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Article

Weak Interaction Dependent Super Gravity of Galactic Baryon Mass

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Abstract: In our recently published papers, considering Planck mass based light speed growing black hole universe and scaled Hawking's black hole temperature formula, we have developed a simple procedure for estimating the current Hubble parameter and current cosmic mass. In addition to that, without considering galactic dark matter, starting from 10 km/sec to 500 km/sec, we have tried to fit the observed galactic flat rotation speeds with a concept of super gravity of galactic baryonic mass. To estimate the equivalent mass of currently hypothecated galactic dark matter, we have introduced a timely increasing cosmological reference mass unit. Its current magnitude seems to be around 200 million solar masses. In this paper, considering 200 million solar masses as a characteristic representation of cosmic weak interaction mass unit, we have developed a simple formula for its estimation. We would like to appeal that, weak interaction boosts the gravity of galaxies in proportion with their virtual dark mass as (galactic baryonic mass)$^{3/2}$ / (200 million solar masses)$^{1/2}$. With further study- dark matter existence and physical properties can be understood in a theoretical approach.

Keywords: Dark matter; Weak interaction; Super gravity of baryonic matter; flat rotation speed; Hubble mass; Hubble radius

1. Introduction

It is believed that, universe is made up of 25% dark matter, 5% baryonic matter and 70% dark energy. After 90 years of strong observational support, considering the increasing number of dark matter deficient galaxies, day by day technical papers are getting published in main stream journals [1]. To understand the absence of dark matter in dwarf galaxies, 'tidal stripping' and 'self interacting dark matter' models have been introduced [2,3,4]. Most recent and most advanced experiments like Lux-Zeplin and ORGAN are showing their inability in detecting weakly interacting massive particles and axions like very light particles [5,6,7]. Experimentalists are trying to tune the experimental set up for detecting dark matter particles in various mass ranges.

Starting from 1983, physicists are trying to understand the dark matter effect in terms of ordinary baryons having different kinds of modified gravity [8-12]. In this paper, we focus our attention on understanding dark matter as a form of super gravity of galactic baryon mass [13]. Considering our light speed expanding black hole universe model [14-18], it seems possible to develop a practical model of quantum cosmology. Thus, in near future, independent of dark matter, models of quantum cosmology can also be developed with baryons, black holes, light speed expansion and super gravity of baryons. Clearly speaking, dark matter and dark energy concepts can be relinquished. In this context, we appeal the readers to see sections 5, 6 and 7.

2. Basic concepts

We propose our basic concepts in the following way.

1) Weak interaction [19] plays a vital role in deciding the rest masses of observed elementary particles.

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2) Weak interaction plays a vital role in deciding the gravity of galactic baryonic mass in two forms.

   a) Gravity is proportional to galactic baryonic mass.
   b) Gravity is proportional to galactic (baryonic mass)$^{3/2}$.

3) Galactic (baryonic mass)$^{3/2}$ can be considered as a characteristic representation of galactic super gravity.
4) This concept can be applied to any particle having a rest mass or rest energy.

3. Basic points and simple formulae

Based on the works of M. Milogram [8,9] and J.W. Moffat et al [10,11,12], in our recently published papers [15-19], we proposed the following basic points.

1) In reality, there exists no dark matter.
2) Galactic baryonic matter experiences a power law super gravity proportional to its hypothetical total mass,

$$\left(M_{Total}\right)_G \cong \left\{\left(M_{baryon}\right)_G + \left[\frac{\left(M_{baryon}\right)_G^{3/2}}{\left(4\times10^{38}\right)^{1/2}}\right]\right\} \text{ kg} \tag{1}$$

   where $\left(M_{\text{Ref}}\right)_0 \cong 4\times10^{38}$ kg =200 million solar masses can be considered as the 'current reference mass unit'.

3) Galactic baryon mass less than 4×10^{38} kg will have a decreasing trend of super gravity and galactic baryon mass greater than 4×10^{38} kg will have an increasing trend of super gravity.
4) For mathematical convenience, for any galaxy, dark matter mass can be considered as,

$$\left(M_{dark}\right)_G \cong \frac{\left(M_{baryon}\right)_G^{3/2}}{\left(4\times10^{38}\right)^{1/2}} \text{ kg} \tag{2}$$

5) Based on current Hubble mass $\left(M_0\right)$, current Hubble radius $\left(R_0\right)$ and hypothetical black hole radius of a galaxy $\left(R_{BH}\right)_G$, galactic flat rotation speeds $\left(V_G\right)$ can be expressed with,

$$\frac{V_G}{c} \cong \frac{1}{4}\left[\frac{\left(M_{Total}\right)_G}{M_0}\right]^{1/4} \cong \frac{1}{4}\left[\frac{\left(R_{BH}\right)_G}{R_0}\right]^{\frac{1}{4}} \tag{3}$$

$$\text{where } \begin{cases} M_0 \cong \dfrac{c^3}{2GH_0}, \; R_0 \cong \dfrac{2GM_0}{c^2} \cong \dfrac{c}{H_0} \\ \left(M_{Total}\right)_G \cong \left[\left(M_{baryon}\right)_G + \left(M_{dark}\right)_G\right], \; \left(R_{BH}\right)_G \cong \dfrac{2G\left(M_{Total}\right)_G}{c^2} \end{cases}$$

6) See the following figures 1 and 2 [13] where reference mass is $\left(M_{\text{Ref}}\right)_0 \cong 3.89\times10^{38}$ kg = 195.6 million solar masses. Figure 1 shows an increase in dark mass with corresponding increase in baryonic mass. It helps in understanding dark matter deficient galaxies [1] as well as dark matter dominating galaxies. Figure 2 shows a comparative increase in galactic flat rotation speeds. It may be noted that, rotation

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speed of UGC 12591 is (488.4 ± 12.5) km/sec and our estimated baryonic mass is $(2.0 \text{ to } 2.25) \times 10^{42}$ kg comparable with recent estimation of 1.37×10^{42} kg [20].

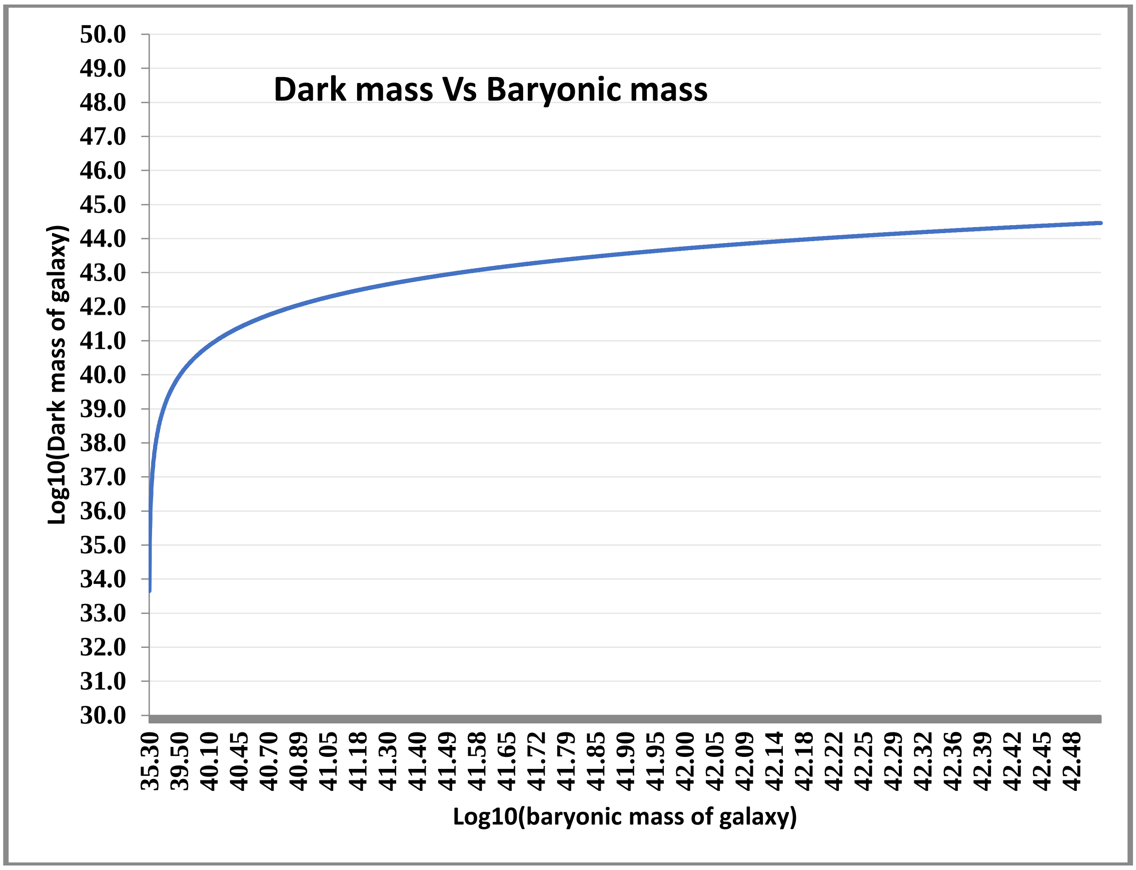

Figure 1: Galactic baryonic mass Vs Dark mass

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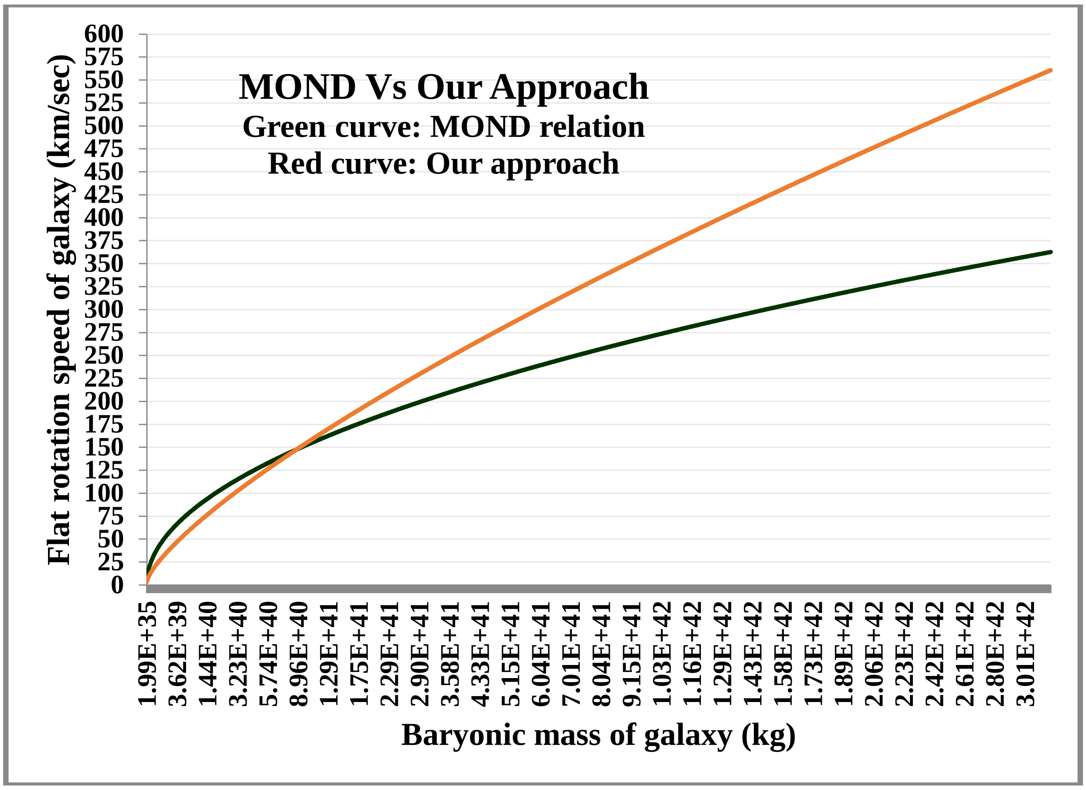

Figure 2: Galactic flat rotation speeds

4. New formula for estimating 200 million solar masses

Based on the standard model of dark matter associated with weakly interacting particles, in this contribution, we assume that, 200 million solar masses can be considered as a characteristic representation of weak interaction associated with whole universe. In a macroscopic view, this mass unit can also be considered as a characteristic lower mass limit of a 'well formed' baby galaxy.

With reference to: 1) Planck scale, 2) Our published model of light speed expanding black hole universe and 3) Charged and neutral weak bosons [12], it seems possible to fit the proposed current reference mass unit in the following way [17].

$$\left.\begin{array}{l}\left(M_{\mathrm{Ref}}\right)_0 \cong \ln\left(\frac{T_{pl}^4}{T_0^4}\right)\times\left(\frac{M_0}{M_{pl}}\right)\times(80.4+91.2)\mathrm{GeV}/c^2 \cong \ln\left(\frac{H_{pl}^2}{H_0^2}\right)\times\left(\frac{M_0}{M_{pl}}\right)\times(80.4+91.2)\mathrm{GeV}/c^2 \\ \cong \ln\left(\frac{M_0}{M_{pl}}\right)\times\left(\frac{M_0}{M_{pl}}\right)\times\left[(2*80.4)+(2*91.2)\right]\mathrm{GeV}/c^2 \cong 183.5 \text{ Million solar masses}\end{array}\right\} \quad (4)$$

$$\text{where, }\left\{\begin{array}{l} M_{pl} \cong \sqrt{\frac{\hbar c}{G}} \cong \frac{c^3}{2GH_{pl}},\ H_{pl} \cong \frac{1}{2}\sqrt{\frac{c^5}{\hbar G}},\ T_{pl} \cong \frac{\hbar c^3}{8\pi k_B G M_{pl}} \cong \frac{\hbar H_{pl}}{4\pi k_B} \\ M_0 \cong \frac{c^3}{2GH_0} \cong 9.3\times10^{52}\,\mathrm{kg},\ T_0 \cong \frac{\hbar c^3}{8\pi k_B G\sqrt{M_0 M_{pl}}} \cong \frac{\hbar\sqrt{H_0 H_{pl}}}{4\pi k_B}\end{array}\right.$$

Above formula needs a physical interpretation and we are working on it. It seems that, continuous decay or annihilation of large number of charged and weak bosons generate so many force carriers in such a way that, any baryonic galaxy experiences a kind of 'dark matter' like super attracting force or super gravity.

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5. Ambiguity among mainstream cosmologists

After 20 years of a strong footing, very shocking news is that, based on 'quintessence' driven universe, within coming 100 million years, universe is coming to a halt and slowly getting contracted to form a big crunch [21]. This technical paper has been reviewed by one of the co-founders of the accelerating universe, Saul Perlmutter and got published in prestigious journal, Proceedings of the National Academy of Sciences of USA in April 2022. In August 2019, based on the opacity of the universe, another technical paper got published in Monthly Notices of Royal Society on the dimming nature of distance supernovae, cosmic acceleration and dark energy [22]. Ambiguity is that, in 2019, it has also been suggested that, universe undergoes a series of cyclic process with different phases [23]. This technical paper has been published in Physics Letters B. It is very clear that, dark energy and quintessence both seem to play a crucial role in understanding the exact nature of cosmic expansion rate. But, it is very unfortunate to say that, so far no cosmologist evidenced the direct impact of 'dark energy' or 'quintessence' in real world and 'both' are being believed on 'modesty'. Frankly speaking, considering unknown and unidentified things, mainstream cosmologists are constructing super models of cosmology. Finally, it is very clear to say that,

1) Technical publications [21-24] that are having very high impact on science community are raising many new ideas and doubts on dark energy.
2) Main stream cosmology is in a crisis and needs a serious review at fundamental level.
3) Reference [21] seems to have a major negative impact on current and future generation cosmologists.

In this context, the following three references can be given a considerable weightage. As per the papers published in Astronomical Journal 2012 [24] and Nature-Scientific Reports 2016 [25], data pertaining to 580 to 740 super novae clearly reveal that, universe is expanding at an uniform rate. In 2018-2019, the same result has been obtained by a student Lisa Goh Wan Khee of National University of Singapore supervised by Cindy Ng [26]. This information can be considered as a base for light speed cosmic expansion. In this context, our light speed expanding black hole cosmology models [13-18] can also be given some consideration. Main advantage of our model is that, considering a scaled form of Hawking's black hole temperature formula [27,28], currently believed cosmic temperature and Hubble parameter can be tightly correlated and tension in estimating the Hubble parameter can be eliminated totally. See the following section-6 pertaining to four great cosmological-astrophysical coincidences.

6. Four major cosmological and astrophysical coincidences

6.1 Cosmic age and cosmic radius

Currently believed cosmic age is 13.8 billion years. Distance travelled by a photon in 13.8 billion years is 1.3x10^{26} m and is almost equal to the currently believed Hubble radius $R_0 \cong (c/H_0)$. It clearly indicates something new about the cosmic expansion speed in terms of speed of photon. We interpret this relation as, from the beginning of Planck scale, universe expands with speed of light. In a mathematical form, $R_t - R_{pl} \cong ct$ where R_{pl}, R_t represent Planck scale cosmic radius and radius at any time t. Lambda model of cosmic age up to (1+ z) = 1100 can be fitted accurately with, $t \cong (1/1+z)^{\frac{3}{2}}(1/H_0) \cong \sqrt{1+z}/H_t$ where $\frac{H_t}{H_0} \cong \left(\frac{T_t}{T_0}\right)^2 \cong (1+z)^2$. It needs a review at fundamental level.

6.2 Cosmic critical density, volume and mass

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Currently believed cosmic critical density is, $\rho_0 \cong \left(3H_0^2/8\pi G\right)$. Considering the product of currently believed cosmic critical density and Hubble volume, $V_0 \cong \left(\frac{4\pi}{3}\right)(c/H_0)^3$, it is possible to show that, $M_0 \cong \left(c^3/2GH_0\right)$. On re-arranging this mass expression, $2GM_0/c^2 \cong c/H_0 \cong R_0$. It clearly indicates something new about the current universe in terms of current cosmic black hole mass, radius and expansion speed. We interpret this relation as, from the beginning of Planck scale, $R_t \cong (c/H_t) \cong 2GM_t/c^2$.

6.3 Cosmic temperature

Currently believed cosmic temperature T_0 seems to be equal to the geometric mean of Hawking temperature of Planck mass, $T_{M_{pl}} \cong \frac{\hbar c^3}{8\pi k_B G M_{pl}}$ and Hawking temperature of current cosmic Hubble mass, $T_{M_0} \cong \frac{\hbar c^3}{8\pi k_B G M_0}$. In a simplified form, it can be expressed as, $T_0 \cong \frac{\hbar c^3}{8\pi k_B G\sqrt{M_{pl}M_0}}$. It clearly indicates something new about the current cosmic temperature in terms of Hawking's Black hole physics [27,28]. We interpret this relation as, from the beginning of Planck scale, $T_t \cong \frac{\hbar c^3}{8\pi k_B G\sqrt{M_{pl}M_t}} \cong \frac{\hbar\sqrt{H_t H_{pl}}}{4\pi k_B}$ where $M_t \cong \frac{c^3}{2GH_t}$, $M_{pl} \cong \sqrt{\frac{\hbar c}{G}}$ and $H_{pl} \cong \frac{1}{2}\sqrt{\frac{c^5}{G\hbar}}$. For an observed value of $T_0 \cong 2.72548$ K, estimated $H_0 \cong 2.167867\times10^{-18}\ \text{sec}^{-1} \cong 66.89$ km/sec/Mpc. We would like to emphasize the point that, based on Hawking's black hole temperature formula, geometric mean of Planck mass and the so called Hubble mass, seems to play a crucial role in estimating the observed cosmic microwave back ground temperature, (CMBR) [29]. This kind of relation is missing in Lambda cosmology and to a great extent, currently observed discrepancy or tension in estimating the Hubble parameter can be eliminated. Considering Planck mass and the Universe, both, as 'point particles', this relation can be derived with three hypothetical conditions, $\frac{GM_t M_{pl}}{r_t^2} \cong \left(\frac{c^4}{8\pi G}\right)$; $r_t \cong \left(\frac{2.898\times10^{-3}}{2\pi T_t}\right)$ and $M_t \cong \left(\frac{c^3}{2GH_t}\right)$. Derived relation is, $T_t \cong \frac{\hbar c^3}{24.891 k_B G\sqrt{M_{pl}M_t}}$ and the numerator coefficient 24.891 is almost equal to $8\pi \cong 25.13274$.

6.4 Galactic light travel distances

It may be noted that, by the time of defining the definition of galactic red shift, maximum red shift value was around 0.003. We would like to emphasize the point that, definition of galactic red shift is ambiguous [30]. It can also be defined as, $z_{new} \cong \frac{\lambda_{Observed} - \lambda_{Lab}}{\lambda_{Observed}} \cong 1 - \frac{\lambda_{Lab}}{\lambda_{Observed}} \cong \frac{z}{z+1}$.. With reference to current definition, z value lies between 0 and infinity. By following our new definition, z value lies between 0 and 1. It may be noted that, with our given definition, it is very easy to implement 'light speed expansion' in cosmic evolution scheme. Figure 3 compares galactic light travel distances according to our new definition, $(z_{new})(c/H_0)$ (Red curve) and the conventional formula connected with dark energy density and other density fractions (Green curve). For verification, readers are encouraged to visit the URLs, http://www.atlasoftheuniverse.com/cosmodis.c and https://cosmocalc.icrar.org/.

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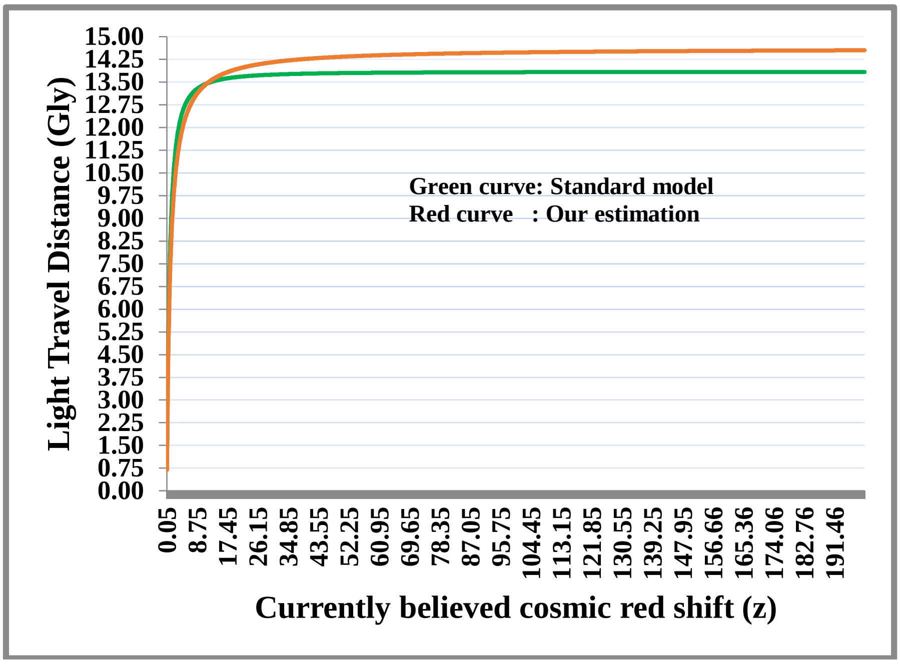

Figure 3 Comparison of standard and estimated light travel distances

These four coincidences will certainly encourage any cosmologist to solve Einstein's field equations with a closed curvature spreading at speed of light. We are working in this direction.

7. Dark matter as a super gravity of baryonic mass of galaxy

As per modern cosmological observations, most of the cosmologists infer dark matter as a characteristic and inherent feature of any galaxy. Dark matter seems to have a major role in understanding 6 different issues pertaining to many of the galaxies. They are [31,32]:

1) Galactic formation and evolution.
2) Galactic rotational curves.
3) Gravitational lensing of galaxies.
4) Galactic collisions.
5) Motion of galaxies within galaxy clusters.
6) Fluctuations in cosmic microwave radiation.

Here, important points to be noted are,

1) Rather than confirming the necessity of introducing dark matter, 'number of applications' should throw light on the nature and address of dark matter. It is not happening so.
2) All these observations are studied on the basis of apprehension of existence of dark matter and in-reality, no cosmologist is having a clear knowledge on the actual identity of dark matter.
3) Dark mater seems to be inferred and understood only with its behavior associated with gravity (produced by observed and unobserved galactic baryonic matter).
4) Particle physics point of view, no single known particle can be considered as a dark matter candidate.
5) So far, no ground based experiment or no cosmological observation could establish any direct evidence for the existence of dark matter [5,6,7].
6) To some extent, existence of dark matter can be confirmed with confirming the existence of 'pure dark matter' galaxies (galaxies having no baryonic matter).

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In this context, we would like to emphasize the point that, in reality there exists no dark matter and the observed effects of dark matter can be understood in terms of super gravity of dark matter in the form of an effective (virtual) increase in the baryonic mass as represented in relations (1) and (2).

In a cosmological approach, 'tidal stripping' mechanism refers to pulling of stars and stellar material of a small galaxy by its neighboring massive galaxy. It depends on galactic baryonic mass and dynamics [4]. In case of dark matter deficient galaxies, the basic question to be answered is, why mother galaxy is absorbing dwarf galaxy's dark matter in larger proportion compared to dwarf galaxy's baryonic matter? To understand this issue, scientists are developing 'self interacting' dark matter models [5]. Compared to 'tidal stripping' and 'self interacting' mechanisms, our approach is very simple in understanding the deficiency of galactic dark matter. Five advantages of our approach are:

1) Scalable for elementary particles, stars, black holes, dwarf galaxies and super massive galaxies.
2) Generally believed weak interaction seems to play an interesting role in understanding super gravity of massive galaxies.
3) Testing is easy. For example, Sun's estimated equivalent dark mass is around $1.5\text{x}10^{26}$ kg and its effect seems to be negligible. It can be tested with future technological set up.
4) Estimated effective or virtual dark matter mass can be compared with other methods of estimation [13].
5) For the past cosmic time, reference mass unit associated with weak interaction can be estimated with,

$$\left.\begin{aligned}(M_{\text{Ref}})_t &\cong \ln\left(\frac{T_{pl}^4}{T_t^4}\right)\times\left(\frac{M_t}{M_{pl}}\right)\times(80.4+91.2)\,\text{GeV}/c^2\\ &\cong \ln\left(\frac{H_{pl}^2}{H_t^2}\right)\times\left(\frac{M_t}{M_{pl}}\right)\times(80.4+91.2)\,\text{GeV}/c^2\\ &\cong \ln\left(\frac{M_t}{M_{pl}}\right)\times\left(\frac{M_t}{M_{pl}}\right)\times\left[(2*80.4)+(2*91.2)\right]\text{GeV}/c^2\end{aligned}\right\} \quad (5)$$

$$\text{where, } M_t \cong \frac{c^3}{2GH_t},\; T_t \cong \frac{\hbar c^3}{8\pi k_B G\sqrt{M_t M_{pl}}} \cong \frac{\hbar\sqrt{H_t H_{pl}}}{4\pi k_B}$$

8. Conclusion

Based on relation (3) and by knowing the galactic flat rotation speeds, galactic total mass can be estimated. Based on relations (1) and (2) and with a simple computer program, total mass can be split into baryonic mass and equivalent dark mass. Thus, our proposal is having one observational input - galactic flat rotation speed, one semi empirical reference mass unit – (180 to 200) million solar masses and one empirical formula for estimating the (virtual) dark mass. Recent world class advanced experiments are showing negative results on the existence of presumed dark matter particles. It may be noted that, even if such a very small massive particle is found to be in existence - with that particle's network – it is very difficult to fit and understand the nature and behavior of huge galactic dark mass.

In this context, we emphasize the point that, our approach can be considered as a multipurpose tool in exploring the real facts of galactic flat rotation speeds. With available tools and other observational techniques, further study can be carried out as per the choice of researcher. Clearly speaking, those who are interested in dark matter, can proceed with dark matter concept and those who are not interested in dark matter concept, can proceed with super gravity concept. By 2030 - 2040, ground reality can be understood in theoretical and experimental approaches.

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