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► **To cite this version:**

Kirill Vankov, Anatoli Vankov. Dark Matter in Galaxies and Lambda-CDM Universe. 2023. hal-04055449v4

HAL Id: hal-04055449

<https://hal.science/hal-04055449v4>

Preprint submitted on 14 Dec 2023

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Dark Matter in Galaxies and Lambda-CDM Universe

Kirill Vankov, Anatoli Vankov

December 14, 2023

Abstract

This article presents the results of our research on a multifaceted Centennial problem of the apparent inability of Newton's gravity to treat observations of galaxies and their hierarchical structure by Kepler's laws. The suspected cause is "Dark Matter" (further, Galactic Dark Matter, - GDM), which is invisible but interacts with the ordinary one through Newton's gravity. However, misapplying Newton's theory is not excluded: there are cases demonstrating galactic observations in terms of GDM-free Keplerian orbits. We revisited this problem in all aspects and scrutiny and found its hidden roots in compromised conceptions of Kepler's orbits and mass-to-light ratio Y . Consequently, we developed an approximate algorithm for treating galactic observations in the Newtonian gravitation framework and demonstrated its success. We also considered observations on a cosmic scale for a possible interplay of GDM with Cold Dark Matter (CDM) and other parameters of the Lambda-CDM Cosmology. The conclusion is made that GDM and CDM were introduced for different reasons and our findings for GDM do not necessarily affect the Cosmological Model.

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1 Introduction

1.1 History notes on advent of GDM

Dark Matter has a long history dating back to the 1930s when astronomers encountered difficulties with the suspiciously fast motion in galactic structures. The main argument revolved around the apparent inability of Kepler's laws to explain a flat rotational curve (RC): constancy of galactic disc rotation within significant radial range. These galaxies were referred to as "non-Keplerian," in contrast to "Keplerian" systems where velocities decrease with radius similar to the Solar planetary system.

Specifically, the problem arose due to an apparent discrepancy between observed flat RCs and their theoretical predictions. Roughly, it can be thought that a centrally dominated mass calculated from the observed luminous material was kinetically insufficient to produce the conditions necessary for a flat RC in a galactic disc. The "missing mass" was named Galactic Dark Matter (GDM).

In the end of last Century, a status of "missing mass" can be seen from the textbook by Prof. Kaufmann [1]. There, in example of Milky Way, the enclosed mass within the radius $R = 8 \text{ Kpa}$, - the place of our Sun, the mass estimated from observations is $M_0 = 9.4 \times 10^{10} M_\odot$. The mass requested for "explanation" of GDM presence, must be, at least $M_0 = 6 \times 10^{11} M_\odot$. Interesting, our GDM-free assessment is $M_0 = 1.0 \times 10^{11} M_\odot$, which is closed to their value. This fact characterizes a deep historical confusion in posing the GDM problem.

Nowadays, astronomers have a large experience in treatment the GDM with phenomenological parametric models. Numerous attempts to directly detect it, so far, failed. They concluded that the GDM has a hypothetical form of gravitating substance devoid of atomic and nuclear structure, it cannot emit or absorb light, it is collisionless as being long-range interacting. It should not be mixed up with Cold Dark Matter (CDM) in cosmology.

1.2 Criticism of Dark Halo model

There are, at least two competing models stand out among other proposals: Modified Newtonian Dynamics model (MOND) and the GDM Halo model. The fact that there are two rival models is strange. Only one of them could be true, if both were not false.

Proponents of MOND suggest that Newton's gravity is deficient and fundamentally "modify" it by introducing a new constant a_0 in addition to the Universal gravitational constant G . Here, we avoid MOND because, in our view, it violates conservation laws. In recent paper by Banik with coauthors [2] (2023), they tested the Model on fresh data on Wide Binary Stars (WBS) sensitive to MOND

predictions and concluded that Model is deficient and the data are much better explained by Newton's gravity. Let us briefly discuss prevailing Dark Halo model. Its proponents try testing the model using Newton's gravitation starting with the potential

$$\Phi(r) = G M m / r = m V(r)^2, \quad F = G m_1 m_2 / d^2 \quad (1)$$

They use it in a narrow meaning of the circular rotation of a test particle, which is a particular case of Newton's Universal law of static attracting force between two bodies of masses m_1 and m_2 , where d is a distance. When one of the masses is however small, the potential exhibits equality of gravity pull on the test particle and reacted centripetal acceleration in a circle rotation.

The Potential concept is basis of phenomenological GDM Halo Model aimed at simulate GDM distribution $M_{dm}(r)$ in non-Keplerian galaxies. Keplerian ones are considered "explained" in analogy to Solar planets' orbits. As previously emphasized, the criterion of GDM presence is Non-Keplerian RC. Usually, potential superposition technique is used for to model space-distributed sources from GDM and ordinary matter including Halo, all composing a frame at rest. Those sources must provide the rotation of GDM-made and ordinary matter radially distributed along the disc. To our understanding, there are two types of mixed matter: sources at rest and a rotating objects driven by them.

From the superposition principle, they try, using the RC velocity components, to decompose radial distribution of mass profile into main sources in the disc, like Black Hole, Bulge, Disc, finally Dark Matter, if present

$$V(r)^2 = V_{bh}(r)^2 + V_b(r)^2 + V_d(r)^2 + V_h(r)^2 \quad (2)$$

where, bh- Black Hole, b- Bulge, d- Disc, h- Halo [3].

We argue that the Dark Halo model could not provide algorithms for conducting physically meaningful research. Indeed, the above formula may have a sense if the sources are attached to a rigid frame like charges in Electrostatic but not in a galaxy wrapped in Dark Halo. It is not clear, which parts of Dark Halo are mixed with ordinary matter and participate in disc rotation. Neither it's clear how GDM as the attractor could rest upon skies. A required amount of GDM is huge, at least, an order the ordinary matter, most in the outer Halo. If so, a galaxy should rotate about center of mass somewhere shifted from $r = 0$ to some much greater position.

There is no way to assess how the system is bounded. Newtonian Gravitation Dynamics is far from being in hand. Obviously, all physical laws must be broken there. The Dark Halo model does not provide algorithms for conducting research. In practice, different authors suggest a variety of prepared integrated conceptions. Astronomers use them for fitting tests depending on type of galaxies [3]. To our knowledge, there is no a single publication on a successful demonstration of resolving the GDM puzzle by the model.

A real Newton's theory can tell us if the input data right or wrong but cannot distinguish between gravitational identical matter painted in dark or white. In other words, it would tell if the galaxy is "Keplerian" or not. For example, there is an excellent textbook "Classical Mechanics" (3 Editions) [4] demanded since 1950 till today.

All things considered, we conclude that the problem of Dark Halo is ill-posed.

2 Roots of the problem: revelation

Strictly speaking, the problem in terms of phenomenological Dark Halo model is not even physically ill-posed, because the model has no a theory providing "theoretical prediction" of discrepancy from observations. The historical note of Professor Peebles has pointed at a very root of the problem: a possibility of *astronomers' misapplication's of Newton's theory*. The possibility turns out to be true reality.

There are numerous textbooks presenting theoretical fundamentals of GDM treatments, for example, an excellent textbook [5] giving the basic principle of GDM conception. There, the role of potential is presented in section 2.7, "The Potential of our Galaxy", p. 110-111, see the extract. It gives us a revelation clearly explaining, why they avoid the potential usage in the dynamic regime, see a citation:

Ideally, we should rely solely on dynamical tracers, such as the velocity fields of gas and stars and observations of gravitational lensing, to map out the distribution of mass in the Galaxy. Sadly, at the present time, such a project is unfeasible.

Since we are not yet in a position to model the Galactic density and gravitational field in a purely dynamical way, we flesh out the available dynamical constraints with photometric information. In particular, we simply assume that each component has a mass-to-light ratio Y that is independent of position. For the reason given above, this procedure is arbitrary and unsatisfactory, but it yields concrete Galactic potentials, which make testable predictions regarding the kinematics of stars and gas.

We agree with the above acknowledgment that among astronomers' community, a pure dynamical luminosity-free approach to Galactic Dynamics is neglected together with a simple idea, which follows from the dynamical potential (1): the "non-Keplerian" flat RCs becomes "Keplerian" if an enclosed mass-source increases proportionally to radius. One can restore the mass and density distributions using the equations of motion governed by conservation laws, what is beyond a capacity of phenomenological fitting models. Naturally, Newton's theory allows us to treat galaxies regardless of luminosity measurements. Instead, a wrong option is chosen: the usage of "arbitrary and unsatisfactory photometric information

from luminosity measurements”. In [6], readers find a detailed descriptions of Dark Matter problem and its treatment in phenomenological fitting models.

Results of our analysis mean the GDM conception being fictitious ant the Centennial GDM crisis is over. It should take time to return to a physical science of GDM-free astronomy respecting classical heritage. Still, many physical problems are left for further studying, among of them is the luminosity and measurements with a fuzzy Υ criterion.

The further successful demonstration Newtonian Gravitation Dynamics applied to Galaxies will complete the first part of the article before discussions of Dark entities on cosmic scale.

3 Newtonian Gravitation Dynamics of Galaxies

In this section, readers will come across notable innovations in our presentation of classical elliptic orbits. Instead of relying on geometric parameters like the semi-major axis and eccentricity, we adopt a single dimensionless physical parameter denoted as σ . This approach introduces the concept of the Standard Test Particle (STP) at rest with energy $m c^2$, serving as an initial approximation of Special Relativity Dynamics. This inclusion remarkably streamlines orbit categorization and enhances the physical interpretation of solutions to problems.

Kepler’s laws hold significant historical and pedagogical value when illustrating planetary orbits in their elliptical form for the potential $1/R$, described in terms of two geometric parameters: eccentricity and semi-latus rectum. They constitute a phenomenological representation of Newton’s Universal Gravitational Law without explicitly incorporating the equations of motion. However, Kepler’s laws fall short in defining Classical Gravitation Dynamics, which is governed by the conservation laws for total energy and angular momentum in isolated gravitational systems of material bodies moving through spacetime. These laws are formulated using physical parameters and are underpinned by Emmy Noether’s renowned Space-Time Symmetry Theorem. Additionally, the Virial Theorem is relevant to the dynamic stability of complex N-body systems. While we employ Kepler’s laws to describe the orbital motion of the Standard Test Particle (STP) under the One-Body approximation, we apply the equations of motion to intricate problems such as Galactic Dynamics, where this model proves remarkably effective. In situations demanding it, the N-body problem becomes necessary, although applying classical methods to groups and clusters of galaxies remains a challenge.

The equations of motion are governed by laws that express the conservation of total energy ϵ_0 and angular momentum l_0 . The nature of an orbit is contingent upon initial conditions, which are provided below alongside the conservation laws and equations of motion: $r = r_0, \beta = \beta_0, \theta = 0$.

$$\epsilon_0^2 = 1 - 2\frac{r_g}{r} + \beta_r^2 + \frac{l_0^2}{r^2}, \quad l_0 = r\beta_\theta = r_0\beta_0, \quad (3)$$

$$(d\xi/d\theta)^2 = 1 - 2\sigma + 2\sigma\xi - \xi^2, \quad (4)$$

$$r(\theta)/r_0 = (\sigma + (1 - \sigma) \cos \theta)^{-1}, \quad (5)$$

Denotations:

- radial speed $\beta_r = dr/dt$;
- angular speed β_θ ;
- angle of rotation θ ;
- radial (inverted) coordinate $\xi = r_0/r$;
- mass of source M ;
- gravitational radius $r_g = GM/c_0^2$;
- parameter of orbit type $\sigma = (r_g/r_0)/\beta_0^2$.

Given initial conditions, the equations of STP motion describe all possible classical orbits in the Newton's One-Body approximation. The one-parameter classification is illustrated in the Fig. 1. There are 5 types of them ranked by β_0 in the picture: a circle (2), $\sigma = 1$, elliptic sub-circle (1), $1 < \sigma < \infty$ and over-circle (3), $0.5 < \sigma < 1$, parabolic (unstable) (4), $\sigma = 0.5$, and hyperbolic (unbounded) (5), $\sigma < 0.5$. We recommend astronomers to abandon Kepler's geometrical orbits in favor of the above physical one-parameter equations.

Notice a remarkable feature of the σ criterion symmetry $GM/r = V^2$: a proportionality $M \propto r$ gives the same solution with the orbiting speed V unchanged (flat RC). Also, see GDM-free Mestel disc in GR dynamics, which is widely used in the GDM Halo model [7].

The theorems and laws altogether constitute the basis of Classical Gravitational Dynamics. As noted, in the advanced form it can be extended to the Special Relativity Dynamics (SRD) in Minkowski space [8, 9]. Using the SRD, one can assess the relativistic effects of high speed and strong field. Sadly, the SRD is almost forgotten or ignored in Modern Physics.

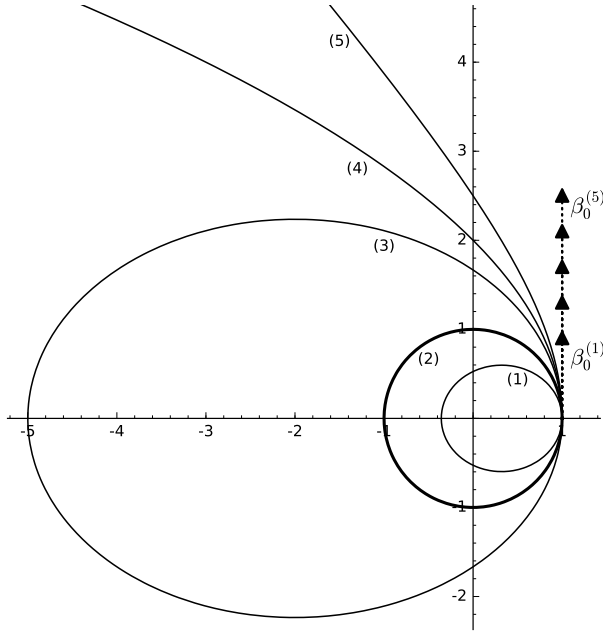


Figure 1: Five possible classical orbits in the framework of One-Body Newtonian Gravitation.

4 Galactic Structure in Theory

4.1 The Core and the Disc

Observations of the Core with central SBH are usually well treated by astronomers in the Newtonian approach, however, serious complications can arise with galactic structure, particularly, in the determination of mass and density distributions. The MW galaxy is a barred spiral one having a bulge and central SBH. The bulge is much heavier than that of the central SBH SgrA*. Its shape looks like two eggs, back-to-back glued and bar-connected. The SBH and bulge constitute a galactic Core, the zone of transition from spherical geometry to a disc in polar or cylindrical coordinates. Strictly speaking, this is N-body problem requiring a numerical simulation of conditions of transition from spherical to cylindrical geometry, that is a topic of separate study. However, we can assess a role of the Core in RC empirically seeing its flattening, specifically, at some point about $R_1 = 1$ kpc at the speed of rotation about $V_1 = 240$ km/s with a critical mass about $M_c = 5 \times 10^{10} M_\odot = 1 \times 10^{41}$ kg.

4.2 Concepts of rings, self-sustained rotation, and standard test particle

Bearing in mind that the radial disc density on average is smooth, let us consider an integral mass distribution $M(r_i)$. Here, we use a composition of R_i -rings of thickness Δr . Each ring contains all kinds of galactic materials rotating with the same speed $V_i(r)$ in accordance with the Equivalence Principle. Corresponding differential mass distribution will be $\Delta M(r_r)/\Delta r$.

By definition, a rotation of any R_i -ring is due to its source M_i that is, an inner mass $M_R(r_i)$ for $r < R_i$, provided being significantly greater than the fixed Core mass. In other words, the whole disc consists of huge number of R_i -rings each having its own source $M_R(r_i)$. We call it the Self-Sustained Rotating Disc provided being energized by the Core mass. A slight influence of the outer part of the disc at $r > R$ on the rotation of inner rings can be neglected to the next-order precision. This is true because adding or removing some edge rings does not influence density distribution and stability of the disc rotation.

We can choose $\Delta M(r_r) \ll M_R(r_i)$ so that the R_i can be considered the standard test particle (STP). According to Newton's gravity, its mass must be however small regardless of value (3, 4, 5). More details are given further.

4.3 Black Holes and the Principle of Ultimate Gravitational Compression

Astronomers used to notice but did not paid much attention to that the average density of a black holes inside the Schwarzschild sphere is inversely proportional to the square of its mass [10]. However, this happens under special condition of the Event Horizon in non-rotating black hole: the greater size and mass, the lesser density. Let us call it the *Principle of ultimate compression*, which tells us that the critical (nuclear) density, say, $d_{cr} \approx 1 \times 10^{19} \text{ kg/m}^3$ cannot be physically exceeded. Ideally, it occur when a natural radius of solid sphere with an observed border R approaching a theoretical radius $r_g = G M/c_0^2$, while the speed of STP approaches infinity. Notice, we are actually work with the Gravitational radius r_g , which is half the Schwarzschild radius. This brings us to the interesting result.

Assuming that BH mass M is measured, one can calculate theoretical values of the other two parameters d and R . We have

$$R = r_g = r = \frac{G M}{c_0^2}, \quad d = \frac{3 c_0^2}{4 \pi G R^2}, \quad (6)$$

where $R \sim M$, $M \sim R^3 d$, and $d \sim R^{-2}$. The equality $R = r_g$ imposes a constraint on the 3 parameters R , M , d . Given any of them, the other two can be calculated

using the above proportionality rules. If you double the mass, radius is doubled too, volume jumps cubic, hence, density falls in square. Such a scheme of mass compression in BH is physically meaningful in a certain range of masses above the Solar mass M_{\odot} . The smallest one is the Neutron star (NS), which can be considered the lightest stellar BH.

The proposed Principle of Ultimate Gravitational Compression to the critical density d_{cr} is principally different from the conventional conception of gravitational collapse, and it changes our understanding of Galactic Dynamics.

In the case of Milky Way, measured mass of SgrA* is $M = 4.1 \times 10^6 M_{\odot}$. Then, the calculation gives values of

- $R = 6.0 \times 10^9$ m and
- $d = 6.0 \times 10^6$ kg/m³;
- the actually measured radius is about $R = 2.4 \times 10^{10}$ m.

In another example of galaxy NGC 1052-DF2 of Ultra Diffuse type, the measured SBH of mass is $M = 1.5 \times 10^8 M_{\odot}$. The calculated values are:

- $R = 2.3 \times 10^{11}$ m
- $d = 6000$ kg/m³

that is, the mass density drastically drops.

The heaviest SBH is identified in the center of Messier 87 galaxy at the distance about 16 Mpc with the measured BH mass about $M = 6 \times 10^9 M_{\odot}$ (1500 times heavier than SgrA*). One can imagine “devouring monster”. Surprisingly, by the above proportionality rules, the calculated quantities are $R = 9 \times 10^{12}$ m, and density of the monster comes to level of air $d = 1.2 \times 10^3$ kg/m³. This is the consequence of UGC Principle, when Supermassive Black Holes can hardly exist in a stable spherical form, it is rather flattened by rotation while bounded. If so, observations and treatments of them could be confusing and misinterpreted.

Back to the Neutron Star. Assume that the measured parameters of SgrA* are reasonably true, particularly, mass density $d_{sgr} = 9.0 \times 10^6$ kg/m³. Then, one can assess the NS parameters by take one of them given and finding the rest using the proportionality rule. For example, let us take the critical density $d_{cr} = 1.0 \times 10^{19}$ kg/m³ to compare it with d_{sgr} . From the square proportionality factor $k^2 = 1.1 \times 10^6$, the values of radius and mass of the Neutron Star follow $R = 5.67 \times 10^3$ m, $M = 3.84 M_{\odot}$, what is physically reasonable. In our approach, one can assess any BH and NS case individually or in comparison.

4.4 RC unfolding algorithms

Talking about STP in the potential $\Phi(r) \sim 1/r$ due to a single source of mass M , we refer to the parameter σ in a physical dimensionless form applied to equation of STP motion in a dimensional form. Recall, this parameter in (5) describe all types of orbits including the sub-circle, which is not recognized in geometrical classification.

In Galactic Dynamics, one has to deal with a disk composed of multiple R -rings, the sources $M(r_i)$ for STPs. The purpose is to calculate the integral radial mass distribution using measured RC velocities $V(r_i)$. As noted, empirical RC data include a set of numbers, which generally cannot be approximated by simple smooth functions. Hence, output calculations might be also a set of numbers.

$$M(r_i) = \frac{1}{G} [r_i (V(r_i))^2] \quad (7)$$

We have to determine and express empirical data in terms of Newton's physics of galaxy. As noted, the mass m on both sides of equation represents the STP of any $m \ll M_i$. The differential radial mass distribution, by definition, should be a plot of $\Delta M(r_i)/\Delta r$ consistent with the equation (7). Then, the distribution of mass density $D(r_i)$ can be derived.

$$\frac{\Delta M(r_i)}{\Delta r} = 2 \pi H D(r_i) r_i = \frac{1}{G} [V(r_i)^2 + 2 r_i V(r_i)] \frac{\Delta V(r_i)}{\Delta r} \quad (8)$$

$$D(r_i) = \frac{(1/G) [V(r_i)^2 + 2 r_i V(r_i) \Delta V(r_i)/\Delta r_i]}{2 \pi H r_i} \quad (9)$$

Those equations guide using empirical RC data to unfold the whole physical information about galactic strictures in the Newtonian Gravitation Framework.

Galaxies, which does not distinctly reveal a Core and RC, should be treated with more sophisticated numerical approach. Next, Newtonian Dynamics of galaxies is demonstrated.

5 Milky Way

Here, we demonstrate the power and elegance of Newton's physics in the simplified example of Milky Way (MW) Galactic Dynamics. Before numerical calculations of MW characteristics, we define the differential mass increment

$$\Delta M(r) = 2 \pi H r D(r) \Delta r \quad (10)$$

From the concept of R_i -ring as the standard test particle, we know that ΔM is constant in the RC flat region of maximal stability. There the source mass $M(r)$

increases with r : $M(r) \sim r$ to make $G M(r)/r = \text{Cont}$. Then, the average density of matter $D(r)$ must decrease inversely proportional to radius $D(r) \sim 1/r$, what is a natural proportionality for a radial density distribution in cylindrical geometry.

From observations in the RC flat region of Milky Way, for example, at the Solar place, we have measured speed V_0 at $r = R_0$, as the reference quantities. Also, we measure the disc thickness H .

Having this done and using the above proportionality rules in the formulas, one can define and calculate all quantities in the flatness range, including gravitational radius r_g , total and kinetic energies, and angular momentum of any part of galaxy. The mean mass density can be roughly assessed from proportionality $D(r) = R_c D_c/r$ with respect to the starting point in the Core area. Using the data for $R_0 = 8 \text{ kpc}$, let us take the mass increment per $\Delta M \Delta r \approx M_0/R_0$, here ΔM is a familiar quantity in the concept of R_i -ring as the standard test particle. We have $\Delta M/\Delta R_0$. The volume containing this quantity is $\text{Vol}_0 = 2\pi H R \Delta R$, where $\Delta R = 1 \text{ m}$. Therefore, the local density is $D_0 = \Delta M_0/\text{Vol}_0$. Giving those illustrative numbers, we do not pay attention to their real accuracy of estimations.

So we have

- $R_0 = 8 \text{ kpc} = 2.47 \times 10^{20} \text{ m}$;
- $V_0 = 2.40 \times 10^5 \text{ m/s}$;
- $M_0 = 2.16 \times 10^{41} \text{ kg} = 1.0 \times 10^{11} M_\odot$;
- $H = 0.3 \text{ kpc} = 9.3 \times 10^{18} \text{ m}$;
- $D_0 = 5.5 \times 10^{-19} \text{ kg/m}^3 = 8 M_\odot/\text{pc}^3$
- $r_g = 1.6 \times 10^{14} \text{ m}$.

The density of matter in the MW on average is extremely low and favorable for collisionless motion of stars. Hence, the concept of test particle is justified.

The extrapolation to $R_1 = 1 \text{ kpc}$ gives $M_1 = 2.7 \times 10^{40} \text{ kg} = 1.3 \times 10^{10} M_\odot$. This is consistent with observations and the requirement of Core engagement in self-supporting disc rotation: its mass and density in the Core area should grow with radius faster than in the RC flat region.

Having measured V_0 and H and using the above proportionality rules, one can calculate other galactic quantities in the range of RC flatness. In particular, one can calculate a time period P of orbit rotation at any radius r . This quantity implicitly reveals the 3d Kepler's law $P^2 \sim r^3$. At Sun's position $r = R_0$, the period is $P_0 = 2.3 \times 10^8$ per year. Using the law $P^2 \sim R^3$, one can calculate $P(R)$ at any R in comparison with P_0 .

The relationship $P^2 \sim r^3$ is the consequence of formula $G M_0/R_0 = V_0^2$, which reflexes the Virial Theorem statement that in a circular gravitation orbit of particle of mass $m \ll M$, the potential energy $\Phi \sim 1/R$ is a doubled kinetic energy $K = m V^2/2$. At the same time, the period of rotation $P = 2 \pi R/V$ is, equivalently, $P = (R^3/G M)^{3/2}$. In elliptic orbits, one should use the semi-major axis a instead of radius R . The RC flatness is only one of the physical features of Keplerian orbits. One should be aware that all types of them in the gravitational potential $1/r$ are Keplerian.

Let us consider galactic Kinematics of large disc like in MW. It is remarkable that the potential function at the rings in a flat RC area is constant in all rings,

$$\Phi = r_g/R = 6.48 \times 10^{-7} = \text{const} \quad (11)$$

At the same time, the acceleration $g(R)$ (the force) on the ring surface decreases with the radius, $g(R) = V_0^2/R$. At $R = 8 \text{ Kpc}$, it is $g = 2.3 \times 10^{-10} \text{ m/s}^2$. Consequently, instability increases leading to developing of spiral arms, when orbits become over-circle or hyperbolic ($\sigma < 0.5$), Then disc material will flow out through the spiral arms. This phenomenon related to worsening ratio of angular momentum $L(r) \propto r^2$ vs the constant rotation energy, while a local acceleration decreases $g(r) \propto 1/r$. This factor characterizes a growth of velocity dispersion. Astronomers used this effect for identifying ages of stars and other physical properties depending on angular momentum $L(r)$ [11].

Finally, let us consider how strong the MW galaxy is bounded judging by the total energy ϵ : (3), the lower its value the stronger it is bounded, it is unbounded when $\epsilon > 1$. We have for every Ring $\epsilon = 1 - 3 \times 10^{-2}$, what characterizes a force strong enough to hold a huge galaxy in a stable rotation.

6 Other galaxies

6.1 Preliminary notes

Thus, we have introduced new concepts in Galactic Dynamics, such as R_i -rings, which play the role of STP in the One-Body approximation. We also explore the notion of self-sustained disc rotation and, finally, the Principle of Ultimate Compression of Black Hole mass in the Core. These concepts form the basis of our methodology for interpreting galactic observations within the framework of Newtonian Gravitation applied to the GDM problem. We need to develop algorithms for determining and calculating the main characteristics of a galactic disc, specifically the integral and differential radial mass distributions $M(r)$ and $\Delta M(r_i)$, as well as the mass density distribution $D(r)$. This is provided that the disc's thickness H and orbiting velocities $RC(r)$ are measured at a reference point

R_0 . For now, we won't delve into the study of brightness and mass-luminosity ratios.

In the treatment of galactic observations, careful consideration must be given to methodological issues. One such issue is the bottom-up evolution of galaxies. The focal point here is the physical process of forming a bound system of matter rotating around the center of mass. Another area of interest pertains to the ages of galaxies. A newly formed "baby galaxy" could potentially contain a stellar Black Hole. The subsequent evolution hinges significantly on the amount of matter in the surrounding space, or the Halo. As we have realized, mature spiral galaxies have Supermassive Black Holes (SMBH) within a constrained mass range. The heaviest of these galaxies become flattened by rotation, leading to complications in the Core's structure, which serves as a primary factor in galactic evolution.

Morphological issues also arise due to the interactions between galaxies in various environments. A larger galaxy might collide with a massive object, giving rise to the creation of "unconventional" galaxies, such as irregular dwarf galaxies and others. The stochastic nature of galactic evolution should manifest as irregularities and anomalies in the radial mass density distribution $D(r)$ within a galactic disc. On the contrary, sparser environments might yield galaxies with lower masses, lacking distinct spirals and visible discs. These galaxies could fall into the elliptic or "irregular" categories, making it challenging to precisely define their degree of gravitational binding. We'll delve further into this issue later. With an understanding of these matters, we are now prepared to discuss algorithms for Newton's investigation into the purported presence of GDM in galactic structures.

6.2 Non-flat RC

The majority of galaxies seem to have non-flat RCs. Our explanation is the following. Large galaxies, like the MW, usually have super-heavy central BH, large Halo, spiral arms, and no distinct edge. They could be mature, bounded systems in an environment rich in material. Our analysis of RC formation looks like an imitation of "bottom to top" evolution, – the large, the older. But accidental events could happen. Theoretically, cutting off some outer part of a large disc would leave the galaxy stable. Galaxies as giant as the MW can host inside a smaller ring galaxy, most likely, as a result of galactic collision. A similar observed phenomenon is known as Hoag's object [12]. The variety of environment is a good reason for the diversity of galaxies, particularly, in their morphology. Some examples are given next.

6.3 Spiral galaxy Messier-33

The galaxy M-33 is one among others revealing their stage of cosmological evolution. It is half the size of MW and presents puzzles: it does not have neither a visible SBH nor a Bulge. The RC measured in the range up to about 15 kpc shows the proportionality $V(r) \sim r^{1/2}$ that is,

$$V(r) = \left(\frac{G M(r)}{r} \right)^{1/2} \quad (12)$$

According to the above discussed proportionality rules, the disc density must be constant, what makes the mass proportional to the square of r , $M(r) \sim r^2$. How could it be possible with no SBH?

Our explanation goes to the *Principle of Ultimate Gravitational Compression*. Suppose, the galaxy should have a rotating SBH of mass somehow greater than in the MW. If so, the density becomes so low that such the SBH cannot exist as a sphere. By rotation, it must flatten down to the density of solid matter similar to the Disc of very large radius.

From assessment based on the proportionality rules, the approximate value of M at $R = 8$ kpc is $M = 5 \times 10^{10} M_{\odot}$, about half that in MW. One can expect that the RC above $R > 15$ kpc will approach a maximal value and then slowly decline without forming a large SSD. Based on the current RC data, astronomers decided a need for the GDM Halo in this galaxy.

6.4 Elliptical galaxy Messier-87

The considered above M-87 galaxy has some similarity with M-33. As shown, it has the estimated heaviest SBH of mass about 1500 times that of SgrA* mass calculated density is about the Earth's air one. Similarly to the case of M-33, the SBH of such a low density cannot exist as a spherical mass. Instead, it should be flattened by rotation to the ellipsoidal shape containing significantly suppressed mass. If so, we observe a solid galactic Core, which visible size extends up to 200 kpc of diameter.

The M-87 galaxy is approximately double in size that of the MW, and it has the substantially larger mass. It is considered elliptic, possibly surrounded by a huge matter Halo. Obviously, it cannot be characterized by the RC. This is the case when numerical simulations of observations are needed. Anyway, some astronomers try to find signs of the GDM existence in the hypothetical Halo there [13].

Recently, NASA astronomers demonstrated new breakthrough images of SBH in the M-87 and MW galaxies from the Event Horizon Telescope (EHT), which is actually a system of several telescopes at different locations. The project cost

dozens of millions dollars before starting. The idea is a reconstructing virtual image of the BH using information from many images [14]. *The Event Horizon* is a hypothetical phenomenon when gravity about Black Hole is so strong that nothing can escape, not even light. According to General Relativity, it is *the apparent horizon* unlike *the absolute event horizon* in the Cosmology. They say, “notion of a horizon in General Relativity is subtle and depends on fine distinctions”.

According to [15], the BH images turned out to be not true, rather the result of incorrect reconstruction procedure. This is not surprising in view of our treatment of the M-87 galaxy and its SBH.

6.5 Ultra-diffuse galaxies

To astronomers’ surprise, they observe galaxies apparently lacking the GDM, in particular, in ultra-diffuse galaxies (UDG) having low density. Often, they have an elliptic form and a non-flat RC looking “Keplerian”, meaning no GDM. In terms of Newtonian Dynamics, their disc rotation is not self-sustained due to the Core mass smallness. The mass and its density are not sufficient to keep the disc rotation at the maximal speed reached in the Core zone. Consequently, the RC(r) is going down with the radius. Unfortunately, observations of the Core with a central BH in such galaxies is aggravated by extremely low luminosity of UDGs.

In recent observations of the gas-rich ultra-diffuse galaxy AGC 114905 [16], the authors managed to get high resolution precision allowing them to determine parameters of RC and the Halo. They concluded that the galaxy definitely does not have the GDM. This is not an exclusion from a long list of UDF galaxies lacking GDM.

We believe that our approach would reveal more information about the UDF structure from currently available data, including by WEB. Overall, the results of our research in the Newtonian Gravitational framework brings the proof of GDM being fictitious,- the product of abstract minding.

6.6 Declaration of truth

In this article, we present two stages of proving physical non-existence of the GDM phenomenon,- the theoretical and practical proofs. Firstly, we argue that existing approaches to the problem, as in examples of MOND, and Dark Halo model, are not acceptable due to an obvious breakage of conservation laws and other basic principles of Classical Newton’s gravitational dynamics. Besides, we show that actually Newton’s gravity in contemporary form is misapplied. Secondly, we practically demonstrate its full success in treating galactic observations.

We also emphasize that Galactic conditions are compatible with requirements of Newton’s theory (small speeds and weak forces), though galaxies have com-

plexities due space, time, and mass huge scaling. To deal with them, we present new concepts and principles in clear physical formulations ensuring successful application of Newton's theory to Galactic Dynamics. All the above is a breakthrough novelty of fundamental importance in view of Centennial status due GDM "puzzle" and huge spending of human and material resources to solve it. Now we state the puzzle being resolved that allows us return from a pseudo-science to normal Science of Astronomy.

We understand that there are only a small number of physicists, who specialize in classical physics of orbits and are aware of non-triviality of Galactic Dynamics. So we are ready to answer any question from scientists, who could have any confusions about our results. Meanwhile, let us give readers some amazing features about galaxies learned from our findings and understandable to those, who has general knowledge about Newton's gravity and Solar planetary system.

There is a question about similarity and difference of Solar planetary system (Keplerian orbits?) and Milky Way (non-Keplerian ones?). As we found, all of them are normal Keplerian orbits of planets considered point-like Standard Test Particles (STP) of however small mass m in the One-Body approximation. An odd comparison is in scaling. The planets rotate about the Sun having mass of order $M_{\odot} = 1 \times 10^{30}$ kg. In Milky Way, the STPs rotate about the Core of a huge mass approximately $1 \times 10^{10} M_{\odot}$. Here, the STPs are the Rings of however small thickness Δr composing the whole disc.

In the Solar system, a ration of total rotating mass to Sun' mass is about 1×10^{-3} , that makes an average density about 5×10^{-7} kg/m³, while in the MW at Sun's place, the enclosed rotating mass is $1.0 \times 10^{11} M_{\odot}$ with a local density $D_0 = 5.5 \times 10^{-19}$ kg/m³. Rings rotate with the same speed about $V = 2.4 \times 10^5$ m/s, at the same time, a period of rotation decreases with radius in accordance to the 3d Kepler's law, what looks strange. Our concepts of self-rotating disc works very well.

The MW is extremely heavy and very empty, at Sun's place, distance between stars is about 5 light-years, a probability of their collisions must be small. More likely, it happens due to exchange galactic materials between disc and surrounding Halo, when two heavy stars could collide and form neutron star. Our concept of ultimate gravitational compression is very helpful to explain observations relative related to central SBHs.

Our algorithm of treating Rotational Curves based on our concept of Ring in a role of STP work very well. It is amazing to think that a single Ring contains myriads of planetary worlds, some of which could be a Hub for alien civilizations. Having all the above said, we bring Classical Heritage back to the observed true realm of worlds beyond the Solar system.

7 Dark Matter in Lambda-CDM Cosmology

7.1 GDM vs CDM

Experts in the field believed that astronomical observations contain “strong evidence” revealing an extended timeline of GDM evolution till today. So, our critique of GDM on a local scale should be extended back to cosmological observations on the largest cosmic scale in the context of appearing Cold (optionally warm) Dark Matter in Early Universe. Specifically, we are talking about the role of CDM in birth and evolving galaxies during metric space expansion and expanded acceleration due appearance of Dark Energy. An important issue is adjusting the cosmic density Ω to the right proportion of ED, CDM, and ordinary matter to match measured database with the flat expanding Universe. The benchmark observations include Cosmic Microwave Background (specifically, temperature fluctuation), and galactic lensing. We agree with this view only partly and argue in the following ways:

- Disputes are premature in view of revolutionary new observations coming from Webb telescope.
- Cosmological evidence of CDM is superficial comparing with direct galactic data;
- It was introduced for reasons different to GDM;
- CDM can be optionally cold, warm, or fuzzy, that means different physical properties compared to GDM;

7.2 GDM and Cosmic Microwave Background (CMB)

In the scenario of Early Universe, the observed CMB is thought a remnant of primeval radiation appeared after the Big Bang. A supporting observation was conducted by astronomers in 1964 as a thermal radiation from cosmic space with average temperature about 2,7 K and wavelength 2 mm, called Black Body radiation. Later on, it was carefully measured in the whole sky with attention to temperature (or wavelength) fluctuation within precision about 5×10^{-4} . It could be thought a roughness in uniformity as a function of angular scale, usually presented on the so-called power spectrum. There are several peaks, three of them are the main: “acoustic” showing the Universe being flat (no curvature); “baryonic” showing the ordinary matter (only 5%); the DM “evidence CDM” about 27%, the rest is Dark Energy, no more our comments.

Putting the above GDM/CMB evidence in the Big Bang aside, consider CMB history in textbook physics. Before Lambda-CDM model was accepted and independent of it, scientific history of Black-body radiation was marked by revolutionary Planck's discovery in 1900. Planck's law explained existing at that time ultra-violet "catastrophe" by quantum nature of energy. In Classical Physics, the thermal radiation was known long ago as a microwave field in thermodynamic quasi-equilibrium with surrounding bodies. The theory includes Stefan-Boltzmann law,– dependence of radiated total energy on temperature $E = sT^4$, also Wien Law giving peak wavelength shift inversely proportional to the temperature $\lambda \propto \text{const}/T$. Both laws can be derived from the Planck's law. Later on, the discovery of Sunyaev-Zeldovich physics effect allows us better understand physical nature of thermal radiation and its interaction with charged particles outside the Big Bang. High-energy Cosmic Rays also can contribute to the effect, [17, 18].

So, instead of imaginable abstractions, we suggest a real CDM physics, which tells us that there is no such a thing as "empty space",– there exists a kind of ether. This is a quantum field in equilibrium state of minimal energy density D_{en} and temperature: $T = 2.7 \text{ K}$ and $D_{en} = 4.2 \times 10^{-14} \text{ J/m}^3$, correspondingly, the equivalent mass density $D_{en}/c^2 = 1 \times 10^{-31} \text{ kg/m}^3$. The challenging problem of "equilibrium" is a balance of produced and worked-out energy: a cyclic conversing massive matter into light and back. Otherwise, the CMB field would be in "quasi-equilibrium state" with temperature T monotonously either rising or cooling. We think that this problem, as many others, could be resolved in alternative cosmological model with matter-antimatter coexisting.

7.3 GDM lensing

The idea of detecting the invisible GDM by gravitational lensing is simple. One has to observing how the gravity of massive galaxy clusters containing dark matter bends the light of more-distant galaxies located behind the cluster. A trick is that the observer must have some prior information about position and construction of both, in particular, the presence of Dark Matter and its amount. Besides, the observer should have a theoretical guidance for simulation, - a theory of light bending by gravitational field. Otherwise, the observer can use intuition. Assume, the observed distant galaxy looks unusually bright, then she/he may decide on assumed lensing. In reality, there are several physical theoretic approaches to be discussed.

The bending effect was tested in observations of light propagating close to the Sun or planet's surface. It was the first classical General Relativity test, treatment of which is based on Einstein's equations describing the space-time curvature with a constant speed of light, $c = \text{const}$. The GR 4th test was performed by Shapiro, who measured the time delay of radar pulses sent to a planet and reflected back,

when light passing near the Sun [19]. Actually, this is a modification of the first test, the bending effect due to changing speed on light in the field, provided the frequency is preserved as a mystification of total energy and angular momentum conservation. Specifically, the light speed depends on electric permittivity ϵ and magnetic permeability μ : $c^2 = \epsilon \mu$. In space free of forces, they are constants: $c_0^2 = \epsilon_0 \mu_0$ but in gravitational or electric fields, the light speed decreases due to changes in permittivity and permeability of space. This phenomenon is known in the SR Dynamics.

There is another important aspect of light bending by gravitational force. The ratio of light speed in “empty” space and in a field $n = c_0/c(r) > 1$ is known in Classical Electricity as the refractive index determining the light bending in transparent media such as air, water, optical glass etc. Also, it is widely used in fiber-optic technology. There, the effects are much greater than in gravitational field but they all have the same physical nature related to the change of permittivity and permeability in media comparing with “empty” space, that is free of gravitational and electric forces. The lensing measurements in galactic environment are considered the strong evidence of GDM existence, what is actually not true. Our point is that the bending of light by gravitation field means an interaction between electromagnetic wave and gravitating matter. This is contrarily to the statement that Dark Mater does not interact with light and not collide with matter. Otherwise, the light can pass through Dark Matter walls like in vacuum with no “lensing”, what again looks fantastic.

7.4 Notes on Lambda-CDM model

There is an agreement between Cosmologists that the Observed Universe is open and exists in almost flat space characterized by the space metric expansion (Friedmann’ solution) with acceleration (GR Lambda parameter) accompanied by Hubble’s receding of galaxies due to Big Bang (Lemaître’s) cosmological redshift, unlike due motion in SR. The acceleration has started several Billion years ago with a mysterious advent of Dark Energy in proportions DE 68 %, CDM 27 % with the ordinary matter only 5 %. As previously noted, this must make the average relative density of all matter/energy about $\Omega \approx 1$. Since then, galaxies must be seen moving away from each other progressively faster in space and time. It is an exponential expansion, eventually with a relative speed faster than light, when galaxies became vanishing from view line (Cosmic Horizon). Actually, the Model explains and predicts nothing meaningful in terms of classical physics.

In our view, Lambda-CDM phenomenological parameterized model operates with imaginary abstractions like “Big Bang”, “Inflation”, “Dark Matter”, “Planck Era prior to 1×10^{-43} sec after the Big Bang”, and so forth. Once more, we emphasize its irrelevance to observations vaguely justified by fictitious fitting, which

makes the Model non-refutable by established theoretical means. Somebody can call it “new physics” on the time scale 1×10^{-43} with no ticking clocks. In fact, the Model is even more complicated due to numerous parameters accounting for “tensions” between observations and theory, particularly for Hubble constant. There is no consensus among Cosmologists about the ultimate fate of the Universe. Variants are Big Freeze, or Thermal Death. Sadly, “Dark matter” was not theoretically predicted at all.

8 Webb world and alternative to Big Bang

8.1 Lambda-CDM model under test

Even before the Webb telescope, there were increasingly numerous works criticizing the Standard Model of Cosmology, authors of which rightly point out to its deficiency at the fundamental level,— in the inherent inconsistency, and observational “tensions”, particularly, related to the CDM and Dark Energy. In addition, all flaws of General Relativity are to be accounted for in analyses of the Standard Cosmological Model, [20, 21, 22, 23] with references, and more.

Webb revolutionary images gives a lot new to digest by astronomers. We observe Early Universe about 400-600 M yrs after Big Bang (dark ages) with rich structure containing heavy Black Holes and large galaxies about mass $1 \times 10^{11} M_{\odot}$, like Milky Way. Those things could not be there in the existing Lambda-CDM Cosmology Model [24, 25, 26, 27].

In the work [28], authors study the Webb image MACS0647–JD in amazingly high resolution. They consider it a triply-lensed $z \sim 11$ galaxy in a state of merging with two galaxies of stellar masses about Solar mass $10^8 M_{\odot}$. According to the Lambda-CDM scenario, such a high redshift must indicate the Epoch of Reionization about 400 Million years after Big Bang. The first stars could appear about 100 million years after the Big Bang, and Billion years needed to start formation of galaxies. In the Alternative GU Collision scenario, this Webb image shows return us to time of intensive disintegration of TU-m and TU-a having initial high density, a physical reason for high numbers of redshift. We observe past releasing a huge thermal energy due to annihilation, still continuing today.

In the work [29], authors describe how, using the Gemini South telescope, astronomers have discovered a new way stars can be destroyed: by colliding near a supermassive black hole in an ancient galaxy. There are the following comments.

“Astronomers studying a powerful gamma-ray burst (GRB) with the Gemini South telescope may have detected a never before-seen way to destroy a star. Unlike most GRBs, which are caused by exploding massive stars or the chance mergers of neutron stars, astronomers have concluded that this GRB came instead from the

collision of stars or stellar remnants in the jam-packed environment’. Actually, we must observe different forms of annihilation, including stars and Black Holes.

In the work [30], authors took advantage of Webb high resolution to study the “cosmic noon” epoch, 3-6 Billions years ($z \sim 1 - 2$) after Big Bang. At that time, the biggest galaxies presumably hosted the biggest SBHs in a variety of environments. There is a following comment.

“The study’s findings suggest that these black holes are not growing rapidly, absorbing limited material, and perhaps not significantly impacting their host galaxies. This discovery opens up a whole new perspective on black-hole growth since our current understanding is largely based on the most massive black holes in the biggest galaxies, which have significant effects on their hosts, but the smaller black holes in these galaxies likely do not.”

Recall, we introduced the Principle of Ultimate Gravitational Compression, which restricts the existence of dense Black Holes having a big mass as in example of M-87 galaxy. This is the explanation.

The work [31] presents the results of the analytic test of Lambda-CDM Model, based on analysis of Webb (JWST) images with the following Conclusion.

“The first JWST observations of high-redshift objects cannot be explained by the expanding-Universe model. Everything points to the possibility that actual age of the objects in Universe is far larger than predicted by Lambda-CDM cosmology. Before dismissing the Lambda-CDM paradigm, it is important to robustly confirm the new findings. Longer exposures would likely result in new galaxies discovered at $z \sim 20$ or more. We predict that the JWST should discover more galaxies observed as very luminous, with well-developed morphology. They would be approximately the same as galaxies of the late Universe. In such a case, the expanding-Universe paradigm would require correction and modification, in line with the discussion presented here”.

This is a remarkable work in straightforward conclusion of revising the Lambda-CDM-BB. We agree with them and state that all “strange” Webb images must be physically explained on a new space-time scale, and it is right time for changing the Lambda-CDM paradigm.

8.2 Alternative to Big Bang

This work is not intended to falsify or refute the Big Bang, however, it should be clear to readers about our critical opinion about it. Concerning the Lambda-CDM-BB paradigm, we are ready to suggest an Alternative Cosmology [32] (needs an update). We call it “the Grand Universe” (GU). The Alternative resolves long existing problems, such as Big Bang, cosmic rays, matter dominance, and many others. Webb images, which continue to come out revealing pictures impossible in the Lambda-CDM Model, are actually predicted or better understood.

A physical idea is simple: the Grand Universe (GU) is infinite in space and time. It comprises Typical Universes (TUs) equally made of matter and anti-matter. They are floating in the space of GU Background (GUB) and interacting with it and each other. The GUB is filled with microwave field of very low temperature, and all kind of materials, like evolving TUs, and debris. Also, it is filled with Cosmic and Gamma Rays, which originated far away from each points, hence, having no causality connection with their origin. This is the reason for their spectrum extended to ultra-high energy, it is possible due to GU infinity.

Having a mixture of bodies and anti-bodies of great mass spectrum, one can expect their full annihilation into light, however, it would not happen in infinite space. Indeed, a pair of same type matter will non-elastically collide and partly combine with a growing mass. Otherwise, a pair will, at least, partly annihilate with creation of light so that energy in the form of mass and light on average remained equally conserved. This is a statistical matter-antimatter separation [?].

In the random collisions of two same-matter TUs combining the total mass. Similarly, there are matter-antimatter collisions leading to mass annihilation. It can be called “Big Bumps” in comparison with a single Big Bang. In this scenario, TUs are destroyed and new TUs evolved in eternal cycles of renewal so that the GU as a whole exists in a steady state. Each TU has horizon-free boundary, angular momentum, and the flattened form due to rotation. It is clear now why our observed Universe has comparatively low-density of dominated matter and some anti-matter.

In the thought collision scenario in our Observed Universe, it was likely lasting hundreds Billions years by our clock. The TU-m of a bigger size lost a large part of mass making it unbounded and slowly disintegrating (“expansion”). In a back-time view, we see isotropic receding galaxies. We do not see yet the boundaries, so may assume our location is being close to the center of masses at the time of collision.

The observed receding galaxies have high gravitational physics redshift first of all due to high density and tendency of redshift rising with look-back time at that epoch. This is because a density of matter dropped during the annihilation. Currently, we live in the matter dominated Universe but have anti-matter in amount greater than usually thought. Actually, Webb images show the Early Universe at tee time when clock ticking rates was slowed down comparing with our time. Clearly, the distance time scale based on theoretically corrected redshift in Lambda-CDM model is wrong. In a deepest long view, we can expect that the Observed Universe is anisotropic and preserve a rotational moment. Hence, there is a theoretical possibility to detect its unisotropy and boundaries. We are ready to make the proposal of a deepest 3D view for the Webb team.

In Milky Way, we clearly observe, but not recognized yet, results of annihilation and presence of anti-matter leftovers, consequently, there are a variety of unusual phenomena. In particular, there are objects steadily or explosively releasing huge

amount of energy, high-energy flashes and pulses, also, large-scale structures after burned anti-matter, and a great diversity of galaxy types. Most likely, the Milky Way was hit and survived in decaying state. Likely, the Tunguska event in 2008 was a fall of large fragments after annihilating explosion far away. Yet, there are real observations of UFO/UPA phenomena, and many other “puzzles”, which could be explained.

The suggested GU Cosmology is radically different from Big Bang, especially, in naturality, simplicity, and harmonic complexity yet to be learned. It has in practice a great explanatory and predictive power, as such, it is a rich source of Scientific Project proposals.

At this moment, we have no Word Dictionary to translate our work into the Lambda-CDM abstract language. Hopefully, right decoding of Webb’s images could resolve the problem. Many nonphysical statements and expressions should be removed from usage, for example, “120 order high vacuum catastrophe” in Lambda-CDM and GR-DE; time measurements without cloak to the precision $\Delta t = 1 \times 10^{-43}$ s after BB, and so forth.

9 Summary and Conclusion

This work is an expression of our independent critical opinion on the main current problems of Physics Frontiers. The primary purpose of this work is to explain the Centennial Galactic DM puzzle of apparently “strange” RC behavior in galaxies. We state the cause being misapplying Newton’s theory. Our breakthrough explanation is straightforward using Newtonian Gravitation framework, albeit the technique is not trivial. We present new fundamentally important physical ideas and concepts needed for theoretical analysis and treatment of galactic observations on the basis of space-time symmetries and corresponding conservation laws. Concerning the SBH, we principally revised their conventional understanding with the emphasis on Neutron Star unique role in the phenomenon of Ultimate Gravitation Compression.

One can argue that such phenomena as GDM and Cosmological (Cold) DM are similar, both physically unexplained and should have the same explanation, however, we disagree with that. Unlike GDM, the CDM was introduced for a continuing “high-precision” treatment of the Observed Early Universe and its evolution in the Lambda-CDM Cosmological Model. Therefore, a falsification of CDM does not necessarily affect the cosmic role of CDM in the Model. We express our critical opinion about Lambda-CDM Big Bang Model and suggest the Alternative to be discussed.

The stated proof of GDM physical non-existence could make a precedent for more critical studies in Physics Frontiers and alternatives. This is time when Webb

revolutionary images continue old questioning whether Big Bang happened.

Any comments from agreeing, disagreeing, and angry readers are greatly appreciated.

References

- [1] W. J. Kaufmann. *Universe*. W H Freeman & Co, 1993.
- [2] I. Banik et al. Strong constraints on the gravitational law from gaia dr3 wide binaries. *Monthly Notices of the Royal Astronomical Society*, 527(3):4573–4615, November 2023.
- [3] Y. Sofue. Rotation curve of the Milky Way and the dark matter density. *Galaxies*, 8(2):37, 2020.
- [4] H. Goldstein et al. *Classical mechanics*. Pearson, 2001.
- [5] J. Binney and S. Tremaine. *Galactic Dynamics*. Princeton University Press, Princeton, NJ USA, 2008.
- [6] L. Kay et al. *21st Century Astronomy*. W. W. Norton & Company, Inc., 2013.
- [7] L. Mestel. On the Galactic Law of Rotation. *Monthly Notices of the Royal Astronomical Society*, 126(6):553–575, November 1963.
- [8] J. L. Synge. *Relativity: the General theory*. North Holland Publishing Company, Amsterdam, 1964.
- [9] J. L. Synge. *Relativity: the Special theory*. North Holland Publishing Company, Amsterdam, 1965.
- [10] B. E. Baaquie and F. H. Willeboordse. *Exploring the invisible universe: from black holes to superstrings*. World Scientific, 2015.
- [11] S. Sharma et al. Fundamental relations for the velocity dispersion of stars in the Milky Way. *Monthly Notices of the Royal Astronomical Society*, 506(2):1761–1776, 06 2021.
- [12] I. Finkelman et al. Hoag’s Object: evidence for cold accretion on to an elliptical galaxy. *Monthly Notices of the Royal Astronomical Society*, 418(3):1834–1849, 12 2011.
- [13] J. D. Murphy et al. Galaxy kinematics with VIRUS-P: The dark matter halo of M87. *The Astrophysical Journal*, 729(2):129, February 2011.

- [14] K. Akiyama et al. First Sagittarius A* Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole in the Center of the Milky Way. *The Astrophysical Journal Letters*, 930(2), May 2022.
- [15] M. Miyoshi et al. The jet and resolved features of the central supermassive black hole of M87 observed with the event horizon telescope (EHT). *The Astrophysical Journal*, 933(1):36, June 2022.
- [16] P. E. Mancera Piña et al. No need for dark matter: resolved kinematics of the ultra-diffuse galaxy AGC 114905. *Monthly Notices of the Royal Astronomical Society*, 512(3):3230–3242, 2022.
- [17] M. Birkinshaw. The sunyaev-zel’dovich effect. *Physics Reports*, 310(2):97–195, March 1999.
- [18] J. Erler et al. Planck’s view on the spectrum of the sunyaev–zeldovich effect. *Monthly Notices of the Royal Astronomical Society*, 476(3):3360–3381, 2018.
- [19] I. I. Shapiro et al. Fourth test of general relativity: Preliminary results. *Phys. Rev. Lett.*, 20(22):1265–1269, May 1968.
- [20] M. Křížek. Ten arguments against the proclaimed amount of dark matter. *Gravitation and Cosmology*, 24:350–359, 2018.
- [21] M. Křížek et al. Which effects of galactic clusters can reduce the amount of dark matter. *Bulgarian Astronomical Journal*, 21:43–65, 2014.
- [22] M. Křížek et al. Dark matter and rotation curves of spiral galaxies. *Bulgarian Astronomical Journal*, 25:64–77, 2016.
- [23] M. Křížek and L. Somer. Excessive extrapolations in cosmology. *Gravitation and Cosmology*, 22:270–280, 2016.
- [24] I. Labbé et al. A population of red candidate massive galaxies 600 myr after the big bang. *Nature*, 616(7956):266–269, April 2023.
- [25] L. Ferreira et al. Panic! At the Disks: First Rest-frame Optical Observations of Galaxy Structure at $z > 3$ with JWST in the SMACS 0723 Field. arXiv:2207.09428 [astro-ph.GA], 2022.
- [26] M. Boylan-Kolchin. Stress testing Lambda-CDM with high-redshift galaxy candidates. *Nature Astronomy*, 7(6):731–735, June 2023.
- [27] S. Comerón et al. The massive relic galaxy ngc 1277 is dark matter deficient. *A&A*, 675, 2023.

- [28] T. Y.-Y. Hsiao et al. Jwst reveals a possible $z \sim 11$ galaxy merger in triply-lensed macs0647-jd. *arXiv preprint arXiv:2210.14123*, 2022.
- [29] A. J. Levan et al. A long-duration gamma-ray burst of dynamical origin from the nucleus of an ancient galaxy. *Nature Astronomy*, pp. 1–10, 2023.
- [30] A. Kirkpatrick et al. Ceers key paper vii: Jwst/miri reveals a faint population of galaxies at cosmic noon unseen by spitzer. *arXiv preprint arXiv:2308.09750*, 2023.
- [31] N. Lovyagin et al. Cosmological model tests with jwst. *Galaxies*, 10(6):108, 2022.
- [32] K. Vankov. Physics Tomorrow: The Proposal of New Cosmology, the Grand Universe Model. hal-01567117, July 2017.