Decisive Role of Gravitational Parameter G in Cosmology

Vladimir S. Netchitailo

netchitailov@gmail.com

Measure what can be measured and make measurable what cannot be measured.

Galileo Galilei

Abstract

In 1937, P. Dirac proposed the Large Number Hypothesis and the Hypothesis of the variable gravitational "constant," and later added the notion of continuous creation of Matter in the World. The Hypersphere World-Universe Model (WUM) follows these ideas, albeit introducing a different mechanism of Matter creation. In this paper we show that Gravitational parameter G that can be measured directly makes measurable all Cosmological parameters, which cannot be measured directly.

1. Introduction

About 21 years ago, I developed an interest in Cosmology. For 11 years, I have been elaborating a model I dubbed World-Universe Model (WUM), and then in 2013, I uploaded the first papers on viXra [1], [2], which were, in fact, the beginning of a New Paradigm in Cosmology. From 2015, I published a serious of articles on WUM in the Journal of High Energy Physics, Gravitation and Cosmology (Editor-in-Chief Prof. Dr. C. Corda – an expert in the fields of mathematics, theoretical physics, astrophysics, and cosmology). The manuscript "Review Article: Cosmology and Classical Physics" [3] is a synthesis of my approach to Cosmology and the article "JWST Discoveries—Confirmation of World-Universe Model Predictions" [4] is a quintessence of WUM. The present paper is a continue of the previous manuscript "Fundamental Physical Constants and Primary Physical Parameters" [5]. It concentrates on the detailed analysis of Primary Physical Parameters and emphasizes the decisive role of experimentally measured Gravitational parameter G in Cosmology.

2. Principal Points of WUM

2.1. Fundamental Physical Constants

Maxwell's equations were published by J. C. Maxwell in 1861 [6]. He calculated the velocity of electromagnetic waves from the value of an **electrodynamic constant** c measured by Weber and Kohlrausch in 1857 [7] and noticed that the calculated velocity was very close to the velocity of light measured by Fizeau in 1849 [8]. This observation made him suggest that **light is an electromagnetic phenomenon** [9].

We emphasize that c in Maxwell's equations **is the electrodynamic constant** but **not the speed of light in vacuum.** 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 stable elementary particles.

Rydberg constant R_∞ is a physical constant relating to atomic spectra. The constant first arose in 1888 as an empirical fitting parameter in the Rydberg formula for the hydrogen spectral series [10].

Electron Charge-to-Mass Ratio e/m_e is a Quantity in experimental physics. It bears significance because the electron mass m_e cannot be measured directly. The e/m_e ratio of an electron was successfully measured by J. J. Thomson in 1897 [11]. We name it after Thomson: $R_T \equiv e/m_e$.

Planck Constant h was suggested by M. Planck in 1901 as the result of investigating the problem of black-body radiation. He used Boltzmann's equation from **Statistical Thermodynamics**: $S = k_B \ln W$ that shows the relationship between entropy S and the number of ways the atoms or molecules of a thermodynamic system can be arranged (k_B is the Boltzmann constant) [12].

Based on the **experimentally measured** values of the constants R_∞ , R_T , c , h , and the magnetic constant: $\mu_0 = 4\pi \times 10^{-7}\ H/m$ we make measurable the **most important constants** as follows [5]:

- Basic size unit a :

$$a = 0.5\left[8(\mu_0 h/c)^3 R_\infty R_T^6\right]^{1/5} = 1.7705641 \times 10^{-14}\ m$$

- Dimensionless Rydberg constant α :

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

- Electron rest energy E_e :

$$E_e = \alpha hc/a$$

- Elementary charge e :

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

All these Fundamental constants, including classical electron radius $a_o = a/2\pi$, could be calculated based on the experimentally measured constants before Quantum Physics! It is worth noting that the constant α was later named “Sommerfeld’s constant” and later “Fine-structure constant.”

2.2. Basic Units

In WUM we introduce the following Basic Units:

- Size a
- Time $t_0 = a/c$
- Frequency $\nu_0 = c/a$
- Energy $E_0 = hc/a$
- Surface Energy Density $\sigma_0 = hc/a^3$
- Energy Density $\rho_0 = hc/a^4$

2.3. Medium of the World

WUM introduces the Medium of the World, which consists of stable elementary particles with lifetimes longer than the age of the World: protons, electrons, photons, neutrinos, and Dark Matter Particles (DMPs). The **existence of the Medium is a principal point of WUM**. It follows from the observations of Intergalactic Plasma; Cosmic Microwave Background Radiation; Far-Infrared Background Radiation. There is no empty space (vacuum) in WUM. Inter-galactic voids discussed by astronomers are, in fact, examples of the Medium in its purest. Cosmic Microwave Background Radiation is part of the Medium; it then follows that the **Medium is the absolute frame of reference**. Relative to the Cosmic Microwave Background rest frame, the Milky Way galaxy and the Sun are moving with the speed of 552 and 370 $km\ s^{-1}$, respectively [13].

2.4. Principal Role of Maxwell's Equations

Maxwell's Equations (MEs) form the foundation of classical electrodynamics. Gravitoelectromagnetism (GEM) is a gravitational analog of Electromagnetism. GEM equations differing from MEs by some constants were first published by O. Heaviside in 1893 as a separate theory expanding Newton's law. GEM is an approximation to the Einstein's gravity equations in the weak field limit. H. Thirring pointed out this analogy in his "*On the formal analogy between the basic electromagnetic equations and Einstein's gravity equations in first approximation*" paper published in 1918 [14]. It allows us to use formal analogies between the electromagnetism and relativistic gravity. MEs produce only two physically measurable quantities: energy density and energy flux density [15].

The value of MEs is even greater because J. Swain showed that "*linearized general relativity admits a formulation in terms of gravitoelectric and gravitomagnetic fields that closely parallels the description of the electromagnetic field by Maxwell's equations"* [16]. We emphasize that **GEM considers not only interactions between masses but also between mass currents**, which produce gravitomagnetic field.

In 2021, G. Ludwig in his paper "Galactic rotation curve and dark matter according to gravitomagnetism" wrote: *Most theories used to explain the rotation curve have been restricted to the Newtonian potential framework, disregarding the general relativistic corrections associated with mass currents. In this paper it is shown that the gravitomagnetic field produced by the currents modifies the galactic rotation curve, notably at large distances. The coupling between the Newtonian potential and the gravitomagnetic flux function results in a nonlinear differential equation that relates the rotation velocity to the mass density. The solution of this equation reproduces the galactic rotation curve without recourse to obscure dark matter components.* ***The effects attributed to dark matter can be simply explained by the gravitomagnetic field produced by the mass currents*** [17]

WUM is based on Gravitomagnetism. The explanation of the galactic rotation curve made by G. O. Ludwig is in good agreement with the approach of WUM.

3. Primary Cosmological Parameters

There are only two directly measured Cosmological Parameters: the Gravitational parameter G and the Temperature of the Cosmic Microwave Background Radiation T_{MBR}. To the best of our knowledge, Q. Li, *et al*. in 2018 experimentally measured the most accurate values of G using two independent methods [18]:

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

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

with Relative Standard Uncertainty (RSU): $RSU = 1.16 \times 10^{-5} = 11.6\ ppm$.

D. J. Fixsen in 2009 measured the value of T_{MBR} with $RSU = 3 \times 10^{-5} = 30\ ppm$ [19]:

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

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

3.1. Inter-Connectivity of Primary Cosmological Parameters

The constancy of the universe fundamental constants, including Newtonian constant of gravitation, 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 Primary Cosmological Parameters that depend on dimensionless time-varying quantity Q that is a measure of the Size R and Age A_τ of the World:

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

which in present epoch equals to: $Q = 0.7599440 \times 10^{40}$ and is, in fact, the Dirac Large Number (see Section 3.4). **WUM is based on two parameters only**: α and Q .

3.2. Energy Density of the World

Imagine that the World is a Hubble Bubble with a radius $R = c\tau$ (where c is a gravitodynamic constant and τ is a cosmological time) and an energy density of a spherical surface σ_0 . With Nikola Tesla's principle at heart – *There is no energy in matter other than that received from the environment* – we calculate an energy of the World E_W :

$$E_w = 4\pi R^2 \sigma_0$$

and average energy density ρ_W :

$$\rho_W = \frac{3\sigma_0}{R} = \frac{3hc}{a^3 R} = \frac{3hc}{a^4}\frac{a}{R} = 3\rho_0 \times Q^{-1}$$

that is inversely proportional to R .

3.3. Critical Energy Density

The principal idea of WUM is that ρ_W equals to the critical energy density ρ_{cr} :

$$\rho_W = \rho_{cr}$$

which can be found by considering a sphere of radius R_M and enclosed mass M that can be calculated by multiplication of critical mass density by the volume of the sphere. When the World has the critical density, the Hubble velocity $H \times R_M$ ($H = c/R$ is the Hubble's parameter) equals to the escape velocity:

$$2G \times \tfrac{4\pi}{3} R_M^3 \times \tfrac{\rho_{cr}}{R_M c^2} = (H \times R_M)^2$$

which gives an equation for ρ_{cr} [20]:

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

This equation can be rewritten as:

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

where $\mu_g = \frac{4\pi G}{c^2}$ is the gravitomagnetic parameter and $\rho_M = \frac{2}{3}\rho_{cr}$ is the energy density of the Medium. Considering that $H \propto R^{-1}$, it is easy to see that the gravitational parameter $G \propto R^{-1}$. We emphasize that the values of the main cosmological parameters G and H depend on the value of ρ_M which is the characteristic of the **Medium** that is Homogeneous and Isotropic.

3.4. Gravitational Parameter G and Dirac Large Number Q

Considering equations in Sections 3.2 and 3.3, we can find the equation for G :

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

The average value of Gravitational parameter G_{av} of the experimentally measured values [18]:

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

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

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

3.5. Intergalactic Plasma

In our Model, the World consists of stable elementary particles with lifetimes longer than the age of the World. Protons with mass m_p and electrons with mass m_e have identical concentrations in the World: $n_p = n_e$. Intergalactic plasma (IGP) consisting of protons and electrons has plasma frequency ω_{pl} :

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

Since the formula calculating the potential energy of interaction of protons and electrons contains the same parameter k_{pe}:

$$k_{pe} = m_p \omega_{pl}^2 = m_e \omega_e^2 = m_e (2\pi \nu_0 \times Q^{-1/2})^2$$

where we assume that ω_e is proportional to $Q^{-1/2}$, then ω_{pl}^2 is proportional to Q^{-1}. Energy densities of protons and electrons are then proportional to Q^{-1}, similar to the critical energy density $\rho_{cr} \propto Q^{-1}$. We substitute $\omega_{pl}^2 = \frac{m_e}{m_p} (2\pi \nu_0 \times Q^{-1/2})^2$ into the first equation and calculate concentrations n_p and n_e :

$$n_p = n_e = \frac{2\pi^2}{a^3} \frac{m_e}{m_p} \times Q^{-1} = 0.254810 \ m^{-3}$$

A. Mirizzi, *et al.* found that the mean diffuse intergalactic plasma density is bounded by $n_e \lesssim 0.27 \, m^{-3}$ [21] corresponding to the WMAP measurement of the baryon density [22]. The calculated Mediums' plasma density is in good agreement with the estimated value [21].

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

$$\Omega_p = \frac{2\pi^2 \alpha}{3} = 0.048014655$$

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

$$\Omega_{MO} = \frac{1}{2} \Omega_p = \frac{\pi^2 \alpha}{3} = 0.024007318$$

The calculated values of Ω_p and Ω_{MO} are in good agreement with their 2015 estimations [23], [24].

In our opinion, measurements of IGP parameters can be done by investigations of the Fast Radio Bursts, which are millisecond duration radio signals originating from distant galaxies. These signals are dispersed according to a precise physical law and this dispersion is a key observable quantity which, in tandem with a redshift measurement, can be used for fundamental physical investigations [25].

The dispersion measure and redshift, conducted by E. F. Keane, *et al.*, provide the measurement of the cosmic density of ionized baryons in the intergalactic medium Ω_{IGM} [25]:

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

that is in excellent agreement with the predicted by WUM value of $\Omega_p = 0.048014655$. Using the equation for n_e, we calculated the value of photons' time delay [26]:

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

which is in good agreement with experimentally measured value [25]:

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

To summaries: the values of the Intergalactic plasma parameters predicted by WUM in 2013 [1] are confirmed by experiments conducted in 2016 [25].

3.6. Minimum Energy of Photons

Analysis of Intergalactic plasma shows that the value of the lowest plasma frequency ν_{pl} is [1]:

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

Photons with energy smaller than $E_{ph} = h\nu_{pl}$ cannot propagate in plasma, thus $h\nu_{pl}$ is the smallest amount of energy a photon may possess:

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

The above value, predicted by WUM in 2013, is in good agreement with the value:

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

obtained by L. Bonetti, *et al.* in 2017 [27]. Following L. Bonetti, *et al.* we can call this amount of energy the rest energy of photons. In our opinion, it is more relevant to call E_{ph} the minimum energy of photons which can pass through the Intergalactic plasma.

3.7. Origin of Cosmic Microwave Background Radiation

According to the standard Big Bang Model, the photons that existed at the time of photon decoupling (380,000 years after the Big Bang) have been propagating ever since, though growing fainter and less energetic, since the expansion of space causes their wavelength to increase over time.

WUM: Wavelength is a classical notion. Photons, which are quantum objects, have only four-momenta. They do not have wavelengths. By definition, "*Black-body radiation is the thermal electromagnetic radiation within or surrounding a body in thermodynamic equilibrium with its environment*".

According to WUM, the black body spectrum of Microwave Background Radiation (MBR) is due to thermodynamic equilibrium of photons with IGP consisting of protons and electrons. It explains why MBR is a perfect blackbody.

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

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

where T_{MBR} is MBR temperature. We can now calculate the value of T_{MBR}:

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

Thus calculated value of T_{MBR} is in excellent agreement with experimentally measured value of $2.72548 \pm 0.00057\ K$ [19].

At the Beginning of the World, the extrapolated value of T_{MBR0} at $Q = 1$ is:

$$T_{MBR0} = 2.1927\ \text{MeV} = 2.5445\times10^{10}\ \text{K}$$

Note that T_{MBR0} is considerably smaller than values commonly discussed in literature.

Let us proceed to calculate the value of T_{MBR} at different Ages of the World A_τ (see **Table 1**).

Table 1. The value of T_{MBR} at different Ages of the World.

Age	T_{MBR}
1 s	70,5377 K
10^8 s $\cong$ 3.2 yr	705.377 K
10^{16} s $\cong$ 0.32 Byr	7.05377 K
1.4×10^{16} s $\cong$ 0.45 Byr (Luminous Epoch)	6.47747 K
3×10^{17} s $\cong$ 9.6 Byr (birth of Solar system)	3.01403 K
4.49×10^{17} s $\cong$ 14.22 Byr (present)	2.725245 K

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

3.8. Primary Parameters

According to WUM, the following parameters of the World depend on Q [5]:

- Newtonian parameter of gravitation G

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

- Hubble's parameter H

$$H = \frac{c}{a} \times Q^{-1}$$

- Age of the World A_τ

$$A_\tau = \frac{a}{c} \times Q$$

- The Worlds' size R

$$R = a \times Q$$

- Critical energy density ρ_{cr}

$$\rho_{cr} = 3\frac{hc}{a^4} \times Q^{-1}$$

- Concentration of intergalactic plasma n_{IGP}

$$n_{IGP} = \frac{2\pi^2}{a^3}\frac{m_e}{m_p} \times Q^{-1}$$

- Minimum energy of photons E_{ph}

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

- Temperature of the Microwave Background Radiation (MBR) T_{MBR}

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

- Temperature of the Far-Infrared Background Radiation (FIRB) peak T_{FIRB}

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

3.9. Hubble's Parameter and Age of the World

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

$$H_0 = \frac{8\pi hc}{a^3 c^3} \times G_{av} = 68.75084\ km\ s^{-1} Mpc^{-1}$$

$$A_\tau = \frac{a^3 c^3}{8\pi hc} \times G_{av}^{-1} = 4.4882037 \times 10^{17} s = 14.22226\ By$$

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

4. Age of Universe

In physical cosmology, the age of the universe is the time elapsed since the Big Bang. We do not know the exact age of the universe, but we believe that it is around 13.8 billion years. Astronomers estimate the age of the universe in different ways:

- NASA's Wilkinson Microwave Anisotropy Probe (WMAP) project's nine-year data released in 2012 estimated the age of the universe to be (13.772$\pm$0.059) billion years. This measurement is made by using the location of the first acoustic peak in the microwave background power spectrum to determine the size of the decoupling surface (size of the universe at the time of recombination). The light travel time to this surface (depending on the geometry used) yields a reliable age for the universe. **Assuming the validity of the models** used to determine this age, the residual accuracy yields a margin of error near one percent [28];
- In 2015, P. A. R. Ade, *et al.* presented results based on full-mission Planck observations of temperature and polarization anisotropies of the CMB. **These data are consistent with the six-parameter inflationary LCDM cosmology**. From the Planck temperature and lensing data, for this cosmology they estimated the

age of the universe to be (13.813±0.038) billion years [23], slightly higher but within the uncertainties of the earlier number derived from the WMAP data [28];

- The age of the universe based on the best fit to Planck 2018 data alone is 13.787±0.020 billion years. This number was obtained from the final full-mission Planck measurements of CMB anisotropies, combining information from the temperature and polarization maps and the lensing reconstruction (in contrast to other methods which typically involve Hubble's law and the age of the oldest stars in globular clusters). In authors opinion, *It is possible to use different methods for determining the same parameter (in this case, the age of the universe) and arrive at different answers with no overlap in the "errors"* [29];
- The oldest known star HD 140283 (Methuselah star) is a subgiant star about 190 light years away from the Earth for which a reliable age has been determined. H. E. Bond, *et al.* found its age to be 14.46 +/- 0.8 Gyr [30] that does not conflict with the age of the Universe, 13.77 +/- 0.06 Gyr, based on the microwave background and Hubble constant [28]. It means that this star must have formed between 13.66 and 13.83 Gyr, amount of time that is too short for formation of second generation of stars according to prevailing theories. 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 [31];
- 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! Astronomers believe that our own Milky Way galaxy is approximately 13.6 billion years old [32];
- The most distant galaxy in 2016 we know of was a galaxy called GN-z11 that is 13.4 billion light-years away. Because it is that far away, Hubble sees the light from the young galaxy as it was when the Universe was just 400 million years old [32]. In 2022, astronomers confirmed that the galaxy GLASS-z12 (previously known as GLASS-z13) is one of the earliest and most distant galaxies ever discovered. It is 13.6 billion years away [33];
- CEERS-93316 is a candidate high-redshift galaxy, with an estimated redshift of approximately z = 16.4. If confirmed, it would be one of the earliest and most distant known galaxies observed. CEERS-93316 would have a light-travel distance (lookback time) of 13.7 billion years [34].

We emphasize that now with JWST we are looking for the earliest and most distant galaxies, and at the same time, **we live in one of the earliest galaxies – Milky Way**! According to Standard Cosmology, massive mature disk galaxies with mass up to $M^{*}{\sim}10^{11}M_{\odot}$ cannot form for the amount of time (100-400) million years because it takes billions of years to form them, and so should not be there at all.

WUM explains these discoveries the following way [4]:

- **It is a question of time!** The Beginning of the World was **14.22 Gyr** ago! WUM introduces **Dark Epoch** (spanning for Laniakea Supercluster 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 Volcanic Rotational Fission** of Overspinning DM Supercluster's Cores and self-annihilation of DMPs. Ordinary Matter is a byproduct of DMPs self- annihilation;
- Different Superclusters have different transition time from Dark Epoch to Luminous Epoch. It means that "Age of universe" (the beginning of Luminous Epoch for the whole universe) is not fixed. We stress that in WUM, the Beginning of the World (Dark Epoch) is fixed. **14.22 Gyr is the absolute Age of the World**;
- Most of galaxies (including early galaxies) are disklike galaxies due to the Rotational Fission of the overspinning DM Supercluster's Cores. DM Galaxy's Cores obtain their orbital and rotational angular momenta from rotational angular momentum of DM Superclusters' Cores;
- Early-galaxies formed in near present configuration. There are no protogalaxies in the World and frequent mergers of them at the early epoch. That is why JWST did not see their images;

- 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;
- Macroobjects form from the top (Superclusters) down to Galaxies and Extrasolar systems in parallel around different Cores made up of different DMPs.

5. Conclusion

Thanks to the revealed by WUM Inter-Connectivity of Primary Cosmological Parameters, we show that Gravitational parameter G that can be measured directly makes measurable all Cosmological parameters, which cannot be measured directly. We recommend for consideration in CODATA Recommended Values of the Fundamental Physical Constants 2022 the measured value of the Gravitational parameter G_{av} and introduce the dimensionless Quantity Q for the calculations of all Cosmological parameters.

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.

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