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JWST Discoveries—Confirmation of World-Universe Model Predictions

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Abstract

In 1937, P. Dirac proposed the Large Number Hypothesis and Hypothesis of Variable Gravitational Constant [1], and later added notion of Continuous Creation of Matter in the World [2]. Developed Hypersphere World-Universe Model (WUM) follows these ideas, albeit introducing different mechanism of Matter creation. Most direct observational evidence of validity of WUM are: 1) Microwave Background Radiation and Intergalactic Plasma speak in favor of existence of **Medium**; 2) Laniakea Supercluster with binding mass $\sim 10^{17} M_{\odot}$ is home to Milky Way (MW) galaxy and $\sim 10^5$ other nearby galaxies, which did not start their movement from Initial Singularity (see **Figure 1**); 3) MW is gravitationally bounded with Virgo Supercluster (VSC) and has **Orbital Angular Momentum** calculated based on distance of 65 Mly from VSC and orbital speed of ~400 km·s^{-1}, which far exceeds rotational angular momentum of MW; 4) Mass-to-light ratio of VSC is ~300 times larger than that of Solar ratio. Similar ratios are obtained for other superclusters (see **Figure 2**). These ratios are main arguments in favor of the presence of tremendous amounts of **Dark Matter** (DM) in the World. JWST discoveries confirm the most important predictions of WUM in 2018: 1) **Absolute Age** of World is 14.22 Gyr; 2) **Dark Epoch** (spanning for Laniakea Supercluster (LSC) from the Beginning of World for 0.45 Gyr) when only DM Macroobjects (MOs) form and evolve; 3) **Luminous Epoch** (ever since, 13.77 Gyr for LSC) when Luminous MOs (superclusters, galaxies, extrasolar systems, 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) DM Supercluster's Cores and self-annihilation of DM Particles (DMPs); 5) MOs of World form from top (Superclusters) down to Galaxies and Extrasolar systems in parallel around different Cores made up of different DMPs; 6) 3D Finite Boundless World presents a Patchwork Quilt of different Luminous Superclusters, which emerged in different places of World at different Cosmological times.

Keywords

James Webb Space Telescope, World-Universe Model, Medium, Angular Momentum, Dark Matter, Dark Epoch, Luminous Epoch, Rotational Fission, Patchwork Quilt, Early-Galaxies, Inter-Connectivity of Primary Cosmological Parameters

1. Introduction

Cosmology is a branch of Classical Physics. It should then be described by classical notions, which define emergent phenomena. By definition, an emergent phenomenon is a property that is a result of simple interactions that work cooperatively to create a more complex interaction. Physically, simple interactions occur at microscopic level, and the collective result can be observed at macroscopic level.

In 1937, Paul Dirac in the paper "A New Basis for Cosmology" said [1]:

Since general relativity explains so well local gravitational phenomena, we should expect it to have some applicability to the universe as a whole. We cannot, however, expect it to apply with respect to the metric provided by the atomic constants, since with this metric the "gravitational constant" is not constant but varies with the epoch. We have, in fact, the ratio of the gravitational force to the electric force between electron and proton varying in inverse proportion to the epoch, and since, with our atomic units of time, distance and mass, the electric force between electron and proton at a constant distance apart is constant, the gravitational force between them must be inversely proportional to the epoch. Thus, the gravitational constant will be inversely proportional to the epoch.

In Summary, he concluded:

It is proposed that all the very large dimensionless numbers which can be constructed from the important natural constants of cosmology and atomic theory are connected by simple mathematical relations involving coefficients of the order of magnitude unity. The main consequences of this assumption are investigated, and it is found that a satisfactory theory of cosmology can be built up from it.

Paul Dirac in 1974 discussed a continuous creation of matter by an additive mechanism (uniformly throughout space) and a multiplicative mechanism (proportional to the amount of the existing matter) [2]:

- *One might assume that nucleons are created uniformly throughout space, and thus mainly in intergalactic space. We may call this* ***additive creation****;*
- *One might assume that new matter is created where it already exists, in proportion to the amount existing there. Presumably, the new matter consists of the same kind of atoms as those already existing. We may call this* ***multiplicative creation****.*

The developed Hypersphere World-Universe Model (WUM) follows these ideas, albeit introducing a different mechanism of matter creation (see Section 2.2). WUM was developed over the last 20 years and is, in fact, a Paradigm Shift for Cosmology. The main objective of the Model is to unify and simplify existing results in Classical Physics into a single coherent picture of a New Cosmology. Results obtained in WUM are quoted in the current work without a full justification; an interested reader is encouraged to view the referenced paper "*Review Article. Cosmology and Classical Physics*" [4] (and references therein) in such cases.

2. Hypersphere World-Universe Model

2.1. Assumptions

WUM is based on the following primary assumptions:

- The World is a Finite Boundless 3D 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*. As the result, the Hypersphere is evenly stretched;
- The Eternal Universe serves as an unlimited source of Dark Matter (DM), which is continuously created in the Nucleus of the World. Ordinary Matter is a byproduct of DM Particles (DMPs) self-annihilation.

2.2. Principal Points

The WUM is based on the following Principal Points:

Beginning. 14.22 Gyr ago, 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 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. The **Initial Center of the World** coincides with the center of the 4D Nucleus and located in the fourth spatial dimension of the Nucleus. **The 3D World is curved in the fourth spatial dimension!**

Expansion. The 4D Nucleus is expanding along its fourth spatial dimension so that its radius is increasing with speed c that is the gravitodynamic constant. Its surface, the 3D Hypersphere, is evenly stretched. The stretching of it can be understood through the analogy with an expanding 3D balloon: imagine an ant residing on a seemingly 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 expands but does not observe a preferred center.

Creation of Matter. WUM follows the idea of the continuous creation of matter by the **additive mechanism**, albeit introducing a different mechanism of matter creation. The surface of the Nucleus is created in a process analogous to sublimation. Continuous creation of matter is a result of this process. Sublimation is a well-known endothermic 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. DM is created by the Universe in the 4D Nucleus. DMPs carry new DM into the 3D Hypersphere World. Ordinary Matter is a byproduct of DMPs self-annihilation. Consequently, a Matter-Antimatter Asymmetry problem discussed in literature does not arise (since antimatter does not get created by DMPs self-annihilation). By analogy with 3D ball, which has 2D spherical surface (that has a surface energy), we can imagine that 3D Hypersphere World has a "Surface Energy" of 4D Nucleus. A grows of the surface of 4D Nucleus means an increase of the World's "Surface Energy".

The proposed 4D process is responsible for Expansion, 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 Worlds' 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 expansion;
- Creation of DM occurs homogeneously in all points of the 3D Finite Boundless Hypersphere World.

Content of World. The World consists of the Medium and Macroobjects (MOs). Total energy density of the World equals to the critical energy density (calculated with the Hubble's law) throughout the World's evolution. The energy density of the Medium is 2/3 of the total energy density and MOs (Superclusters, Galaxies, Extrasolar Systems, Planets, Moons, *etc.*)—1/3 in all cosmological times. The relative energy density of DM Fermions DMF4 is ≅68.8%; five DMPs (DMF1, DMF2, DMF3, DIRACs, and ELOPs) is $\cong 4.8 \times 5 = 24\%$, and Ordinary particles (protons, electrons, photons, and neutrinos) is ≅4.8% in the Medium of the World and $\cong 4.8/2 = 2.4\%$ in MOs (see Section 2.3.2).

WUM introduces **Dark Epoch** (spanning for LSC from the Beginning of the World for 0.45 Gyr) when only DM Macroobjects existed, and **Luminous Epoch** (ever since, 13.77 Gyr). Transition from Dark Epoch to Luminous Epoch is due to an **Explosive Rotational Fission** of Overspinning DM Supercluster's Cores and self-annihilation of DMPs. Ordinary Matter is a byproduct of DMPs self-annihilation.

Macroobjects Formation. Superclusters are principal objects of the World. Macroobjects form from the top (Superclusters) down to Galaxies and Extrasolar systems in parallel around different Cores made up of different DMPs. 3D Finite Boundless World presents a Patchwork Quilt of different Luminous Superclusters ($\gtrsim 10^3$), which emerged in different places of the World at different Cosmological times. The distribution of Macroobjects in the World is spatially Inhomogeneous and Anisotropic and temporally Non-simultaneous.

Macroobjects Evolution. 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.

Dark Matter Reactors. MOs' cores are essentially DM Reactors fueled by DMPs. All chemical elements, compositions, radiations are produced by MOs themselves as the result of DMPs self-annihilation in their DM cores. **Nucleosynthesis** of all elements occurs inside of MOs during their evolution.

2.3. Main Pillars

2.3.1. Medium

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 Dark Matter Particles (DMPs). The Medium is an active agent in all physical phenomena in the World. The existence of the Medium is a principal point of WUM. It follows from the observations of Intergalactic Plasma; Cosmic Microwave Background Radiation (MBR); Far-Infrared Background Radiation. 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, MW galaxy and the Sun are moving with the speed of 552 and 370 km·s^{-1}, respectively.

WUM is the classical model, therefore classical notions can be introduced only when the very first ensemble of particles was created at a cosmological time τ_M equals to: $\tau_M = \alpha^{-2} \times t_0 \cong 10^{-18}\ \text{s}$, where α is the dimensionless Rydberg constant: $\alpha = (2aR_\infty)^{1/3}$ (that was later named "Fine-structure constant"); t_0 is a basic time unit: $t_0 = a/c = 5.9059662 \times 10^{-23}\ \text{s}$; a is a basic size unit:
$a = 1.7705641 \times 10^{-14}\ \text{m}$; and c is a gravitodynamic constant. It is worth noting that the **speed of light in vacuum**, commonly denoted as c, is not related to the World in our Model, because there is no vacuum in it. Instead, there is the Medium of the World consisting of elementary particles. In WUM, the cosmological principal **Universality of physical laws** is valid at the cosmological times $\tau \geq \tau_M$ because they are determined by the Medium of the World.

In frames of WUM, Time and Space are closely connected with the Mediums' impedance (wave resistance) Z_g that equals to the Hubble's parameter H: $Z_g = H = \tau^{-1}$ and the gravitomagnetic parameter μ_g, which equals to: $\mu_g = R^{-1}$ (R is the size of the World). 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. The Gravitation is a result of simple interactions of DMPs with Matter (by a proposed **Weak Interaction**) that work cooperatively to create a more complex interaction. DMPs are responsible for Le Sage's mechanism of the gravitation. **Gravity**, **Space and Time** are all emergent phenomena.

Inter-Connectivity of Primary Cosmological Parameters (PCPs). The constancy of the universe fundamental constants, including Newtonian constant of gravitation *G*, is now commonly accepted, although has never been firmly established as a fact. All conclusions on the constancy of *G* are model-dependent. 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 some other areas of physics. WUM holds that there indeed exist relations between all PCPs that depend on dimensionless time-varying quantity *Q* that is a measure of the Size *R* and Age A_τ of the World:

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

which in present epoch equals to: $Q = 0.759972 \times 10^{40}$ and is, in fact, the Dirac Large Number. WUM is based on two parameters only: *a* and *Q*: the World's energy density is proportional to Q^{-1} in all cosmological times and particles relative energy densities are proportional to *a*.

The Model develops a mathematical framework that allows for direct calculation of the following parameters through *Q*:

- The predicted value of *G* in 2013 [5] [6]:

$$G = 6.674536 \times 10^{-11}\ \mathrm{m^3 \cdot kg^{-1} \cdot s^{-2}}$$

is in excellent agreement with the experimentally measured by Qing Li, *et al.* in 2018 values [7]:

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

$$G(2) = 6.67484 \times 10^{-11}\ \mathrm{m^3 \cdot kg^{-1} \cdot s^{-2}}\ \ (11.61\ \mathrm{ppm})$$

- The predicted value of H_0 in 2013 [5] [6]:

$$H_0 = 68.733\ \mathrm{km/s \cdot Mpc}$$

is in excellent agreement with the most recent measured value in 2021 [8]:

$$H_0 = 68.7 \pm 1.3\ \mathrm{km/s \cdot Mpc}$$

using only Cosmic Microwave Background data;

- The calculated value of $T_{MBR} = 2.72518\ \mathrm{K}$ in the present epoch is in excellent agreement with experimentally measured value of 2.72548 ± 0.00057 K [9]. It is worth noting that at the Beginning of the Luminous Epoch (0.45 Gyr) the calculated value was $T_{MBR} = 6.4775\ \mathrm{K}$ and at the Birth of the Solar System (9.65 Gyr) – $T_{MBR} = 3.0141\ \mathrm{K}$. Therefore, any Model describing **creation of MOs must hold true in cold World conditions**;
- The Age of the World: $A_\tau = t_0 \times Q = 14.22\ \mathrm{Gyr}$ is determined by the parameters of the Medium only.

As the conclusion:

- It turned out that an abandoning of the Luminiferous Aether in 1905 was crucial for Classical Physics;
- The Medium of the World is the Savior of Classical Physics! **Don't throw the baby out with the bathwater**.

2.3.2. Multicomponent Dark Matter

WUM proposes multicomponent DM system consisting of two couples of co-annihilating DMPs: a heavy Dark Matter Fermion (DMF) – DMF1 (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 the elementary charge); a heavy fermion – DMF2 (9.6 GeV) and a light spin-0 boson – ELOP (340 keV) that is a dipole of preons with electrical charge e/3; self-annihilating fermions DMF3 (3.7 keV) and DMF4 (0.2 eV). The reason for this multicomponent DM system was to explain:

- The diversity of Very High Energy gamma-ray sources in the World;
- The diversity of DM Cores of Macroobjects of the World (superclusters, galaxies, and extrasolar systems), which are Fermion Compact Objects in WUM.

WUM postulates that rest energies of DMFs and bosons are proportional to a basic energy unit: $E_0 = hc/a$ (h is the Planck constant) multiplied by different exponents of α and can be expressed with following formulae:

DMF1 (fermion): $E_{DMF1} = \alpha^{-2} E_0 = 1.3149950\ \text{TeV}$

DMF2 (fermion): $E_{DMF2} = \alpha^{-1} E_0 = 9.5959823\ \text{GeV}$

DIRAC (boson): $E_{DIRAC} = \alpha^{0} E_0 = 70.025267\ \text{MeV}$

ELOP (boson): $E_{ELOP} = 2/3\alpha^{1} E_0 = 340.66606\ \text{keV}$

DMF3 (fermion): $E_{DMF3} = \alpha^{2} E_0 = 3.7289402\ \text{keV}$

DMF4 (fermion): $E_{DMF4} = \alpha^{4} E_0 = 0.19857111\ \text{eV}$

It is worth noting that the rest energy of electron E_e equals to: $E_e = \alpha E_0$ and the Rydberg unit of energy is: $Ry = hcR_\infty = 0.5\alpha^3 E_0 = 13.605693\ \text{eV}$.

We still do not have a direct confirmation of DMPs' rest energies, but we do have a number of indirect observations. The signatures of DMPs self-annihilation with expected rest energies of 1.3 TeV; 9.6 GeV; 70 MeV; 340 keV; 3.7 keV are found in spectra of the diffuse gamma-ray background and the emissions of various Macroobjects in the World. We connect observed gamma-ray spectra with the structure of Macroobjects (nuclei and shells composition). Self-annihilation of those DMPs 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 in WUM.

In this regard, it is worth recalling a story about neutrinos: "*The neutrino was postulated first by W. Pauli in 1930 to explain how beta decay could conserve energy, momentum, and angular momentum (spin). But we still don't know the values of neutrino masses*". Although we still cannot measure neutrinos' masses directly, no one doubts their existence.

Neutrons serve as another example. The mass of a neutron cannot be directly determined by mass spectrometry since it has no electric charge. But since the masses of a proton and of a deuteron can be measured with a mass spectrometer, the **mass of a neutron can be deduced** by subtracting proton mass from deuteron mass, with the difference being the mass of the neutron plus the binding energy of deuterium.

DMPs do not possess an electric charge. Their masses cannot be directly measured by mass spectrometry. Hence, they can be observed only indirectly due to their self-annihilation and irradiation of gamma-quants.

2.3.3. Macroobject Shell Model

In WUM, Macrostructures of the World (Superclusters, Galaxies, Extrasolar systems) have Nuclei made up of DMFs, which are surrounded by Shells composed of DM and Baryonic Matter. The shells envelope one another, like a Russian doll. The lighter a particle is, the greater the radius and the mass of its shell are. Innermost shells are the smallest and are made up of heaviest particles; outer shells are larger and consist of lighter particles. The proposed Weak Interaction of DMPs with Matter provides integrity of all shells. Table 1 describes the parameters of Macroobjects' Cores, which are 3D fluid balls with a very high viscosity and function as solid-state objects.

The calculated parameters of the shells show that:

- Nuclei made up of DMF1 and/or DMF2 compose Cores of stars in Extrasolar Systems;
- Shells of DMF3 and/or Electron-Positron plasma around Nuclei made up of DMF1 and/or DMF2 make up Cores of Galaxies;
- Nuclei made up of DMF1 and/or DMF2 surrounded by shells of DMF3 and DMF4 compose Cores of Superclusters.

According to WUM, Cores of Galaxies are DM Compact Objects made up of DMF1 and/orDMF2 with shell of DMF3 with the calculated maximum mass of $6\times10^{10} M_{\odot}$ (see Table 1). This value is in good agreement with the experimentally obtained value of the most massive "black hole" ever found, with a mass of $6.6\times10^{10} M_{\odot}$ at the center of TON 618 [10]. It is worth noting that there are no black holes in WUM.

"*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 particles. Other particles, including DM and baryonic matter, form shells surrounding the cores*" [5].

Table 1. Parameters of Macroobjects' cores made up of different fermions in present epoch.

Fermion	Fermion Mass m_f, MeV	Macroobject Mass M_{max}, kg	Macroobject Radius R_{min}, m	Macroobject Density ρ_{max}, kg·m^{-3}
DMF1	1.3×10^{6}	1.9×10^{30}	8.6×10^{3}	7.2×10^{17}
DMF2	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}
DMF3	3.7×10^{-3}	1.2×10^{41}	5.4×10^{14}	1.8×10^{-4}
DMF4	2×10^{-7}	4.2×10^{49}	1.9×10^{23}	1.5×10^{-21}

In WUM, Cores of all MOs possess the following properties:

- Their Nuclei are made up of DMFs and contain other particles, including DM and Baryonic matter, in shells surrounding the Nuclei;
- DMPs are continuously absorbed by Cores of all MOs. Ordinary Matter (about 7.2% of the total Matter) is a byproduct of DMPs self-annihilation. It is re-emitted by Cores of MOs continuously;
- Nuclei and shells are growing in time: size $\propto \tau^{1/2}$; mass $\propto \tau^{3/2}$; and rotational angular momentum $\propto \tau^2$, until they reach the critical point of their stability, at which they detonate. Satellite cores and their orbital L_{orb} and rotational L_{rot} angular momenta released during detonation are produced by Overspinning Core (OC). The detonation process does not destroy OC; it's rather gravitational hyper-flares;
- Size, mass, composition, L_{orb} and L_{rot} of satellite cores depend on local density fluctuations at the edge of OC and cohesion of the outer shell. Consequently, the diversity of satellite cores has a clear explanation.

WUM refers to OC detonation process as Gravitational Burst (GB), analogous to Gamma Ray Burst. In frames of WUM, the repeating GBs can be explained the following way:

- As the result of GB, the OC loses a small fraction of its mass and a large part of its rotational angular momentum;
- After GB, the Core absorbs new DMPs. Its mass increases $\propto \tau^{3/2}$, and its angular momentum L_{rot} increases much faster $\propto \tau^2$, until it detonates again at the next critical point of its stability;
- Afterglow of GBs is a result of processes developing in the Nuclei and shells after detonation;
- In case of Extrasolar systems, a star wind is the afterglow of star detonation: star Core absorbs new DMPs, increases its mass $\propto \tau^{3/2}$ and gets rid of extra L_{rot} by star wind particles;
- Solar wind is the afterglow of Solar Core detonation 4.57 Gyr ago. It creates the bubble of the heliosphere continuously;
- In case of Galaxies, a galactic wind is the afterglow of repeating galactic Core detonations. In Milky Way it continuously creates two Dark Matter Fermi Bubbles.

S. E. Koposov, *et al.* present the discovery of the fastest Main Sequence hyper-velocity star S5-HVS1 with mass about 2.3 solar masses that is located at a distance of ~9 kpc from the Sun. When integrated backwards in time, the orbit of the star points unambiguously to the Galactic Centre, implying that S5-HVS1 was kicked away from Sgr A* with a velocity of ~1800 km/s and travelled for 4.8 Myr to the current location. So far, this is the only hyper-velocity star confidently associated with the Galactic Centre [11]. In frames of WUM, this discovery can be explained by Gravitational Burst of the overspinning Core of MW 4.8 million years ago, which gave birth to S5-HVS1 with the speed higher than the escape velocity of the Core.

C. J. Clarke, *et al.* observed CI Tau, a young 2-million-year-old star. CI Tau is located about 500 light years away in a highly-productive stellar "nursery" region of the galaxy. They discovered that the Extrasolar System contains four gas giant planets that are only 2 million years old, amount of time that is too short for formation of gas giants according to prevailing theories [12]. In frames of the developed Rotational Fission (RFS) model, this discovery can be explained by Gravitational Burst of the overspinning Core of MW two million years ago, which gave birth to CI Tau system with all planets generated at the same time.

To summarize:

- Rotational Fission of Macroobject DM Cores is the most probable process that can generate satellite cores with large orbital momenta in a very short time;
- Macrostructures of the World form from the top (superclusters) down to galaxies, extrasolar systems, planets, and moons;
- Gravitational waves can be a product of RFS of overspinning DM Macroobject Cores.

2.3.4. Angular Momentum

Angular Momentum Problem is one of the most critical problems in Standard Cosmology that must be solved. Standard Cosmology does not explain how Galaxies and Extrasolar systems obtained their enormous orbital angular momenta:

- Solar System (SS) has an orbital momentum L_{orb}^{SS} calculated based on the distance of 26.4 kly from the galactic Centre and orbital speed of about 220 km/s: $L_{orb}^{SS} = 1.1 \times 10^{56}\ \text{J} \cdot \text{s}$, which far exceeds the rotational angular momentum: $L_{rot}^{SS} = 3.2 \times 10^{43}\ \text{J} \cdot \text{s}$;
- MW galaxy is gravitationally bounded with Virgo Supercluster and has an orbital angular momentum L_{orb}^{MW} calculated based onthe distance of 65 Mly from VSC and orbital speed of about 400 km/s [13]: $L_{orb}^{MW} = 2.5 \times 10^{71}\ \text{J} \cdot \text{s}$ that far exceeds the rotational angular momentum of MW: $L_{rot}^{MW} \approx 1 \times 10^{67}\ \text{J} \cdot \text{s}$.

In our opinion, there is only one mechanism that can supply angular momenta to MOs—**Rotational Fission** of Overspinning 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 frames of WUM, Prime Objects are DM Cores of Superclusters, which must accumulate tremendous rotational angular momenta before the Birth of the Luminous World. It means that it must be some long enough time in the history of the World, which we named "Dark Epoch".

To be consistent with the Law of Conservation of Angular Momentum, in 2018 we developed a New Cosmology [14]:

- WUM introduces Dark Epoch (spanning for LSC from the Beginning for 0.45 Gyr) when only DM MOs existed, and Luminous Epoch (ever since for 13.77 Gyr for LSC) when Luminous MOs emerged due to the RFS of Overspinning DM Superclusters' Cores and self-annihilation of DMPs;

- Proposed **Weak Interaction** of DMPs with Matter provides the integrity of DM Cores, which are **3D fluid balls with very high viscosity** and act as solid-state objects;
- The principal objects of the World are overspinning DM Cores of Superclusters, which accumulated tremendous rotational angular momenta during Dark Epoch and transferred it to DM Cores of Galaxies during their RFS. The experimental observations of galaxies in the universe showed that most of them are disk galaxies. These results speak in favor of the developed Rotational Fission mechanism;
- Size, mass, density, composition, L_{orb} and L_{rot} of satellite cores depend on local density fluctuations atthe edge of the overspinning prime DM cores and cohesion of the outer shell. Consequently, the diversity of satellite cores has a clear explanation;
- In our view, satellite DM cores are given off by "**Volcanoes**" on prime DM cores erupting repeatedly over millions or billions of years;
- Macroobjects' cores are essentially DM Reactors fueled by DMPs. All chemical elements, gases, water vapors, compositions, radiations are produced by MOs themselves as the result of DMPs self-annihilation;
- DM Core of MW was born 13.77 billion years ago as the result of the **Explosive RFS** of VSC DM Core;
- DM Cores of Extrasolar systems, planets and moons were born as the result of the repeating Explosive Rotational Fissions of MW DM Core in different times (4.57 billion years ago for SS);
- Macrostructures of the World form from the top (superclusters) down to galaxies, extrasolar systems, planets, and moons.

3. Macrostructures

Laniakea Supercluster is a galaxy supercluster that is home to MW and approximately 10^5 other nearby galaxies (see **Figure 1**). It is known as one of the largest superclusters with estimated binding mass $10^{17} M_{\odot}$. Neighboring superclusters are Shapley Supercluster, Hercules Supercluster, Coma Supercluster, and Perseus-Pisces Supercluster (see **Figure 2**). The mass-to-light ratio of Virgo Supercluster is ~300 times larger than that of the Solar ratio. Similar ratios are obtained for other superclusters [15]. In 1933, F. Zwicky investigated the velocity dispersion of Coma cluster and found a surprisingly high mass-to-light ratio (~500). He concluded: "*If this would be confirmed, we would get the surprising result that dark matter is present in much greater amount than luminous matter*" [16].

We emphasize that ~10^5 nearby galaxies are moving around Centre of LSC. They belong to it. All these galaxies did not start their movement from the "Initial Singularity". The neighboring superclusters have the same structures (see **Figure 2**). It means that the World is, in fact, a Patchwork Quilt of different Luminous Superclusters ($\gtrsim 10^3$).

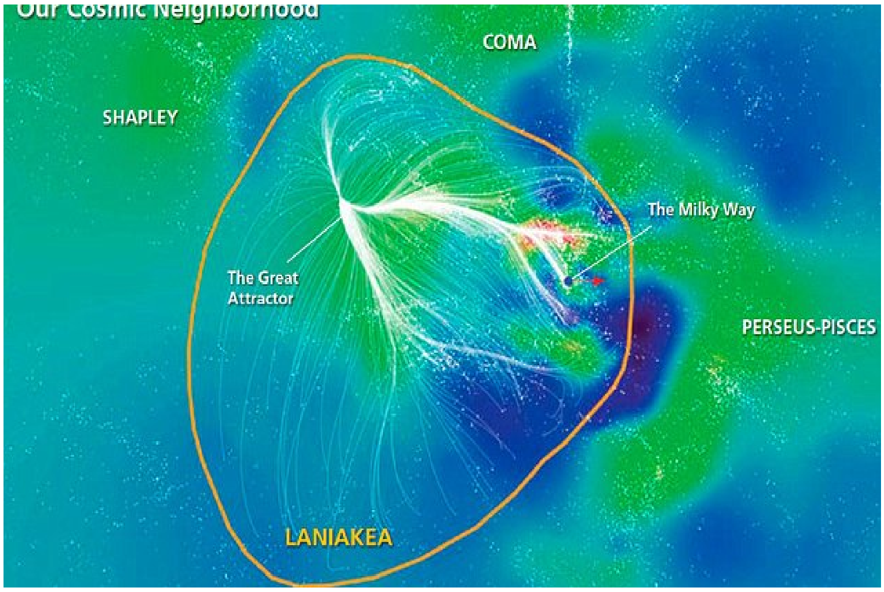

Figure 1. Laniakea supercluster. Adapted from [3].

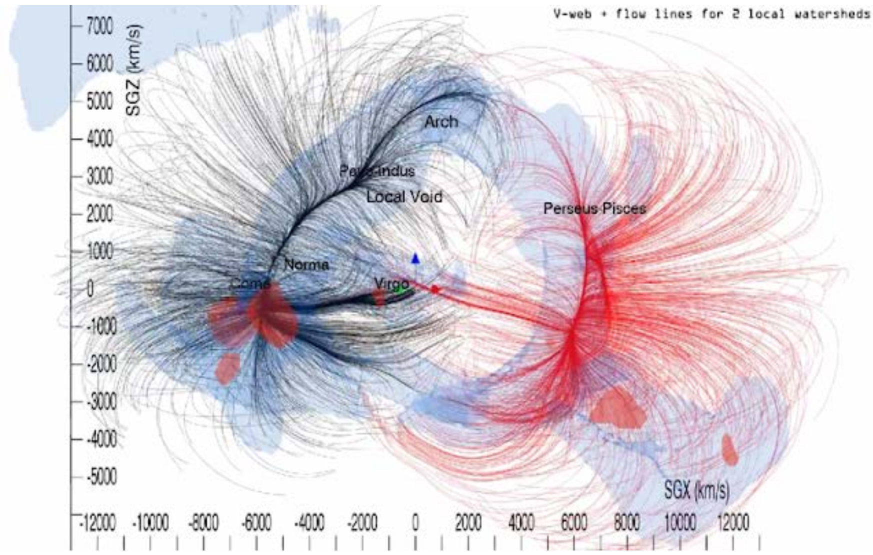

Figure 2. A representation of structure and flows due to mass within 6000 km·s^{-1} (~80 Mpc). Surfaces of red and blue respectively represent outer contours of clusters and filaments as defined by the local eigenvalues of the velocity shear tensor determined from the Wiener Filter analysis. Flow threads originating in our basin of attraction that terminate near the Norma Cluster are in black and adjacent flow threads that terminate at the relative attractor near the Perseus Cluster are in red. The Arch and extended Antlia Wall structures bridge between the two attraction basins. Adapted from [3].

In frames of **WUM**, Laniakea Supercluster emerged 13.77 billion years ago due to Rotational Fission of a Supercluster Overspinning DM Core and self-annihilation of DMPs. The Core was created during Dark Epoch when only DM MOs existed.

B. Carr, *et al.* "*consider the observational constraints on stupendously large black holes* (*SLABs*) *in the mass range* $M > 10^{11} M_{\odot}$. *These have attracted little attention hitherto*, *and we are aware of no published constraints on a SLAB* *population in the range* $\left(10^{12}-10^{18}\right)M_{\odot}$. *However, there is already evidence for black holes of up to nearly* $10^{11}M_{\odot}$ *in galactic nuclei* [17], *so it is conceivable that SLABs exist, and they may even have been seeded by primordial black holes*" [18].

WUM. A calculated maximum mass of supercluster DM Core of 2.1 × 10^{19} solar mass (see **Table 1**) is in good agreement with the values discussed by B. Carr, *et al.* [18]. In the future, these stupendously large compact objects can give rise new Luminous Superclusters as the result of their DM Cores' rotational fission. 13.77 billion years ago, the estimated number of DM Supercluster Cores in the World was around $\gtrsim 10^3$. It is unlikely that all of them gave birth to Luminous Superclusters at the same cosmological time being far away from each other. In our view, there were many "Beginnings" for different Luminous Superclusters (even at a time that was more than 13.77 Gyr ago and less than 14.22 Gyr).

According to R. B. Tully, *et al.*, "*Galaxies congregate in clusters and along filaments, and are missing from large regions referred to as voids. These structures are seen in maps derived from spectroscopic surveys that reveal networks of structure that are interconnected with no clear boundaries. Extended regions with a high concentration of galaxies are called* '*superclusters*', *although this term is not precise*" [3].

P. Wang, *et al.* made a great discovery: "*Most cosmological structures in the universe spin. Although structures in the universe form on a wide variety of scales from small dwarf galaxies to large super clusters, the* ***generation of angular momentum across these scales is poorly understood****. We have investigated the possibility that filaments of galaxies—cylindrical tendrils of matter hundreds of millions of light-years across, are themselves spinning. By stacking thousands of filaments together and examining the velocity of galaxies perpendicular to the filament's axis* (*via their red and blue shift*), *we have found that these objects too display motion consistent with rotation making them the largest objects known to have angular momentum.* ***These results signify that angular momentum can be generated on unprecedented scales***" [19].

In 2021 at the "*Giant Arc at the 238th virtual meeting of the American Astronomical Society*", A. Lopez reported about the discovery of "*a giant, almost symmetrical arc of galaxies—the Giant Arc—spanning 3.3 billion light years at a distance of more than 9.2 billion light years away that is* ***difficult to explain in current models of the Universe***". *The Giant Arc is twice the size of the striking Sloan Great Wall of galaxies and clusters* "*that is seen in the nearby Universe. This new discovery of the Giant Arc adds to an* ***accumulating set of* (*cautious*) *challenges to the Cosmological Principle***" [20].

WUM. These latest observations of the World can be explained in frames of the developed WUM only:

- "*Galaxies* **do not** *congregate in clusters and along filaments*". On the contrary, Cosmic Web that is "*networks of structure that are interconnected with no clear boundaries*" is the result of the Rotational Fission of DM Cores of neighbor Superclusters;

- "*Generation of angular momentum across these scales*" provide DM Cores of Superclusters through the Rotational Fission mechanism;
- "*Spinning cylindrical tendrils of matter hundreds of millions of light-years across*" are the result of spiral jets of galaxies generated by DM Cores of Superclusters with internal rotation;
- The Giant Arc is the result of the intersection of the Galaxies' jets generated by the neighbor DM Cores of Superclusters;
- Cosmological principal is valid for the Homogeneous and Isotropic Medium of the World consisting of elementary particles with 2/3 of total Matter. The distribution of Macroobjects with 1/3 of total Matter is Inhomogeneous and Anisotropic, and therefore, the Cosmological Principal is not viable;
- The main conjecture of Standard Cosmology: "*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 (see **Figure 1** and **Figure 2**).

4. JWST Discoveries

According to NASA, "*Most galaxies are between 10 billion and 13.6 billion years old. Our universe is about 13.8 billion years old, so most galaxies formed when the universe was quite young! The newest galaxy we know of formed only about 500 million years ago. In 2016, astronomers used NASA's Hubble Space Telescope to measure a galaxy called GN-z11 that is 13.4 billion light-years away*" [21].

H. Yan, *et al.* introduced a New JWST Program and discussed the very first observations [22]:

On July 13, 2022, NASA released to the whole world the data obtained by the James Webb Space Telescope (JWST) Early Release Observations (ERO). These are the first set of science-grade data from this long-awaited facility, marking the beginning of a new era in astronomy. Many critical questions unanswered in the past several decades now see the hope of being addressed. JWST will push the redshift boundary far beyond what has been reached by the Hubble Space Telescope (HST), and in so doing it will lead to the understanding of how the first luminous objects—first stars and first galaxies—were formed in the early universe. The red wavelength cut-off at 1.6 micron limits HST to redshift around 11, which is when the age of the universe was only ~420 million years.

The NIRCam instrument, the most sensitive camera onboard JWST, extends to 5 micron and will allow for the detection of early objects only several tens of million years after the Big Bang should they exist.

Here we report the result from our search of candidate galaxies at redshift larger than 11 using these ERO data. We have a total of 88 such candidates spreading over the two fields, some of which could be at redshifts as high as 20. ***Neither the high number of such objects found nor the high redshifts they reside at are expected from the previously favored predictions.***

J. Achenbach outlined the following situation with the measurements of early galaxy formation by JWST [23]:

- *The first scientific results have emerged in recent weeks, and what the telescope has seen in deepest space is a little puzzling. Some of those distant galaxies are **strikingly massive**. A general assumption had been that early galaxies—which formed not long after the first stars ignited—would be relatively small and misshapen. Instead, some of them are **big, bright, and nicely structured***;
- "*The models just don't predict this,*" *Garth Illingworth, an astronomer at the University of California at Santa Cruz, said of the massive early galaxies.* "*How do you do this in the universe at such an early time? How do you form so many stars so quickly?*";
- *What has surprised astronomer Dan Coe of the Space Telescope Science Institute are the number of nicely shaped, **disklike galaxies**. But **dust** can be throwing off the calculations. Dust can absorb blue light and redden the object. It could be that some of these very distant, highly red-shifted galaxies are just very dusty, and not actually as far away (and as "young") as they appear. That would realign the observations with what astronomers expected.*

It is a question of time. Massive mature disk galaxies cannot possibly form so soon according to the big bang theory. The presence of such galaxies so early on is then a refutation of the big bang theory. Massive mature spiral galaxies take billions of years to form, and so should not be there at all at the "beginning".

R. P. Naidu, *et al.* present a search for luminous $z > 10$ galaxies [24]. They infer that the most secure candidates are two systems: GLASS-z13 ($z \approx 13$, Light-Travel Distance (LTD) of 13.4572 Gyr) and GLASS-z11 ($z \approx 11$, LTD of 13.4 Gyr), which have already built up ~10^9 solar masses in stars over the 300 - 400 Myr after Big Bang.

Ivo Labbe, *et al.* have identified galaxies with stellar masses as high as $M^* \sim 10^{11} M_\odot$ out to redshifts $z \sim 6$, approximately one billion years after the Big Bang [25]. They find seven galaxies with $M^* > 10^{10} M_\odot$ and $7 < z < 11$ 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 10 - 30 at $z \cong 8$ and more than three orders of magnitude at $z \cong 10$**.

C. T. Donnan, *et al.* provide details of the 55 high-redshift galaxy candidates, 44 of which are new [26]. Their sample contains 6 galaxies at $z \geq 12$, one of which appears to set a new redshift record as an apparently robust galaxy candidate at $z = 16.7$ (LTD of 13.5512 Gyr). They also measure a stellar mass $\log_{10}\left(M^*/M_\odot\right) = 9.0 \pm 0.4$.

J. A. Zavala, *et al.* report a galaxy, CEERSDSFG-1, for which a photometric redshift fit to the JWST data alone predicts a redshift of $z_{phot} \sim 18$ [27]. However, they show it is a dusty star-forming galaxy (DSFG) at $z \approx 5$ based on deep millimeter interferometric observations. Astronomers also present a detection at 850 μm around the position of candidate galaxy CEERS-93316 ($z \approx 16.7$). While the **authors cannot conclusively show this detection is astrophysical or asso-**

ciated with this object, they illustrate that if it is associated, the available photometry are consistent with a DSFG at z ≈ 5. This provides evidence that DSFGs may contaminate searches for ultra-high-redshift galaxy candidates from JWST observations.

A. Ferrara, A. Pallottini, P. Dayal revealed an unexpected abundance of super-early ($z > 10$), massive ($M^* \sim 10^9 M_\odot$) galaxies at the bright-end of the ultraviolet luminosity function [28]. They present a minimal physical model that explains the observed galaxy abundance at $z = 10$ - 14. The model also predicts that **galaxies at $z > 11$ should contain negligible amounts of dust**. The authors speculate that dust could have been efficiently ejected during the very first phases of galaxy build-up.

Y. Ono, *et al.* present morphologies of 25 galaxy candidates at $z \sim 9$ - 17 [29]. They obtain effective radii $r_e \sim 200\text{ - }300\ \text{pc}$ with the exponential-like profile for galaxies at $z \sim 12$ - 17. One bright galaxy at $z \sim 12$, GL-z12-1, has an extremely compact size with $r_e = 61 \pm 11\ \text{pc}$. Comparing with numerical simulations, authors find that such a compact galaxy naturally forms at $z \gtrsim 10$, and that **frequent mergers at the early epoch produce more extended galaxies**.

F. Ziparo, *et al.* report about the recent JWST discovery of a population of super-early (redshift $z > 10$), relatively massive (stellar mass $M_* = \left(10^8\text{ - }10^9\right) M_\odot$) and evolved (metallicity $Z \approx 0.1 Z_\odot$) galaxies, which nevertheless show blue ($\beta \cong 2.6$) spectra, and very small dust attenuation ($A_V \le 0.02$), challenges our interpretation of these systems [30].

The summary of the JWST discoveries in the Early World:

- The most secure oldest galaxy is GLASS-z13 ($z \approx 13$, LTD of 13.4572 Gyr) that has already built up $\sim 10^9 M_\odot$ in stars;
- The search of 88 candidate galaxies at $z > 11$ shows that some of them could be at redshifts as high as 20. Some of those distant galaxies are strikingly massive;
- Most of the early galaxies are **nicely shaped, disklike galaxies**;
- It could be that some of these very distant, highly red-shifted galaxies are just very dusty. They may contaminate searches for ultra-high-redshift galaxy candidates from JWST observations;
- A new redshift record obtained for galaxy candidate CEERS-93316 at $z = 16.7$ (LTD of13.5512 Gyr) witha stellar mass $\log_{10}\left(M^*/M_\odot\right) = 9.0 \pm 0.4$;
- 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 10 - 30 at $z \sim 8$ and more than three orders of magnitude at $z \sim 10$;
- Extremely Compact Bright Galaxies were found at $z \sim 12$ - 17 with effective radii $r_e \sim 200\text{ - }300\ \text{pc}$. One bright galaxy GL-z12-1 at $z \sim 12$ has an extremely compact size with $r_e = 61 \pm 11\ \text{pc}$;
- Super-early, massive, evolved galaxies with blue spectra, and very small dust attenuation.

5. Analysis of JWST Discoveries

The problem of old galaxies formation is a long-standing problem. The age of the Universe is 13.77 ± 0.06 Gyr, based on data on the cosmic microwave background [31]. Astronomers believe that our own Milky Way (MW) galaxy is approximately 13.6 Gyr old. MW is one of the two largest spiral galaxies in the Local Group (the other being the Andromeda Galaxy) with mass $1.15\times10^{12} M_{\odot}$. Massive mature disk galaxies like MW cannot form so soon for 0.17 Gyr only.

Moreover, the oldest known star HD140283 (Methuselah star) is a subgiant star about 190 light years away from the Earth for which a reliable age has been determined. Its total space motion relative to the Sun is 361.3 km/s [32]. In 2013, H. E. Bond, *et al.* found its age to be 14.46 ± 0.8 Gyr that does not conflict with the age of the Universe. It means that this star must have formed between 13.66 Gyr and 13.83 Gyr, amount of time that is too short for formation of second generation of stars according to prevailing theories [33]. While it currently has a higher estimated age, it is usually a fellow methuselah SMSS J031300.36 - 670839.3 that it cited as the oldest star with an accurately determined age 13.6 Gyr [34].

WUM explains these discoveries the following way [35]:

- **It is a question of time!** The Beginning of the World was **14.22 Gyr** ago! WUM introduces **Dark Epoch** (spanning for LSC from the Beginning of the World for **0.45 Gyr**) when only DM Macroobjects existed, and **Luminous Epoch** (ever since, **13.77 Gyr**). Transition from Dark Epoch to Luminous Epoch is due to an **Explosive Rotational Fission** of Overspinning DM Supercluster's Cores and self-annihilation of DMPs. Ordinary Matter is a by-product of DMPs self-annihilation;
- **Dark Epoch** started at the Beginning of 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 $\cong 10^{-18}\ \text{s}$. At time $\tau \gg 10^{-18}\ \text{s}$ density fluctuations could happen in the Medium of the World filled with DMF1, DMF2, DIRACs, ELOPs, DMF3, and DMF4. The heaviest Dark Matter particles DMF1 could collect into a cloud with distances between particles smaller than the range of the introduced by WUM weak interaction R_W [35]. As the result, clumps of DMF1 will arise. Larger clumps will attract smaller clumps and DMPs and initiate a process of expanding the DM clump followed by growth of surrounding shells made up of other DMPs, up to the maximum mass of the shell made up of DMF4 at the end of Dark Epoch. The process described above is the formation of the DM Cores of Superclusters [35];
- DMPs supply not only additional mass ($\propto \tau^{3/2}$) to Cores, but also additional angular momentum ($\propto \tau^{2}$) fueling the overspinning of DM Supercluster's Cores until reaching a critical point of their stability when surface speed at equator exceeds escape velocity and DM Galaxy's Cores are ejected (as the result of the **Explosive Rotational Fission**). DM Galaxy's Cores obtain their orbital and rotational angular momenta from rotational angular momentum

of DM Superclusters' Cores;

- According to WUM, Early-galaxies formed in near present configuration. There are no protogalaxies in the World. That is why JWST did not see their images;
- Macroobjects form from the top (Superclusters) down to Galaxies and Extrasolar systems in parallel around different Cores made up of different DMPs;
- The oldest known stars in MW (HD140283 and SMSS J031300.36 - 670839.3) are the result of the Rotational Fission of the overspinning DM Core of the MW galaxy 13.77 Gyr and 13.6 Gyr ago, which was ejected 13.77 Gyr ago by the overspinning DM Core of the Virgo supercluster;
- The total space motion of HD140283 relative to the Sun with speed 361.3 km/s is due to the Rotational Fission of the overspinning DM Core of MW;
- Oldest galaxies with high-redshifts up to $z = 26$ (LTD of 13.63 Gyr) will be confirmed. It depends on the physical parameters of JWST;
- Most of galaxies (including early galaxies) are disklike galaxies due to the Rotational Fission of the overspinning DM Supercluster's Cores;
- The presence of very dusty highly red-shifted galaxies should be proved by discussing a mechanism of dust creation. According to Herschel Space Observatory, *dust is formed in stars and is then blown off in a slow wind or a massive star explosion. The dust is then "recycled" in the clouds of gas between stars and some of it is consumed when the next generation of stars begins to form. Dust formed in stellar wind or by Supernova Shockwave* [36]. The dust could have been efficiently ejected during the very first phases of galaxy build-up as A. Ferrara, A. Pallottini, P. Dayal speculated;
- Massive mature disk galaxies with mass up to $M^* \sim 10^{11} M_\odot$ cannot form so soon because it takes billions of years to form them, and so should not be there at all at the "beginning";
- Compact Disc Galaxies emerged as the result of the Rotational Fission of the overspinning DM Core of Superclusters. Each of them has one DM Core. There are no frequent mergers at the early epoch.

6. Conclusion

WUM does not attempt to explain all available cosmological and astrophysical 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, but in its present shape, it can already serve as a basis for a new Cosmology proposed by Paul Dirac in 1937. The Model should be developed into the well-elaborated theory by the entire physical community. We intend to give full details as to the formation of Galaxies by WUM in our next paper.

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