved. But we know that it is stretching without center of stretching. According to WUM, all parameters of the World depending on Q, which is a ratio of radius R to a: $Q = R/a$ are a manifestation of the Worlds' curvature in the fourth spatial dimension.
- **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 is responsible for the creation of UCM in 4D Nucleus of the World. UCPs carry new UCM into the World. Ordinary Matter is a byproduct of UCPs self-annihilation. By analogy with 3D ball, which has a spherical surface (that has surface energy), we can imagine that Hypersphere World has a "Surface Energy" of 4D Nucleus. The growth of the surface of 4D Nucleus means the increase of the World's so named "Surface Energy".
  The proposed 4D process is responsible for 4D Nucleus Expansion, the World Stretching, Creation of Matter, and Arrow of Time. It constitutes the **Main Hypothesis of WUM**. In our view, the arrow of the Cosmological Time does not depend on any physical phenomenon in the Medium of the World. It is the result of the Nucleus expansion due to the driving force for surfaces to be created.
  It is important to emphasize that Creation of Matter is a direct consequence of Nucleus expansion. Creation of UCM occurs homogeneously in all points of the Hypersphere 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 (Superclusters, Galaxies, ESS, *etc.*) – 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.

- **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 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 MW) when only UCM Macroobjects existed.
- **Luminous Epoch** has lasted ever since 13.77 Byr when Luminous MOs emerged due to random **Explosive Volcanic Rotational Fission** of Overspinning UCM Supercluster's Cores, which looks like a Firework of UCM cores of satellite objects at the same time, so that the direction of the sum of satellites angular momentum coincides with the angular momentum of the Prime Object. There are no preferences of directions of satellites rotations at any level (supercluster, galaxy, extra solar system) 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 the 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 ($\gtrsim 10^3$), which emerged in various places of the World at different Cosmological times. The distribution of MOs in the World is spatially inhomogeneous and anisotropic and temporally non-simultaneous. Macrostructures of the World form from the top (superclusters) down to galaxies, ESS, planets, and moons.
- **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.

3.3. 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 are

Shapley, Coma, and Perseus-Pisces. Distance from the Earth to the Centre of LS is ~ 250 Mly (see **Figure 1** and **Figure 2**).

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 ~ 400 $km\ s^{-1}$, which far exceeds rotational **Angular Momentum** of MW.

Figure 1. Laniakea Supercluster. Adapted from article by Tully, R. B., *et al.* [17].

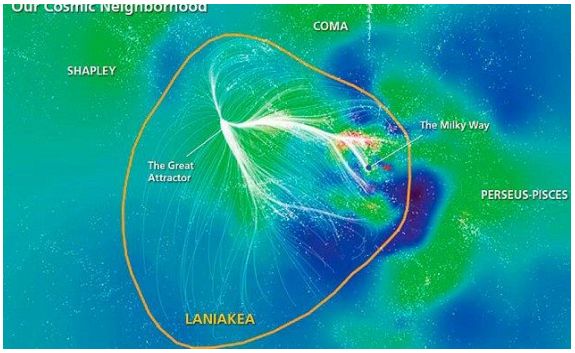
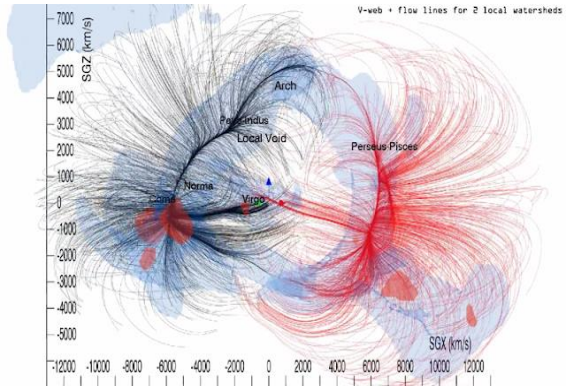


Figure 2. A representation of structure and flows due to mass within ~80 Mpc.



4) Mass-to-light ratio of the Virgo Supercluster is ~ 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 ~ 13.5 Bly away, and a candidate galaxy F200DB-045 that is ~ 13.7 Bly away.

Medium of the World, UC Matter, and Angular Momentum are the main Three Pillars of WUM. To the best of our knowledge, WUM is the only cosmological model that aligns with the Law of Creation and Conservation of Angular Momentum. The presented view of the World represents a fundamental change in the field of Cosmology.

3.4. Medium of the World

WUM introduces the Medium of the World, which consists of stable elementary particles with lifetimes longer than the age of the World: protons, electrons, photons, neutrinos, and UCPs. The Medium is Homogeneous and Isotropic. The **existence of the Medium is a principal point of WUM**. There is no Luminiferous Aether, Perfect fluid, or Vacuum in WUM. Inter-galactic voids discussed by astronomers are, in fact, examples of the Medium in its purest. MBR is part of the Medium; it then

follows that the **Medium is the absolute frame of reference**. Relative to MBR rest frame the MW galaxy and the Sun are moving with the speed of 552 and 370 $km\ s^{-1}$, respectively.
Time, Space and Gravitation are connected with 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*. **There is no Medium - there is Nothing**!
WUM based on Cosmological time τ that marches on at the constant pace from the Beginning of the World up to the modern Epoch along with time-varying Cosmological parameters. Gravity is not an interaction but a manifestation of the Medium.

3.5. Universe-Created Matter

In my previous articles, I 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, I introduced a new term – UCPs, which have following characteristics: **UC Fermions (UCF)** or **Bosons**, **Rest Energies** (see **Table 3**), **Weak Interaction**, and **Self-annihilation**, like Majorana fermions**.** Ordinary particles are a byproduct of UCPs self-annihilation. It is easy to switch from Dark (**D**) Matter to Universe-Created (**UC**) Matter.

Table 3. Universe-Created Particles**.**

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

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

$$E_0 = hc/a = 70.025252\ \ MeV$$

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.
The contemporary Astronomy allows us to observe the World in wavelengths from radio waves up to gamma rays! Then, they are not "dark" at all. The first known binary system was Cygnus X-1(1971) that is typically the brightest persistent source of **hard X-rays with energies up to sixty 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 **eight 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 3**).
  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 $\mu = e/2\alpha$ (e is an elementary charge and α is dimensionless Rydberg constant); 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 μeV).

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 μeV are found in spectra of diffuse gamma-ray background and the emissions of various MOs in the World [2]. 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.

3.6. Gravity

Le Sage's Theory of Gravitation is a kinetic theory of gravity originally proposed by Fatio in 1690 and later by Le Sage in 1748. The theory proposed mechanical explanation for Newton 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 ultra-mundane 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 ultramundane flux is isotropic, and laws of its propagation are similar to that of light.
- He suggested that the ultra-mundane corpuscles might move at the speed of light.
- To maintain mass proportionality, ordinary matter consists of cage-like structures, in which their diameter is only the 10^7th part of their mutual distance, so the particles can travel through them unhindered. In order to achieve exact mass proportionality as in Newton's theory, the ultra-mundane flux must be infinitely intense.

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

In WUM, the time-varying Gravitational parameter $G \propto \tau^{-1}$ is proportional to the energy density of the Medium $\rho_M \propto \tau^{-1}$. It is not a constant. That is why WUM aligns Gravity with Le Sage's theory of gravitation. WUM gives Le Sage's theory the following parameters:

- XIONs (5.3 μeV) are ultra-relativistic UCPs ("ultramundane corpuscles"), which created by the Universe.
- Proposed Weak interaction between XIONs and Matter provides mass proportionality. Energy density of XIONs in the World is about 64% of the total energy density and provides high intensity of their flux.
- Gravitational mass m_g is a classical notion that defines Gravity – the emergent phenomenon. We emphasize that an inertial mass m_i that is a coefficient of proportionality between a force F and an acceleration a : $F = m_i a$, has nothing to do with m_g .

A. Einstein developed General theory of Relativity starting with the **assumption** that the inertial and passive gravitational masses are the same. This is known as the equivalence principle. In WUM, **Gravity is not an interaction but a manifestation of the Medium.**

3.7. Principal Role of Maxwell's Equations

Maxwell's Equations form the foundation of Classical Electrodynamics and Gravitomagnetism. The value of Maxwell's Equations is even greater because J. Swain showed that *linearized general relativity admits a formulation in terms of gravitoelectric and gravitomagnetic fields that closely parallels the description of the electromagnetic field by Maxwell's equations.* We emphasize that **Gravitomagnetism considers not only interactions between masses but also between mass currents**. G. Ludwig in a paper "Galactic rotation curve and dark matter according to gravitomagnetism" [18] wrote: *Most theories used to explain the rotation curve have been restricted to the Newtonian potential framework, disregarding the general relativistic corrections associated with mass currents.* ***The effects attributed to dark matter can be simply explained by the gravitomagnetic field produced by the mass currents.***

The explanation of galactic rotation curves made by G. Ludwig is in good agreement with WUM.

3.8. Inter-Connectivity of Primary Cosmological Parameters

The constancy of universe fundamental constants, including G , is now commonly accepted, although it has never been firmly established as a fact. A commonly held opinion states that gravity has no established relation to other fundamental forces, so it does not appear possible to calculate it from other constants that can be measured more accurately, as is done in other areas of physics.

WUM holds that there indeed exist relations between all Cosmological parameters that depend on dimensionless time-varying quantity Q that is a measure of the Size R and Age A_τ of the World according to the equation:

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

where t_0 is a basic time unit: $t_0 = a/c$. Q in the modern epoch equals to:

$$Q = 0.759972 \times 10^{40}.$$

According to WUM, the following parameters of the World depend on Q :

- Newtonian parameter of gravitation G : $G = \frac{a^2 c^4}{8\pi hc} \times Q^{-1}$
- Hubble's parameter H : $H = \frac{c}{a} \times Q^{-1}$
- Age of the World A_τ : $A_\tau = \frac{a}{c} \times Q$
- The Worlds' Radius of curvature R : $R = a \times Q$
- Critical energy density ρ_{cr} : $\rho_{cr} = 3\frac{hc}{a^4} \times Q^{-1}$
- Concentration of Intergalactic plasma n_{IGP} : $n_{IGP} = \frac{2\pi^2}{a^3}\frac{m_e}{m_p} \times Q^{-1}$
- Minimum energy of photons E_{ph} : $E_{ph} = (\frac{m_e}{m_p})^{1/2} E_0 \times Q^{-1/2}$
- Temperature of MBR T_{MBR} : $T_{MBR} = \frac{E_0}{k_B}(\frac{15\alpha}{2\pi^3}\frac{m_e}{m_p})^{1/4} \times Q^{-1/4}$
- Temperature of Far-Infrared Background Radiation peak T_{FIRB} : $T_{FIRB} = \frac{E_0}{k_B}(\frac{15}{4\pi^5})^{1/4} \times Q^{-1/4}$

In frames of WUM, all these Cosmological parameters are a manifestation of the Worlds' curvature in the fourth spatial dimension. They can be calculated based on experimentally measured value of G_{av} and Q_{av} (see Section 3.10).

3.9. Directly Measured Cosmological Parameters

There are only two directly measured Cosmological parameters: the Gravitational parameter G and the Temperature of the Cosmic MBR T_{MBR} . Q. Li, *et al*. experimentally measured the most accurate values of G using two independent methods [19]

$$G(1) = 6.674184 \times 10^{-11} m^3 kg^{-1} s^{-2}\ (11.64\ ppm)$$

$$G(2) = 6.674484 \times 10^{-11} m^3 kg^{-1} s^{-2}\ (11.61\ ppm)$$

which are in excellent agreement with the value of $G = 6.67420 \times 10^{-11} m^3 kg^{-1} s^{-2}$ predicted by WUM in 2013. In 2009, D. J. Fixsen measured the value of MBR temperature T_{MBR} :

$$T_{MBR} = 2.725181\ K\ (30\ ppm)$$

It means that the most accurate parameter is G , and all other Cosmological parameters could be, in principle, calculated based on the value of G with the same accuracy. Thanks to the revealed by WUM Inter-Connectivity of Cosmological parameters, we show that G that can be measured directly makes measurable all Cosmological parameters, which cannot be measured directly.

3.10. Gravitational Parameter G and Dirac Large Number Q

Considering equations in Section 3.8, we have the following equation for G :

$$G = \frac{a^2 c^4}{8\pi hc} \times Q^{-1}$$

An average value of Gravitational parameter G_{av} of experimentally measured values by Q. Li, *et al*.

$$G_{av} = \frac{G(1) + G(2)}{2} = 6.674334 \times 10^{-11} m^3 kg^{-1} s^{-2}$$

allows us to calculate the value of Q_{av} based on the value of G_{av} :

$$Q_{av} = \frac{a^2 c^4}{8\pi hc} \times G_{av}^{-1} = 0.759944 \times 10^{40}$$

Below, we will use this value of Q_{av} for a calculation of all Cosmological parameters.

3.11. Intergalactic Plasma

In WUM, the World consists of stable elementary particles. Protons with mass m_p and electrons with mass m_e have identical concentrations: $n_p = n_e$. According to Plasma Physics, Intergalactic plasma consisting of protons and electrons has plasma frequency ω_{pl} :

$$\omega_{pl}^2 = \frac{4\pi n_e e^2}{4\pi\varepsilon_0 m_e} = 2 n_e a c^2$$

We substitute the following equation $\omega_{pl}^2 = \frac{m_e}{m_p}(2\pi\nu_0 \times Q^{-1/2})^2$ into this equation (where ν_0 is a basic frequency unit $\nu_0 = c/a$) and calculate concentrations n_p and n_e :

$$n_p = n_e = \frac{2\pi^2}{a^3}\frac{m_e}{m_p} \times Q^{-1} = 0.255\ m^{-3}$$

$\rho_p = n_p E_p$ is the energy density of protons in the Medium. The relative energy density of protons in the Medium Ω_p is then the ratio of ρ_p/ρ_{cr} , which equals to:

$$\Omega_p = 2\pi^2\alpha/3 = 4.8\%$$

According to WUM, the relative energy density of baryons in Macroobjects Ω_{MO} is:

$$\Omega_{MO} = 0.5\,\Omega_p = \pi^2\alpha/3 = 2.4\%$$

Measurements of Intergalactic plasma parameters can be done by investigations of Fast Radio Bursts, which are millisecond duration radio signals originating from distant galaxies. These signals are dispersed according to precise physical law and this dispersion is a key observable quantity that in tandem with a redshift measurement, can be used for physical investigations.

The dispersion measure and redshift, conducted by E. F. Keane, *et al.* in 2016, provide the measurement of the cosmic density of ionized baryons in the intergalactic medium Ω_{IGM} that equals to:

$$\Omega_{IGM} = 4.9 \pm 1.3\%$$

that is in excellent agreement with the predicted WUM in 2013 value of $\Omega_p = 4.8\%$. Using the equation for electrons' concentration n_e , we calculated the value of photons' time delay:

$$\Delta t_{ph}^{cal} = 2.189 \times (\frac{\nu}{1GHz})^{-2}$$

which is in good agreement with experimentally measured value by E. Keane, *et al.*, :

$$\Delta t_{ph}^{exp} = 2.438 \times (\frac{\nu}{1GHz})^{-2}$$

3.12. Minimum Energy of Photons

Analysis of Intergalactic plasma shows that the value of the lowest plasma frequency ν_{min} is :

$$\nu_{min} = \nu_0(\frac{m_e}{m_p})^{1/2} \times Q^{-1/2} = 4.53228\ Hz$$

Photons with energy smaller than $E_{ph} = h\nu_{min}$ cannot propagate in plasma. Thus, $h\nu_{min}$ is the smallest amount of energy a photon may possess, which equals to the value:

$$E_{ph} = (\frac{m_e}{m_p})^{1/2} E_0 \times Q^{-1/2} = 1.87433 \times 10^{-14}\ eV$$

This value, predicted by WUM in 2013, is in good agreement with a value obtained by L. Bonetti, *et al.* in 2017:

$$E_{ph} \lesssim\ 2.2 \times 10^{-14}\ eV$$

3.13. Origin of Cosmic Microwave Background Radiation (MBR)

According to BBM, the photons that existed at the time of photon decoupling (380,000 years after BB) have been propagating ever since, though growing fainter and less energetic, since the expansion of space causes their wavelength to increase over time. These photons are the same photons that we see in MBR now. But then, why is MBR a perfect black-body? What is the mechanism of photons wavelength increasing over time and growing fainter and less energetic?

According to WUM, wavelength is a classical notion. Photons, which are quantum objects, have only four-momenta. They do not have wavelengths. By definition, *Black-body radiation is the thermal electromagnetic radiation within or surrounding a body in thermodynamic equilibrium with its environment*. In WUM, the black-body spectrum of MBR is due to thermodynamic equilibrium of photons with Intergalactic plasma, the existence of which is experimentally proved by Fast Radio Bursts. It explains why MBR is a perfect black-body radiation.

$\rho_e = n_e E_e$ is the energy density of electrons in the Medium. We assume that the energy density of MBR ρ_{MBR} equals to twice the value of ρ_e (due to two polarizations of photons) and consider the Stefan–Boltzmann law:

$$\rho_{MBR} = 2\rho_e = 4\pi^2 \alpha \frac{m_e}{m_p} \rho_0 \times Q^{-1} = \frac{8\pi^5}{15} \frac{k_B^4}{(hc)^3} T_{MBR}^4$$

where k_B is the Boltzmann constant. The calculated value of T_{MBR} is:

$$T_{MBR} = \frac{E_0}{k_B} (\frac{15\alpha}{2\pi^3} \frac{m_e}{m_p})^{1/4} \times Q^{-1/4} = 2.725245\ K$$

which is in excellent agreement with experimentally measured value of $2.72548 \pm 0.00057\ K$ by D. J. Fixsen in 2009.

Let us proceed to calculate the value of T_{MBR} at different Ages of the World A_τ (see **Table 4**).

Table 4. The value of T_{MBR} at different Ages of the World.

Age	T_{MBR}
0.45 Byr (Beginning of Luminous Epoch)	6.47747 K
9.6 Byr (Birth of SS)	3.01403 K
14.22 Byr (Modern Epoch)	2.725245 K

Observe that all Macroobjects – galaxies, stars, planets, moons – have arisen in the cold World. Our SS, for instance, was created when the temperature of MBR was about $3\ K$. Therefore, any Model describing creation of Macroobjects must hold true in the cold World conditions.

3.14. Far-Infrared Background Radiation

The cosmic Far-Infrared (Far-IR) Background Radiation, which was announced in 1998, is part of

the Cosmic Infrared (IR) Background with wavelengths near one hundred microns that is the peak power wavelength of the black-body radiation at temperature 29 K. We calculate the temperature of its peak T_{FIRB} :

$$T_{FIRB} = (15/4\pi^5)^{1/4} E_0/k_B \times Q^{-1/4} = 28.955\ K$$

that is in an excellent agreement with experimentally measured value of $29\ K$.

3.15. Hubble's Parameter and Age of the World

The most important parameters in Cosmology are the Hubble's parameter H_0 and the Age of the World A_τ , which we can calculate by the following equations:

$$H_0 = \frac{8\pi hc}{a^3c^3} \times G_{av} = 68.73\ km\ s^{-1}Mpc^{-1}$$

$$A_\tau = \frac{1}{H_0} = \frac{a^3c^3}{8\pi hc} \times G_{av}^{-1} = 14.22\ Byr$$

We emphasize that the Hubble's parameter H_0 and absolute Age of the World A_τ are determined by the experimentally measured value of G_{av} !

3.16. Hubble Tension

The results of measurements of the Hubble's constant H_0 , which characterizes the expansion rate of the universe, shows that the values of H_0 vary significantly depending on Methodology. The disagreement in the values of H_0 obtained by the various teams far exceeds the standard uncertainties provided with the values. This discrepancy is called the **Hubble Tension**.

In frames of WUM, the Hubble tension can be explained in the following way:

- Hubble's law in Standard Cosmology is valid for BBM only when all galaxies start their movement from a single point named "Initial Singularity" that is not the case in WUM. The main conjecture of BBM: "*Projecting galaxy trajectories backwards in time means that they converge to the Initial Singularity at t=0 that is an infinite energy density state*" is wrong because all Galaxies are gravitationally bound with their Superclusters.
- In WUM, the three-dimensional Finite Boundless World presents a Patchwork Quilt of different Luminous Superclusters, which emerged at various places and Cosmological times.
- The redshift of the Centre of the Laniakea Supercluster is 0.0708. But it does not mean that it is moving away from MW. On the contrary, MW is moving away from the Centre of Supercluster. Some galaxies are moving toward MW, and the others are moving away (see **Figure 1**). Then redshift depends on the position and movement of a particular galaxy in the Supercluster against MW.

The more complicated situation with redshift is when galaxies belong to neighboring superclusters (see **Figure 2**). No wonder that according to S. Gupta, over 8300 blue-shifted galaxies have been discovered beyond the Local Group in 2009. The Andromeda Galaxy is the nearest major galaxy to MW which is blue-shifted. How to explain all these results in standard cosmology?

According to WUM, the value of H should be measured based on MBR only. The calculated value of the Hubble's parameter in 2013: $H_0 = 68.73\ km\ s^{-1}Mpc^{-1}$ is in excellent agreement with the most recent measured value in 2021: $H_0 = 68.7 \pm 1.3\ km\ s^{-1}Mpc^{-1}$ using only MBR data.

4. WUM Explanation of JWST Discoveries

Latest observations by JWST of the World can be explained in frames of WUM only:

- **It is a question of time!** The Beginning of the World was 14.22 Byr ago! Dark Epoch, when only UCM Macroobjects existed, lasted for 0.45 Byr. Luminous Epoch has existed ever since 13.77 Byr.
- Early-galaxies formed in near present configuration as the result of transition from Dark Epoch to Luminous Epoch due to the Explosive Volcanic Rotational Fission of Overspinning UCM Supercluster's Cores and self-annihilation of UCPs. Ordinary Matter is a byproduct of UCPs self-annihilation. There are no protogalaxies in the World. That is why JWST did not see their images.
- Compact Disk Galaxies emerged as a result of the Rotational Fission of the overspinning UCM Core of Superclusters. Each of them have one UCM Core. There were no frequent mergers of galaxies in the early epoch.
- According to Standard Cosmology, massive mature disk galaxies with mass up to $M^* \sim 10^{11} M_\odot$ cannot form for the amount of time $(100 - 400)\ Myr$, because it takes billions of years to form them. So, they should not be there at all at the 'beginning.'
- We hope that oldest candidate galaxies with high-redshifts up to $z > 20.4$ (light-travel distance $> 13.7\ Byr$) will be confirmed. It depends on their spectroscopical confirmation.

We emphasize that now with JWST we are looking for the earliest and most distant galaxies, and at the same time, **we live in one of the earliest galaxies –Milky Way!**

Contrary to C. Ilie, J. Paulin, and K. Freese who consider JADES-GS-z13-0 , JADES-GS-z12-0 , and JADES-GS-z11-0 (at redshifts z ∈ [11, 14]) as Supermassive Dark Stars made of hydrogen and helium but powered by Dark Matter heating [4], we see them as Galaxies with UCM Cores, which are UCM Reactors providing heating of them. In WUM, there are no Black Holes, which were discussed by R. Maiolino, *et al.* [9].

In our view, the unique observations of galaxy JADES-GS-z14-0 :

- Lack of dust inside [5].
- Star formation in the early universe may have been more efficient or occurred in intense bursts [6], [7].
- Significantly more massive and luminous than anticipated [8].
- Rapid mass assembly and metal enrichment during the earliest phases of galaxy formation [10].
- Properties of galaxy populations (2,375 redshifts in the range from z=0.5 up to z=13, including 404 at z>5) in the first billion years after BB [11].
- Spectroscopic redshifts for 178 of the objects targeted extending up to z=13.2 [12].
- Extremely massive galaxy candidates have been identified at z>7, in much larger numbers than expected. Population of ultra-massive galaxies accounts for 20% of the total cosmic star formation rate density [13].

can be explained by MOs formation process proposed by WUM (see Section 3.2).
The observations of Enceladus plume's composition and structure (the fluorescence emissions of H_2O at cryogenic temperatures 25 K and the stable observed outgassing rate 300 kg/s in 15 years [16]) can be explained by continuously working of UCM Reactor inside of Enceladus.

5. Classical Physics. Primary Notions

Principle of Relativity is the requirement that the equations describing the laws of physics have the same form in all admissible frames of reference (including inertial forces). For example, in the framework of Special Relativity the Maxwell equations have the same form in all inertial frames of reference. In the framework of General Relativity, Einstein's field equations have the same form in arbitrary frames of reference.
In **WUM**, this Principle is valid because the Medium of the World is an absolute frame of reference. Then, there is no need to discuss Special Relativity and General Relativity, which abandoned the Aether in 1905. 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, since the forces are expected to act uniformly throughout the universe, and should, therefore, produce no observable irregularities in the large-scale structuring over the course of evolution of the matter field that was initially laid down by BBM.
In **WUM**, this Principal 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 and consist of elementary particles with two-thirds of the total Matter. The distribution of MOs with one-third of the total Matter is spatially Inhomogeneous and Anisotropic and temporally Non-simultaneous, and therefore, this Principal is not viable for the entire World.
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, conservation of linear momentum and angular momentum, and conservation of electric charge.
One particularly important result concerning conservation laws is Noether theorem, which states that there is a one-to-one correspondence between each one of them and a differentiable symmetry of nature:

- Conservation of energy follows from the time-invariance of physical systems.
- Conservation of linear momentum follows from the space-translation invariance (translation along x, y, z directions).
- Conservation of angular momentum follows from the rotation invariance (rotation about x, y, z axes).

Angular Momentum is a problem of all existent cosmological models including BBM. Old-timers of Cosmology should solve this problem.

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. Main Results of WUM

6.1. Predictions

Summary of the calculated by WUM in 2013 cosmological parameters and experimentally measured parameters are presented in **Table 5**. We emphasize that WUM allows for precise calculation of values that were only measured experimentally earlier and makes verifiable predictions.
"*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 is a confirmation of one of the most important predictions of WUM in 2013: "*Macroobjects of the World have cores made up of the discussed DM (UCM) particles. Other particles, including DM (UCM) and baryonic matter, form shells surrounding the cores*."

Table 5. 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 ± 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 World	$14.226\ Byr$		

JWST discoveries confirm the most important predictions of WUM in 2018:

- Absolute Age of World is 14.22 Byr.
- Dark (invisible) Epoch (spanning for Laniakea Supercluster (LSC) from the Beginning of the World for 0.45 Byr) when only UCM MOs form and evolve.
- Luminous Epoch (ever since, 13.77 Byr for LSC) when Luminous MOs (superclusters, galaxies, ESS, etc.) emerge.
- Transition from Dark Epoch to Luminous Epoch is due to Explosive Volcanic Rotational Fission of Overspinning (surface speed at equator exceeding escape velocity) UCM Supercluster's Cores and self-annihilation of UCPs.
- MOs of the World form from top (Superclusters) down to Galaxies and ESS in parallel around different Cores made up of different UCPs.
- Three-dimensional Finite Boundless World presents a Patchwork Quilt of different Luminous Superclusters, which emerged in various places of the World at different Cosmological times.

6.2. Explained Problems [20]

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

- Angular Momentum problem in birth and subsequent evolution of Galaxies and ESS explained by Explosive 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 Volcanic 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 UCM 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, radiation are produced by MOs themselves as the result of UCPs self-annihilation in their different UCM cores.
- Plutonium-244 with half-life of eighty million years exists in Nature. It is not produced by the nuclear fuel cycle, because it needs extremely 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.

- Expanding Earth hypothesis asserts that the position and relative movement of continents is at least partially due to the volume of Earth increasing. In WUM, the Earth's UCM core absorbs new UCPs, and its size is increasing in time $\propto \tau^{1/2}$. Hence, there is an expansion of UCM core, and its surface (the Upper mantle with Crust) is stretching. Due to UCPs self-annihilation, new chemical elements are created inside of the Upper mantle with Crust. As a result, the relative movement of continents is happening.
- 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 a byproduct of UCPs self-annihilation. This problem does not arise since antimatter does not get created by UCPs self-annihilation.
- Black-body spectrum of Microwave Background Radiation is due to thermodynamic equilibrium of photons with Intergalactic plasma.
- Unidentified IR Discrete Emission Bands with peaks 3.3, 6.2, 7.7, 8.6, 11.2, and 12.7 μm explained by a self-annihilation of UC particles UCF4 (0.2 eV).
- 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.
- Lightning Initiation problem and Terrestrial Gamma-Ray Flashes are explained by the self-annihilation of UCPs in Geocorona.
- Ball Lightnings are objects that have cores made up of UCPs surrounded by electron-positron plasma shells contaminated by chemical elements of soil and air as the result of Terrestrial Gamma-Ray Flash strikes of the ground. WUM predicts a new phenomenon—a generation of BLs according to the proposed model of them. Once we master the creation of BLs in a controlled environment, we can concentrate our efforts on harvesting that energy from an infinite Source—the Medium of the World with UCPs.
- 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 quantum mechanics, particularly 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 [21]. Richard 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 [22]. 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 ϕ_{DB} is defined as [23]:

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

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's corona, 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^3.
- On Earth's orbit (1 AU): The density averages between 5 to 10 particles/cm^3.
- Beyond 1 AU: The density decreases with the inverse square of the distance, reaching as low as 0.001 - 0.005 particles/cm^3 between 80 to 120 AU, before rapidly increasing near the heliopause to 0.05 - 0.2 particles/cm^3.

  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."

7. Why is Infrared Radiation Important to Astronomy?

According to "An ESA Mission with Participation from NASA," there are three basic reasons for this [24]:

1. **It is cold out there.** Most of the light in the Universe is in IR and longer wavelengths.
2. **It is dusty out there.** A number of things of great interest to astronomy are hidden within or behind vast clouds of gas and dust. Our view is blocked in visible light because the dust grains are about the same size as optical wavelengths, about one micron or less, and so are highly effective at scattering or absorbing that light. But longer IR wavelengths undulate around the dust. And the longer the wavelength, the thicker the layer of dust it can penetrate. So Far-IR and submillimeter radiation can move freely through the Universe, unobstructed by dust.
3. **The Universe is expanding**. Galaxies outside our own group are traveling away from us with the expansion of the universe, and the more distant they are, the faster they are receding. As they speed away, their light is "redshifted" to longer wavelengths. Light that starts out at optical wavelengths may be stretched into infrared.

Optical astronomy has been around since the first humans looked up and started to chart the motions of the heavens. We have boosted our powers of observation with instruments since 1609, when Galileo pointed a telescope at the moon. But it is only within the last half-century that we have begun to explore the Universe in IR. And the results were astonishing.

The first IR survey of the sky, published in 1965, revealed ten objects that optical telescopes could not see. By 1969, thousands of new objects had been discovered in IR.

More recently, IR astronomy made the surprising discovery that **Jupiter, Saturn, and Neptune have internal sources of heat**. In WUM, it means that they have UCM Reactors inside of them.

IR astronomy found a hundred thousand red giant stars in the central bulge of MW, and ices of water, methane, carbon dioxide, formaldehyde, and carbon monoxide in interstellar space.

IR observations of galaxies 10 Bly away found star-formation at a rate three to four times greater than optical surveys had indicated, dramatically changing our understanding of the early Universe.

IR part of the spectrum spans from about 0.75 μm to a few hundred micrometers :

- JWST's four instruments provide wavelength coverage from 0.6 to 28.5 μm (Mid-Infrared). $z_{max} = 46.5$.
- Herschel Space Observatory covered wavelengths from 55 to 672 μm (Far-IR – Submillimeter). This is also the best part of the electromagnetic spectrum for observing key chemicals in space. About 130 kinds of chemicals have been detected so far in the interstellar medium, and most have rotational spectra - the photon emissions induced by the rotation of the molecules - with wavelengths that peak in the submillimeter range. These include the many forms of water, and the organic molecules thought to be necessary for life.

  The Primeval Structure Telescope (PaST), also called 21-cm Array, is a Chinese radio telescope array designed to detect the earliest luminous objects in the universe. This wavelength falls within the microwave radio region of the electromagnetic spectrum, and it is observed frequently in radio astronomy, since those radio waves can penetrate the large clouds of interstellar cosmic dust that are opaque to visible light.

According to WUM, **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 MW) when only UCM MOs existed. They have

UCM Nuclei made up of UCF1 and UCF2 (1.3 TeV, 9.6 GeV) surrounded by shells of UCF3 and UCF4 (3.7 keV, 0.2 eV).
According to WUM:

- Unidentified IR emission bands around peaks at 3.3, 6.2, 7.7, 8.6, 11.2, 12.7 μm, which are the fingerprints of all galaxies, explained by a self-annihilation of UCF4 (0.2 eV).
- 21-cm Emission with the broad line-width (~ 200 km s^{-1}) explained by the self-annihilation of an **ensemble** of ultra-relativistic UCPs **XIONs** (5.3 μeV).

It means that Far-IR and Radio observatories can observe UCM Macroobjects existing in Dark (invisible) Epoch before Luminous Epoch! These observations would provide further confirmation of WUM and deepen our understanding of the World's fundamental structure.
WUM predicts the existence of UCPs with rest energies of 1.3 TeV, 9.6 GeV, 70 MeV, 340 keV, 3.7 keV, 0.2 eV, and 5.3 μeV . Future efforts should focus on observing cosmic gamma-rays with spectral lines corresponding to these predicted UCPs rest energies.

8. Conclusion

Hypersphere World-Universe Model is consistent with all Concepts of the World. The Model successfully describes primary cosmological parameters and their relationships. WUM allows for precise calculation of values that were only measured experimentally earlier and makes verifiable predictions. The remarkable agreement of calculated values with the observational data gives us considerable confidence in the Model. Great experimental results and observations achieved by Astronomy in last decades should be analyzed through the prism of WUM. Considering JWST's discoveries, WUM's achievements, and 87 years of Dirac's proposals, it is time to initiate a fundamental transformation in Astronomy, Cosmology, and Classical Physics.

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. I am grateful to the anonymous referee for the important critical remarks. Special thanks to my son, I. Netchitailo, for helping me clarify the Model and enhance its understanding.

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Hypersphere World-Universe Model – Natural Extension of Classical Physics

Digest

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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 10^7th 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 $\rho_M \propto \tau^{-1}$ (τ 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 τ: $G \propto \tau^{-1}$.

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

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.*

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_∞ 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_∞ 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/ν 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 $\boldsymbol{h}$ **represents a factor that converts units of frequency** $\boldsymbol{\nu}$ **into units of energy** $\boldsymbol{E}$. In 1901, Planck calculated the value of h from experimental data: $h = 6.55 \times 10^{-34}\, J \cdot s$, 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_∞, 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 :

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

- Dimensionless Rydberg constant α :

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

It is worth noting that the constant α 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 $a_o = a/2\pi$, 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** τ 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 τ. 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 ($\gtrsim 10^3$), 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 TeV	DIRAC	$\alpha^{0}E_0$	70.025252 MeV
UCF2	$\alpha^{-1}E_0$	9.5959804 GeV	ELOP	$2/3\alpha^{1}E_0$	340.66596 keV
UCF3	$\alpha^{2}E_0$	3.7289394 keV	XION	$1/2\,\alpha^{6}E_0$	5.2870895 μeV
UCF4	$\alpha^{4}E_0$	0.19857107 eV			

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

$$E_0 = hc/a = 70.025252\ \ MeV$$

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 μeV).

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 μeV 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 $\sim 400\ km\ s^{-1}$, 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 ~ 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 $\sim 13.5\ Bly$ away, and a candidate galaxy F200DB-045 that is $\sim 13.7\ Bly$ 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 ± 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 ϕ_{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^3.

  On Earth's orbit (1 AU): The density averages between 5 to 10 particles/cm^3.

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

  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 Principal 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.

World-Universe Cosmology. Principal Points. Presentation

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Abstract

The Hypersphere World–Universe Cosmology (WUC) addresses numerous unresolved issues in modern Astrophysics and Cosmology by providing alternative explanations to the prevailing Big Bang Theory (BBT).

WUC solves critical problems such as:

- The Hubble tension.
- The missing baryon problem.
- The origin of Fermi bubbles.
- The age of the Universe discrepancy.
- The coronal heating problem.
- Internal heating and diversity of gravitationally-rounded objects in the solar system.
- The presence of Plutonium-244, with the 80-million-year half-life, in nature.
- Faster core rotations of the Sun and Earth compared to their surfaces.
- The faint young Sun paradox.
- The black-body spectrum of cosmic microwave background radiation.

Additionally, **WUC eliminates** fundamental issues, including:

- The need for the Universe to begin at $t=0$, avoiding a temporal singularity.
- The angular momentum problem in galaxies and extrasolar systems evolution.
- The matter-antimatter asymmetry.
- The magnetic monopole problem.
- The uneven distribution of matter and voids.
- Singularities leading to black holes.
- The formation of supermassive black holes.
- The "Axis of Evil" anomaly in cosmic microwave background measurements.
- The wave–particle duality dilemma.

1. Introduction

Scientific theories are founded on axioms, hypotheses, or assumptions, which serve as starting points for logical reasoning. The WUC is fundamentally distinct from the BBT, offering a framework that bypasses the initial singularity and inflation, while also addressing long-standing cosmological challenges.

Building upon P. Dirac's 1937 Hypothesis of Large Numbers and Variable Gravitational Constant, WUC incorporates a mechanism of continuous matter creation. This innovative approach resolves several key gaps in understanding the World's evolution and structure, paving the way for a more comprehensive cosmological paradigm.

This Presentation is based on the published manuscript: Netchitailo, V.S. (2024) JWST Discoveries and the Hypersphere World-Universe Model: Transformative New Cosmology. *Journal of High Energy Physics, Gravitation and Cosmology*, **10**, 1806-1834. doi: 10.4236/jhepgc.2024.104102.

2. Comparison between WUC and BBT

2.1. Space and Time

BBT posits that we exist within a spacetime framework, a mathematical model that unifies the three spatial dimensions (x, y, z) with a temporal dimension (ict). Here, i represents the imaginary unit, c is the speed of light in a vacuum, and t is cosmic time—a coordinate commonly used in BBT. This results in a "four-dimensional continuum" also known as spacetime, which is, in fact, a **4-manifold**. However, this abstract, imaginary construct may raise questions for those seeking a more intuitive understanding of the Universe.

WUC proposes the **Hypersphere**, a **3-manifold** that locally behaves like a regular Euclidean 3D space. This concept is analogous to how the **2-manifold** surface of the Earth appears flat to observers on a small scale. Similarly, the Hypersphere provides a more physically grounded model of the World's structure. Within WUC, **absolute cosmological time** (τ) serves as a universal temporal factor, independent of any physical phenomenon or observer. This contrasts with the relative nature of time in BBT, offering a more straightforward and physical basis for describing temporal evolution. Overall, the **assumptions of WUC are rooted more deeply in physical intuition and observation compared to the abstract foundations of BBT**.

2.2. Initial Conditions

BBT introduces a concept of an "Initial Singularity," a state where all the matter and energy of the universe were compressed into an infinitesimally small point with infinite energy density. At $t = 0$, spacetime began to expand extremely rapidly—a process known as inflation. However, this raises fundamental questions: *What existed before t=0 ?* and *Where is the center of the Universe's expansion?* These questions remain unanswered within the framework of BBT.

WUC offers an alternative explanation, suggesting that a fluctuation within the Eternal Universe gave rise to a **4D Nucleus of the World**. This nucleus, with an extrapolated radius equal to the fundamental unit (a), possessed a finite extrapolated energy density of Its surface—approximately 10,000 times less than nuclear density. Unlike BBT's singularity, the WUC model avoids infinite densities and inflation. The Nucleus expands in Its fourth spatial dimension at a constant speed (c) that is a gravitodynamic constant. This results in the uniform stretching of the Nucleus's surface, forming the **Hypersphere World**. Crucially, this model eliminates the need for dark energy to explain cosmic expansion.

Key Difference: In BBT, all matter existed at $t=0$, originating from the singularity. In contrast, WUC posits continuous matter creation within the evolving World, offering a dynamic and non-singular explanation for the World's structure and development.

2.3. Structure of the World

BBT: Assumes an almost Infinite homogeneous and isotropic universe around the initial singularity.

WUC: Describes a Finite Boundless World (the Hypersphere of the Nucleus) as a Patchwork Quilt of various main Superclusters in the Cosmic Medium which emerge in different regions of the World at different cosmological times.

2.4. Cosmic Medium

BBT: Often implies a vacuum state in the universe.

WUC: Proposes that the World's homogeneous and isotropic Cosmic Medium (CM) consists of protons, electrons, photons, neutrinos, and Universe-Created Particles (UCPs), previously referred to as "Dark Matter Particles." WUC 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

connected with the Impedance, Gravitomagnetic parameter, and Energy density of CM, respectively. It follows that neither Time, Space nor Gravitation could be discussed in absence of CM. **There is no Cosmic Medium – there is Nothing!** The rejection of the Luminiferous Aether by Special Relativity in 1905 was a critical moment for Classical Physics; however, CM proposed by WUC could be considered a revival of this concept, acting as a savior for Classical Physics.

2.5. Angular Momentum Problem

BBT: Does not explicitly emphasize the creation and conservation of the angular momentum in its foundational principles.

WUC: Stands out as the only theory that provides a mechanism for the angular momentum creation and is consistent with the fundamental law of its conservation.

2.6. Macroobject Formation

BBT: Macroobjects form in the following sequence: Extrasolar Systems → Galaxies → Superclusters.

WUC: Macroobjects (MOs) form in the opposite sequence: Superclusters → Galaxies → Extrasolar Systems due to an Explosive Volcanic Rotational Fission of Superclusters' Overspinning Cores (made up of UCPs), which were created by the Universe during the "Dark (invisible) Epoch." The formation of Galaxies and Extrasolar Systems is not a process that concluded ages ago; instead, it is ongoing.

3. Hypersphere World-Universe Cosmology

3.1. Assumptions

1) The World is a Finite Boundless Hypersphere of a 4D Nucleus of the World that is expanding along a fourth spatial dimension of the Nucleus with speed equals to a gravitodynamic constant c.

2) The Eternal Universe is **the Creator** of the Universe-Created Matter that is continuously created at the Nucleus. Ordinary Matter is a byproduct of UCPs self-annihilation. **The Universe is Everything!**

3) Two fundamental parameters in various rational exponents define all macro and micro features of the World: dimensionless Rydberg constant $\alpha = (2aR_\infty)^{1/3}$ (that is named the fine-structure constant now and R_∞ is the Rydberg constant) and time-varying quantity Q that is, in fact, the Dirac's Large Number. We stress that the best theory is the one which is based on the minimum number of dimensionless parameters.

3.2. Hypersphere World

WUC introduce the concept of the Hypersphere World to address the absence of the center of expansion in the 3D universe, associated with "Initial Singularity." In frames of WUC, a center of the expansion resides in the center of 4D Nucleus. The expansion of the Nucleus causes a stretching of Its surface, which constitutes the Hypersphere World.

Although we cannot directly measure the radius of the curvature R of the World in the fourth spatial dimension, we know that the World stretches without the center of expansion. According to WUC, all parameters of the World depending on a dimensionless time-varying quantity Q, which is a ratio of radius R to a ($Q = R/a$), are a manifestation of a Worlds' curvature in the fourth spatial dimension.

Leveraging Inter-Connectivity of primary cosmological parameters revealed by WUC, we demonstrate that the gravitational parameter G_{av}, which can be measured directly, enables the determination of all other cosmological parameters that are not directly measurable. Using G_{av}, we calculate the radius of the curvature R as follows: $G_{av} \rightarrow Q_{av} \rightarrow R = a \times Q_{av} = 1.3459{\times}10^{26}\ m$.

3.3. Universe-Created Matter

In our previous articles, we followed the standard paradigm "**Dark Matter**" that is not quite right for WUC, 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** with **Rest Energies** (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 (UCM).

It is worth noting that the rest energy of electron E_e equals to: $E_e = \alpha \times E_0$ and the Rydberg unit of energy is: $Ry = 0.5\alpha^3 \times E_0$ (E_0 is a basic energy unit). Considering these two well-known equations and the main goal of WUC – two dimensionless parameters only (α and Q), we proposed for UCPs the values of rest energies, which must be constant (created by the Universe) and therefore are proportional to rational exponents of α .

Table 1. Universe-Created Particles.

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

In this Table, a basic energy Unit E_0 equals to:

$$E_0 = hc/a = 70.025252\ MeV$$

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

The 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(1971) that is typically the brightest persistent source of **hard X-rays with energies up to sixty keV** . In 2000, R. Minchin, *et al.* discovered binary galaxy system VIRGOHI 21 with NGC 4254, which has the **21-cm emission**.

The reason for this multicomponent UCM system was to explain: the diversity of Very High Energy gamma-ray sources in the World and the diversity of UCM Cores of Macroobjects (Superclusters, Galaxies, and Extrasolar systems), which are Fermion Compact Objects and UCM Reactors in WUC.

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; UC Matter radiates **Gamma rays,** which are emitted by nuclei, due to self-annihilation of UCPs with rest energies, covering eighteen orders of magnitude.

The signatures of UCPs self-annihilation with predicted rest energies of 1.3 TeV; 9.6 GeV; 70 MeV; 340 keV; 3.7 keV; 0.2 eV; 5.3 μeV are found in spectra of diffuse gamma-ray background and the emissions of various MOs in the World.

For example, the excess GeV emission ~10 GeV were reported by D. Hooper, *et al.* (2011) from the Galactic Center that corresponds to UCF2 particles self-annihilation. It is worth noting that a similar excess of gamma-rays was observed in the central region of the Andromeda galaxy (M31). S. Profumo, *et al.* (2018) calculated the expected emission across the electromagnetic spectrum in comparison with available observational data from M31 and found that the best fitting models are with the UCPs with rest energy about 11 GeV .

3.4. Macroobject Shell Model

In WUC, Macrostructures of the World (Superclusters, Galaxies, Extrasolar systems) have Nuclei made up of UCFs, which are surrounded by Shells composed of UCM and Baryonic Matter. The shells envelope one another, like a Russian doll. The lighter the particle, the greater the radius and the mass of its shell. Innermost shells are the smallest and are made up of heaviest particles; outer shells are larger and consist of lighter particles. We developed a theory of Fermion Compact Objects. A proposed Weak Interaction of UCPs provides integrity of all shells. **Table 2** describes parameters of MOs' Cores, which are 3D fluid balls with a very high viscosity and function as solid-state objects.

Table 2. Parameters of Macroobjects' Cores made up of different Fermions in present Epoch.

Fermion	Rest Energy E_f, MeV	Macroobject Mass M_{max}, kg	Macroobject Radius R_{min}, m	Macroobject Density ρ_{max}, kgm^{-3}
UCF1	1.3×10^{6}	1.9×10^{30}	8.6×10^{3}	7.2×10^{17}
UCF2	9.6×10^{3}	1.9×10^{30}	8.6×10^{3}	7.2×10^{17}
Electron-Positron	0.51	6.6×10^{36}	2.9×10^{10}	6.3×10^{4}
UCF3	3.7×10^{-3}	1.2×10^{41}	5.4×10^{14}	1.8×10^{-4}
UCF4	2×10^{-7}	4.2×10^{49}	1.9×10^{23}	1.5×10^{-21}

The calculated parameters of the shells show that:

- Nuclei, made up of UCF1 and/or UCF2, compose Cores of dark stars in Galaxies and normal stars in Extrasolar Systems.
- Shells of UCF3 and/or Electron-Positron plasma around Nuclei made up of UCF1 and/or UCF2 make up Cores of Galaxies.
- Nuclei, made up of UCF1 and/or UCF2 surrounded by shells of UCF3 and UCF4, compose Cores of Superclusters.

3.5. Principal Points

Beginning. The World was started by a Fluctuation in the Eternal Universe, and the Nucleus of the World, which is the 4D ball, was born. An extrapolated Nucleus radius at the Beginning was equal to the basic size unit of $a = 1.7705641 \times 10^{-14}\, m$. 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 the 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 the 4D Nucleus Expansion, the World Stretching, Creation of Matter, and Arrow of Time, which does not depend on any physical phenomenon in the World. It is the result of the Nucleus expansion due to the driving force for surfaces to be created. It constitutes the prime hypothesis of WUC. Creation of UCM occurs homogeneously in all points of the World.

Content of the World. The World consists of CM and MOs. Total energy density of the World equals to the critical energy density throughout the World's evolution. The energy density of CM 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 about 4.8% in CM and 2.4% in MOs.

Homogeneous and Isotropic Cosmic Medium, consisting of protons, electrons, photons, neutrinos, and UCPs, is an active agent in all physical phenomena in the World. WUC belongs to Classical Physics. In WUC, classical notions can be introduced only when the very first ensemble of particles was created at a cosmological time $\tau \cong 10^{-18}\ s$ and the notion "Cosmic Medium" can be introduced. **Classical Physics deals with ensembles of quantum objects!**

Time, Space and Gravitation relate to the Impedance, Gravitomagnetic parameter, and Energy density of CM, respectively. It follows that neither Time, Space nor Gravitation could be discussed in absence of CM. **There is no Cosmic Medium – there is Nothing!**

WUC is based on **Cosmological Time** τ that marches on at the constant pace from the Beginning of the World up to the present Epoch along with time-varying Cosmological Parameters, including Hubble's parameter H, which are inversely proportional to τ ($H = \tau^{-1}$). The value of H should be measured based on the Cosmic Microwave Background Radiation data only.

Rotational Fission. The mechanism that can provide Angular Momenta to MOs is the Rotational Fission of overspinning (surface speed at equator exceeding escape velocity) Prime Objects. From the point of view of Fission theory, 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 momenta of its satellites. In WUC, 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) galaxy) when only UCM Macroobjects existed.

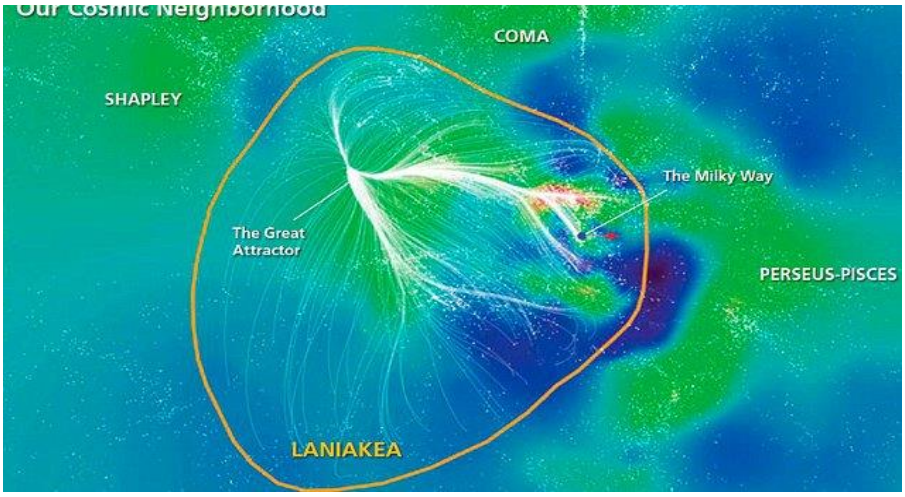
Luminous Epoch has lasted ever since 13.77 Byr when Luminous MOs emerged due to the Explosive Volcanic Rotational Fission of Overspinning UCM Supercluster's Cores. It looks like a Firework of UCM cores of satellites at the same time, so that the direction of the sum of satellites angular momentum coincides with the angular momentum of the 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 Structure. MOs of the World possess 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 in CM, which emerged in various regions 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.

Laniakea Supercluster (LS) with binding mass $\sim 10^{17}\, M_{\odot}$ is home to MW and about one hundred thousand other nearby galaxies, which did not start their movement from "Initial Singularity." All these galaxies are moving around the Center of LS according to Gravitational Laws for masses and mass-currents with the **time-varying parameter** G. Neighboring superclusters Shapley, Coma, and Perseus-Pisces have the same structure.



The stretching of the Hypersphere World can be explained in the following way: the radius of the 4D Nucleus of the World increases along an imperceptible fourth spatial dimension; Its surface area grows; the distance between Centers of main Superclusters increases. **There is no need for Dark Energy**!

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.

A supernova is a powerful and extremely bright explosion that occurs at the end of a massive star's life cycle, releasing vast amounts of energy and matter into space. The temperature of CM will asymptotically approach absolute zero.

Thanks to the revealed by WUC **Inter-Connectivity of Primary Cosmological Parameters**, we show that the 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.

3.6. Most Direct Observational Evidence of Validity of WUC

Cosmic Microwave Background Radiation, Far-Infrared Background Radiation, Intergalactic Plasma, speak in favor of existence of the **Cosmic Medium.**

MW is gravitationally bounded with the Virgo Supercluster and has an orbital Angular Momentum, which far exceeds rotational Angular Momentum of MW. WUC is the only cosmological theory that aligns with the **Law of Creation and Conservation of Angular Momentum.**

Galaxy clusters are particularly important for UCM studies. Mass-to-light ratio of the Virgo Supercluster is ~ 300 times larger than that of Solar ratio. Similar ratios are obtained for other superclusters. These ratios are main arguments in favor of presence of significant amounts of **Universe-Created Matter** in the World.

Masses of superclusters can be estimated in two independent ways: from the scatter in radial velocities of galaxies within clusters and by Gravitational lensing that can measure cluster masses without relying on observations of dynamics.

The existence of “Dark Matter” is accepted by astronomers and orthodoxies of BBT, but WUC is the only theory, which proposes the **Composition** of it.

Cosmic Medium, Universe-Created Matter, and Angular Momentum are three main Pillars of WUC.

4. Conclusion

The Hypersphere World-Universe Cosmology presents a new paradigm and a fresh approach to understanding the Universe and the science of Cosmology. It builds on the foundations of Classical Physics and has the potential to challenge core assumptions in both Cosmology and Classical Physics. Rather than claiming to explain all existing cosmological data or presenting a fully developed theory, WUC serves as a starting point for a New Cosmology envisioned by Paul Dirac in 1937. While further refinement by the global physics community is essential, World-Universe Cosmology’s insights, combined with the groundbreaking discoveries of the JWST and the legacy of Dirac's ideas over 87 years, underscore the need for a Paradigm Shift in Astronomy, Cosmology, and Classical Physics.

Hypersphere World-Universe 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 thirty-eight of 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.

Vladimir Netchitailo

Vladimir S. Netchitailo holds a Master of Science degree from the Moscow Institute of Physics and Technology, a Ph.D. in Quantum Electronics from the Lebedev Physical Institute, and a Doctor of Sciences in Laser Physics from the Moscow Institute of General Physics. Over his career, Dr. Netchitailo has authored more than two hundred scientific papers, including forty articles co-authored by A. Prokhorov, a Nobel Laureate in Physics. Since 2001, Dr. Netchitailo has been developing the World-Universe Model (WUM), which represents a change in basic assumptions in cosmology. In 2013, WUM made precise predictions for several key parameters, including the gravitational constant, Hubble’s constant, intergalactic plasma concentration, and the minimum energy of photons. These predictions were confirmed by independent observations between 2015 and 2021. One of WUM’s most significant contributions was its prediction in 2013 that macroobjects, such as galaxies and stars, possess cores composed of specific Universe-Created Particles (UCPs). Surrounding these cores are shells formed by additional UCPs and ordinary particles. This prediction was supported by the 2020 Nobel Prize-winning discovery of a supermassive compact object at the center of the Milky Way, made by R. Genzel and A. Ghez. Dr. Netchitailo is also a member of the John Chappell Natural Philosophy Society, underscoring his commitment to exploring innovative approaches in physics and cosmology.

Four Spatial Dimension World-Universe Cosmology

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Abstract

This article represents the culmination of a decade-long effort to develop the World-Universe Cosmology (WUC), building upon a series of published works. These include the first one, "*5D World-Universe Model. Space-Time-Energy*" [1] and the last one, "*JWST Discoveries and the Hypersphere World-Universe Model. Transformative New Cosmology*" [2], both featured in the *Journal of High Energy Physics, Gravitation and Cosmology.* WUC is a unified model of the World built around the concept of the Cosmic Medium, composed of particles (protons, electrons, photons, neutrinos, and universe-created particles). WUC provides a mathematical framework that enables precise calculation of Medium-bound physical parameters: Gravitational parameter, Hubble's parameter, Absolute age of the World, Intergalactic plasma parameters, Temperature of microwave background radiation and the Minimum energy of photons. This paper aligns WUC with the theoretical framework developed by P. Wesson and J. Overduin [3], [4], albeit assigning a new physical meaning to the fourth spatial coordinate associated with the total energy of the observable World.

1. Introduction

In 1937, P. Dirac proposed a new basis for cosmology: the hypothesis of a variable gravitational "constant" G [5]; and later (1974) added the notion of continuous creation of matter in the World [6].

In 1983, P. Wesson developed 5D Space-Time-Mass theory that associates the fourth spatial coordinate $x^4 = Gm/c^2 \propto t$ with the rest mass of particles. The gravitational constant serves as the dimension-transposing parameter [3].

According to J. Overduin and P. Wesson (1994): *"a fifth dimension might be associated with rest mass via* $x^4 = Gm/c^2 \propto t$*. The chief effect of this new coordinate on four-dimensional physics was that particle rest mass, usually assumed to be constant, varied with time"* [4]. It worth noting that in WUC the **gravitational parameter** $G \propto \tau^{-1}$ and this "chief effect" does not arise.

J. Overduin and P. Wesson postulated [4] that "*Metrics which do not depend on* x^4 *can give rise only to induced matter composed of* (massless) *photons* (this is the case of the Big Bang Model); *while those which depend on* x^4 *give back equations of state for fluids composed of massive particles"* (this is the case of WUC).

WUC supplies this "fluid" that J. Overduin and P. Wesson have predicted: it is, in fact, the Cosmic Medium (CM) of the Observable World (OW). According to WUC, empty space does not exist; instead, OW is filled with CM that consists of particles with rest energy: protons, electrons, photons, neutrinos, and Universe-Created Particles (UCPs). The Inter-galactic voids discussed by astronomers are, in fact, examples of CM in its purest. Consequently, the Cosmic Medium of OW as described by WUC can serve as further evidence in favor of the four spatial dimension view of WUC.

WUC follows these ideas, albeit introducing a different mechanism of matter creation and the fourth spatial coordinate associated with the total energy of OW, which is a 3D Hubble Bubble.

2. Fundamental Issues in Cosmology

It is well-known that any theory is based on certain hypotheses. WUC and Big Bang Model (BBM) are principally different models with fundamentally different hypotheses [2]:

Initial Conditions:

- **BBM**: Proposes an "Initial Singularity" with infinite energy density of the total Matter of the universe, which was created from Nothing. The need for the universe to begin at t=0 , avoiding a temporal singularity. Extremely rapid expansion of spacetime (inflation). There is no center of expansion in the 3D universe.

- **WUC:** Suggests a fluctuation in the Eternal Universe that created a four spatial dimension Nucleus of the World with an extrapolated radius equal to a basic size unit: $a = 1.7705641 \times 10^{-14}\, m$. The World is a Hypersphere of the Nucleus and had a finite extrapolated energy density (about 10^4 times less than nuclear density). The Nucleus expands in Its fourth spatial dimension at the speed c (a gravitodynamic constant that is identical to the electrodynamic constant c in Maxwell's equations), resulting in the even stretching of the World. There is no need for dark energy!

Structure of Observable World:

- **BBM:** Assumes an almost infinite homogeneous and isotropic universe around the initial singularity with the age 13.787 ± 0.020 Byr. The observable universe is a spherical region of the universe consisting of all matter that can be observed from the Earth with the diameter of $93\ Bly$.
- **WUC:** Describes the Finite Boundless World that is the Hypersphere of the 4D Nucleus with the 3-dimensional surface volume of $V_H = 2\pi^2 R^3$. The absolute age of OW is 14.226 Byr. The observable world is the 3D Hubble Bubble with the radius $R = 14.226\, Bly$, the volume $V_{OW} = 4\pi R^3/3$, and the total volume $V_{OWT} = 2\pi R^3$. It is a Patchwork Quilt of various main luminous superclusters ($\gtrsim 10^3$). The ratio of V_H to V_{OWT} is: $V_H/V_{OW} = \pi$. It means that in the Hypersphere World could exist three "Parallel Worlds" with the same laws of physics because all points of the Hypersphere are equivalent and there are no preferred centers in It.

Cosmic Medium of Observable World:

- **BBM:** Often implies a vacuum state in the universe.
- **WUC:** Proposes that CM, which is both homogeneous and isotropic, while the distribution of Macroobjects (MOs) is spatially inhomogeneous, anisotropic, and temporally non-simultaneous. CM consists of protons, electrons, photons, neutrinos, and UCPs, previously referred to as "Dark Matter Particles." The rejection of the luminiferous aether in 1905 was a critical moment for Classical Physics; however, CM proposed by WUC could be considered a revival of this concept, acting as a savior for Classical Physics.

Conservation Laws:

- **BBM:** Does not explicitly emphasize the creation and conservation of angular momentum in its foundational principles.
- **WUC:** Stands out as the only cosmological model that provides a mechanism for angular momentum creation and is consistent with the fundamental law of its conservation.

Macroobject Formation:

- **BBM:** MOs form from the bottom – extrasolar systems (ESS) up to galaxies and superclusters.
- **WUC:** MOs form from the top – superclusters down to galaxies and ESS due to an Explosive Volcanic Rotational Fission of Superclusters' Overspinning Cores (made up of UCPs), which were created by the Universe during the "Dark (invisible) Epoch" for 0.44 Byr. The formation of galaxies and ESS is not a process that concluded ages ago; instead, it is ongoing.

In conclusion. WUC presents a radically different approach to understanding OW compared to BBM, challenging long-held assumptions, and offering new perspectives on the fundamental nature of Cosmology and Classical Physics. The hypotheses of BBM are mathematical, while those of WUC are more physical in nature. Both models may seem incredible, but there is a key difference: BBM fails to explain many of the experimental results observed by contemporary Astronomy, whereas WUC does [2]!

3. Why Four Spatial Dimension Observable World?

1) WUC introduced the concept of the Hypersphere World to address the absence of the center of expansion in the 3D universe, associated with "Initial Singularity." In frames of WUC, the center of expansion resides in the center of the 4D Nucleus.
2) The expansion of the Nucleus causes the stretching of Its surface, which constitutes the Hypersphere World. There is no need for dark energy.
3) Creation of Matter is a direct consequence of the Nucleus expansion in the fourth spatial dimension associated with the total energy of OW. Creation of UCPs occurs homogeneously in all points of the Hypersphere World.
4) J. Overduin and P. Wesson postulated that "*Metrics which depend on* x^4 *give back equations of state for fluids composed of massive particles."* WUC supplies this "fluid," which consists of "massive" particles with rest energy: protons, electrons, photons, neutrinos, and UCPs.
5) According to WUC, all parameters of OW depending on a dimensionless time-varying quantity Q, which is a ratio of radius R to a basic size unit a ($Q = R/a$), are a manifestation of the Worlds' curvature in the fourth spatial dimension.
6) Leveraging the Inter-Connectivity of primary cosmological parameters revealed by WUC, we demonstrate that the gravitational parameter G_{exp}, which can be measured directly, enables the determination of all other cosmological parameters that are not directly measurable. Using G_{exp}, we calculate the radius of the curvature R as follows: $G_{exp} \rightarrow Q_{exp} \rightarrow R = a \times Q_{exp} = 1.3459 \times 10^{26}\ m$.

4. Energy Density of Observable World

In WUC, the observable World is the Hubble Bubble with the radius $R = c\tau$ (where c is a gravitodynamic constant that is identical to the electrodynamic constant c in Maxwell's equations and τ is a cosmological time) and an energy density of a spherical surface σ_0 that is a temperature invariant surface enthalpy [7]:

$$\sigma_0 = hc/a^3$$

where h is the Planck constant. With Nikola Tesla's principle at heart – *There is no energy in matter other than that received from the environment* – we calculate an energy of OW E_{OW}:

$$E_{OW} = 4\pi R^2 \sigma_0$$

and an average energy density of OW ρ_{OW}:

$$\rho_{OW} = 3\sigma_0/R = 3\rho_0 \times Q^{-1}$$

that is inversely proportional to R. An energy density unit ρ_0 equals to: $\rho_0 = hc/a^4$ and the dimensionless time-varying quantity Q equals:

$$Q_{exp} = \frac{a^2 c^4}{8\pi hc} \times G_{exp}^{-1} = 0.7599440 \times 10^{40}$$

where G_{exp} is the value of the experimentally measured Gravitational parameter [8]:

$$G_{exp} = 6.674334 \times 10^{-11} m^3 kg^{-1} s^{-2}$$

The quantity Q that is a measure of the Size R and Age A_τ of OW, is, in fact, the Dirac Large Number (t_0 is a basic time unit: $t_0 = a/c = 5.9059662 \times 10^{-23}\ s$):

$$Q = R/a = A_\tau/t_0$$

WUC is based on two parameters only: dimensionless Rydberg constant $\alpha = (2aR_\infty)^{1/3}$ (that is named the fine-structure constant now and R_∞ is the Rydberg constant) and time-varying quantity Q . We stress that the best theory is the one which is based on the minimum number of dimensionless parameters.

5. Critical Energy Density

The principal idea of WUC is that the energy density of OW ρ_{OW} equals to a critical energy density ρ_{cr} , which can be found by considering a sphere of radius R_M and enclosed mass M that can be calculated by multiplication of critical mass density by the volume of the sphere. When OW has the critical density, the Hubble velocity $H \times R_M$ ($H = c/R$ is the Hubble parameter) equals the escape velocity v_{esc} [9]:

$$v_{esc}^2 = \frac{2GM}{R_M} = \frac{2G}{R_M} \times \frac{4\pi}{3} R_M^3 \times \frac{\rho_{cr}}{c^2} = (H \times R_M)^2$$

which gives an equation for ρ_{cr} :

$$\rho_{cr} = 3H^2c^2/8\pi G$$

This equation can be rewritten as:

$$\frac{4\pi G}{c^2} \times \frac{2}{3}\rho_{cr} = \mu_g \times \rho_M = H^2 = \frac{c^2}{R^2}$$

where $\mu_g = \frac{4\pi G}{c^2}$ is a gravitomagnetic parameter and $\rho_M = \frac{2}{3}\rho_{cr}$ is an energy density of CM.

Considering that $H \propto R^{-1}$, it is easy to see the gravitational parameter $G \propto R^{-1}$. We emphasize that the values of the main cosmological parameters G and H depend on the value of ρ_M which is the characteristic of CM that is homogeneous and isotropic. The critical energy density of OW in the present Epoch equals to:

$$\rho_{cr} = 3\rho_0 \times Q_{exp}^{-1} = 4.980161\ GeV/m^3$$

6. Cosmic Medium Composed of Particles

Intergalactic Plasma, Microwave Background Radiation (MBR), and Far-Infrared Background Radiation speak in favor of existence of CM:

- **Intergalactic plasma** parameters, consisting of protons with mass m_p and electrons with mass m_e , can be found by investigations of Fast Radio Bursts, which are millisecond duration radio signals originating from distant galaxies. These signals are dispersed according to precise physical law and this dispersion is a key observable quantity that in tandem with a redshift measurement, can be used for physical investigations. The dispersion measure and redshift, conducted by E. F. Keane, *et al.* in 2016 [10], provide the measurement of the cosmic density of ionized baryons in the intergalactic medium Ω_{IGM} that equals:

  $$\Omega_{IGM} = 4.9 \pm 1.3\%$$

  which is in excellent agreement with the predicted by WUC in 2013 value of $\Omega_p = 4.8\%$.

- **Minimum Energy of Photons.** Analysis of the Intergalactic plasma shows that the value of the lowest plasma frequency ν_{min} is:

$$\nu_{min} = \nu_0 (\frac{m_e}{m_p})^{1/2} \times Q^{-1/2} = 4.53228\ Hz$$

where $\nu_0 = c/a$ and m_e/m_p is the electron-to-proton mass ratio. Photons with energy smaller than $E_{ph} = h\nu_{min}$ cannot propagate in the intergalactic plasma. Thus, $h\nu_{min}$ is the smallest amount of energy a photon may possess, which equals to the value:

$$E_{ph} = (\frac{m_e}{m_p})^{1/2} E_0 \times Q^{-1/2} = 1.87433 \times 10^{-14}\ eV$$

where a basic energy unit E_0 equals to:

$$E_0 = hc/a = 70.025252\ MeV$$

This value of E_{ph} predicted by WUC in 2013 is in good agreement with the value obtained by L. Bonetti, *et al.* in 2017 [11]:

$$E_{ph} \lesssim 2.2 \times 10^{-14}\ eV$$

- **Origin of Cosmic Microwave Background Radiation (MBR)**

According to BBM, the photons that existed at the time of photon decoupling (380,000 years after the Big Bang) have been propagating ever since, though growing fainter and less energetic, since the expansion of space causes their wavelength to increase over time. These photons are the same photons that we see in MBR now. But then, why is MBR a perfect black-body? What is the mechanism of photons wavelength increasing over time and growing fainter and less energetic?

According to WUC, 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. By definition, *Black-body radiation is the thermal electromagnetic radiation within or surrounding a body in thermodynamic equilibrium with its environment*. In WUC, the black-body spectrum of MBR is due to thermodynamic equilibrium of photons with Intergalactic plasma. It explains why MBR is a perfect black-body radiation.

$\rho_e = \frac{m_e}{m_p}\rho_p$ is an energy density of electrons and $\rho_p = \frac{2\pi^2\alpha}{3}\rho_{cr}$ is an energy density of protons in CM. We assume that the energy density of MBR ρ_{MBR} equals to twice the value of ρ_e (due to two polarizations of photons) and consider the Stefan–Boltzmann law:

$$\rho_{MBR} = 2\rho_e = 4\pi^2\alpha\frac{m_e}{m_p}\rho_0 \times Q^{-1} = \frac{8\pi^5}{15}\frac{k_B^4}{(hc)^3}T_{MBR}^4$$

where k_B is the Boltzmann constant. The calculated value of T_{MBR} is:

$$T_{MBR} = \frac{E_0}{k_B}(\frac{15\alpha}{2\pi^3}\frac{m_e}{m_p})^{1/4} \times Q^{-1/4} = 2.725245\ K$$

which is in excellent agreement with measured value of $2.72548 \pm 0.00057\ K$ by D. J. Fixsen in 2009 [12].

- **Far-Infrared Background Radiation**

The cosmic Far-Infrared Background (FIRB), which was announced in 1998, is part of the Cosmic Infrared Background with wavelengths near one hundred microns, which is the peak power wavelength of the black-body radiation at temperature 29 K. We calculate the temperature of its peak T_{FIRB} :

$$T_{FIRB} = (15/4\pi^5)^{1/4} E_0/k_B \times Q^{-1/4} = 28.955\ K$$

that is in an excellent agreement with experimentally measured value of $29\ K$ [13].

- **Mass-Varying Neutrinos.** It is established that there are three different types of neutrinos: electronic ν_e, muonic ν_μ, and tauonic ν_τ, and their antiparticles. Neutrino oscillations imply that neutrinos have non-zero masses. We analyzed this phenomenon and calculated the values of their masses [14]:

$$m_{\nu_\tau} \cong 45\ meV/c^2$$
$$m_{\nu_\mu} \cong 7.5\ \mathrm{m}eV/c^2$$
$$m_{\nu_e} \cong 0.31\ \mathrm{m}eV/c^2$$

which are in good agreement with experimental results obtained in [15], [16], [17].

- **Universe-Created Particles.** In our previous articles, we followed the standard paradigm "**Dark Matter**" that is not quite right for WUC, in which OW 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** (see **Table 1**), **Weak Interaction**, and **Self-annihilation**, like Majorana fermions [2]. 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 TeV	DIRAC	$\alpha^0 E_0$	70.025252 MeV
UCF2	$\alpha^{-1}E_0$	9.5959804 GeV	ELOP	$2/3\alpha^1 E_0$	340.66596 keV
UCF3	$\alpha^2 E_0$	3.7289394 keV	XION	$1/2\,\alpha^6 E_0$	5.2870895 μeV
UCF4	$\alpha^4 E_0$	0.19857107 eV			

These particles are "dark," **optically invisible** when astronomers observe OW with telescopes only. The contemporary Astronomy allows us to observe OW on wavelengths from radio waves up to gamma rays! Then, they are not "dark" at all. The first known binary star system was Cygnus X-1(1971) that is typically the brightest persistent source of **hard X-rays with energies up to sixty keV**. In 2000, R. Minchin, *et al.* discovered binary galaxy system VIRGOHI 21 with NGC 4254, which has a **21-cm emission**.

These two kinds of Matter have different origin of radiations [2]:

- Ordinary particles radiate Electromagnetic waves from Radio waves up to X-rays by electrons outside nuclei.
- UCPs radiate **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**).

WUC 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 $\mu = e/2\alpha$ (e is an elementary charge); 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 μeV).

The reason for this multicomponent UCM system was to explain:

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

- **Content of Observable World.** OW consists of CM and MOs. Total energy density of OW equals to the critical energy density throughout the World's evolution. The energy density of CM is two-thirds of the total energy density and MOs (Superclusters, Galaxies, ESS, *etc.*) – 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 CM and 2.4% in MOs.

  One of the principal ideas of WUC holds that relative energy densities of the World's particles in terms of the critical energy density ρ_{cr} are constants in all times and proportional to the proton energy density in the World's CM ρ_p that in the present Epoch equals:

$$\rho_p = \frac{2\pi^2\alpha}{3}\,\rho_{cr} = 0.048014655\,\rho_{cr} = 239.1207\,MeV/m^3$$

  WUC holds that the energy density of all types of self-annihilating UCPs is proportional to ρ_p. In all, there are six distinct types of self-annihilating UCPs: UCF1, UCF2, DIRAC, ELOP, UCF3, and UCF4. Then the total energy density of UCPs ρ_{UCP} is

$$\rho_{UCP} = 6\,\rho_p = 0.28808793\,\rho_{cr}$$

  that is in good agreement with the results in [18]. The total XION energy density ρ_{XION} is :

$$\rho_{XION} = 1.35\pi^2\,\rho_p = 0.63974563\,\rho_{cr}$$

  The total baryonic energy density ρ_B is:

$$\rho_B = 1.5\,\rho_p$$

  The sum of electron and MBR energy densities ρ_{eMBR} equals to:

$$\rho_{eMBR} = 1.5\frac{m_e}{m_p}\,\rho_p + 2\frac{m_e}{m_p}\rho_p = 3.5\frac{m_e}{m_p}\,\rho_p$$

  We take energy density of neutrinos ρ_ν to equal:

$$\rho_\nu = \rho_{MBR}$$

  For Far-Infrared Background Radiation energy density ρ_{FIRB} we take

$$\rho_{FIRB} = \frac{1}{40}\frac{m_e}{m_p}\,\rho_p$$

  Then the energy density of OW ρ_W equals to the theoretical critical energy density:

$$\rho_W = \left[1.35\pi^2 + 7.5 + (5.5 + 1/40)\frac{m_e}{m_p}\right]\rho_p = \rho_{cr}$$

  From this equation we can calculate the value of $1/\alpha$ using electron-to-proton mass ratio m_e/m_p :

$$\frac{1}{\alpha} = \frac{\pi^2}{60}\left[54\pi^2 + 300 + (220 + 1)\frac{m_e}{m_p}\right] = 137.03600$$

  which is in excellent agreement with the commonly adopted value of 137.035999. It follows that there is a direct correlation between constants α and m_e/m_p expressed by the obtained equation. As shown, m_e/m_p is not an independent constant but is instead derived from α .

  As a conclusion:

- The World's energy density is inversely proportional to a dimensionless time-varying quantity Q in all cosmological times.
- The particles relative energy densities are proportional to constant α .

7. There is no Cosmic Medium – there is Nothing!

In 1937, Nikola Tesla declared, "*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.*" The concept of the Cosmic Medium plays a fundamental role in WUC.

WUC, being a classical model, introduces classical notions only from the moment the first ensemble of particles emerged, at a cosmological time $\tau \gtrsim 10^{-18}\ s$. Time, Space, and Gravitation are intrinsically linked to the Impedance (characterized by the Hubble parameter $H = \tau^{-1}$), the Gravitomagnetic parameter, and the energy density of CM, respectively. Consequently, Time, Space, and Gravitation cannot be discussed independently of CM.

Gravity, under WUC, is not an interaction but rather a manifestation of CM. This perspective aligns with the Le Sage's theory of gravitation, which, in WUC, is based on UCPs, referred to as XIONs. Notably, the energy density of CM constitutes two-thirds of the total energy density of OW.

All physical laws are determined by CM, which is both homogeneous and isotropic. Indeed, the Cosmic Medium emerges as the cornerstone of Classical Physics – a savior of its principles. Let us not discard this profound concept with the tide of modernity: **we must not throw the baby out with the bathwater**!

8. Physical Meaning of the Fourth Spatial Coordinate

According to J. M. Overduin and P. S. Wesson: *"a fifth dimension might be associated with rest mass via* $x^4 = Gm/c^2$*"* [4]. In WUC, there are the following parameters [2]:

$$G = \frac{a^2c^4}{8\pi hc} \times \frac{a}{R}$$

$$E_{OW} = \rho_{cr} \times V_{OW} = \frac{3hc}{a^4} \times \frac{a}{R} \times \frac{4\pi R^3}{3}$$

The fourth spatial coordinate is associated with the total energy of the observable World E_{OW} via:

$$x^4 = \frac{2G}{c^2} \times \frac{E_{OW}}{c^2} = \frac{2}{c^2} \times \frac{a^2c^4}{8\pi hc} \times \frac{a}{R} \times \frac{3hc}{a^4c^2} \times \frac{a}{R} \times \frac{4\pi R^3}{3} = R = c\tau$$

As a conclusion:

- The gravitational parameter serves as the dimension-transposing parameter.
- The fourth spatial coordinate is associated with a cosmological time τ, which is defined as $\tau = t_0 \times Q$.

9. Conclusion

Four Spatial Dimension World-Universe Cosmology presents a fresh approach to understanding the Observable World and the science of Cosmology. It builds on the foundations of Classical Physics and has the potential to challenge core assumptions in both Cosmology and Classical Physics. Rather than claiming to explain all existing cosmological data or presenting a fully developed theory, WUC serves as a starting point for a New Cosmology envisioned by Paul Dirac in 1937. While further refinement by the global physics community is essential, World-Universe Cosmology's insights, combined with the groundbreaking discoveries of the JWST and the legacy of Dirac's ideas over 87 years, underscore the need for a Paradigm Shift in Astronomy, Cosmology, and Classical Physics.

Four Spatial Dimension World-Universe 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 am very grateful to P. Wesson for the development of Space-Time-Matter theory. I extend my sincere thanks to 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 WUS and enhance its understanding.

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