DISCOVERING THE NATURE OF THE DARK MATTER

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Abstract

Based on the new hypothesis for electron and positron have been tested: They only have the electrical interaction but do not have the gravitational interaction, the author has presented the structural model of photon is electron-positron pair, they are completely suitable to all experiments. Because of having that structure, photon have not the mass in the electrical field, but it has the mass in the gravitational field. From here, the author has calculated the gravitational mass of photon $\sim 4m_e$, where m_e is the mass of electron. Using this mass value of photon to the calculation program on computer for the stars motion in the galaxies, the author receives the picture which is completely suitable to the observation result for the quick rotary of the galaxies as known. The nature of the dark matter has been discovered.

Keywords: *dark matter, mass of photon, rotary speed of galaxies*

1. What the dark matter is?

In the modern physics, they concept that the components of universe consist of: 4% matter (in the stars, planets, meteoritics, interstellar dust and neutrino), 22% dark matter and 74% dark energy [1].. It is not necessary to discuss "dark energy" – this is the matter with much discussion, in here, we only discuss to "dark matter" – is the concept which appears in the astronomy in the years of 30 of the last century and up to now they still try their best to look up. When observing the movement of the stars in the galaxy, Mr. Jan Oort [2] discovered that the stars are far from the centre of galaxy do not rotate slowdown as the calculation of Newton mechanics but nearly do not change, and this phenomenon is observed in almost different spiral galaxies (see the Fig. 1a). While, for the globe or ellipse galaxies, they are "worse": the rotary speed of the outside stars are bigger and bigger (see the Fig. 1b).
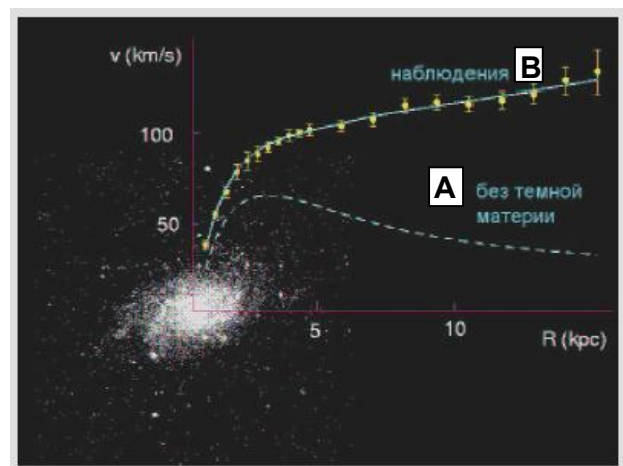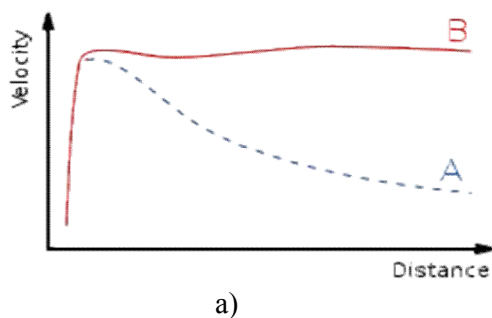

a)

Figure 1. The curve which prevent the rotary speed of the stars in the spiral galaxies a) and globe or ellipse galaxies b) depend on the distance: As per the calculation (A) and as per the observation without dark matter (B).

b)

If we only consider particularly the attendance of matter forms as known in the galaxies (in the stars, planets, meteorites, interstellar dust and neutrino), Newton mechanics cannot take into account the such quick rotary speed and thus, in order to explain that pictures, they assume that "the dark matter" is distributed in the galaxies, although it cannot be recorded by the device or observation by the astronomic telescope, that is have not electromagnetic interaction but having the gravitational interaction with the matter objects. Recently, there are the information that this dark matter has been found out in the type of "affiliation fibre" [3] (see the Fig. 2).
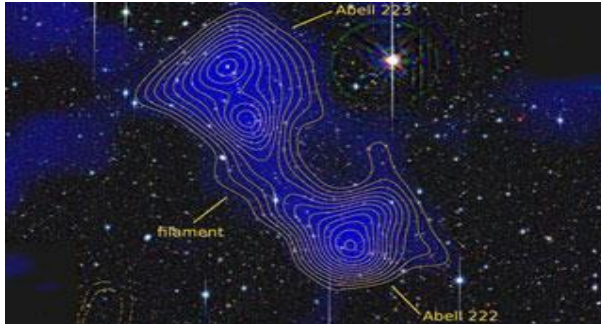

Figure 2. They assume that Abell 222 and Abell 223 are connected by the dark matter fibre.

In this topic, the author would like to proof that the resistance of the abnormal rotate of galaxies are not caused by any "dark" matter but only the "light" matter in the universe, it is just photons.

2. What the photon is?

In the "Photon structure" Report presented at the 6th National Conference on Optics and Spectroscopy, 2010 in Hanoi, which is published in the Proccedings: "Advances in Optics, Photonics, Spectroscopy & Applications VI, 2011" [5], the author showed that there are some experiments, for example, phenomena of photon decay and photon emission, evidences the photon including two fundamental particles with opposite charge: electron and positron; these particles in some way combinate each other, result of which may become a electric neutralization particle from a certain distance R_T (see Fig. 3), like a electric neutral atom consisting of opposite charges.
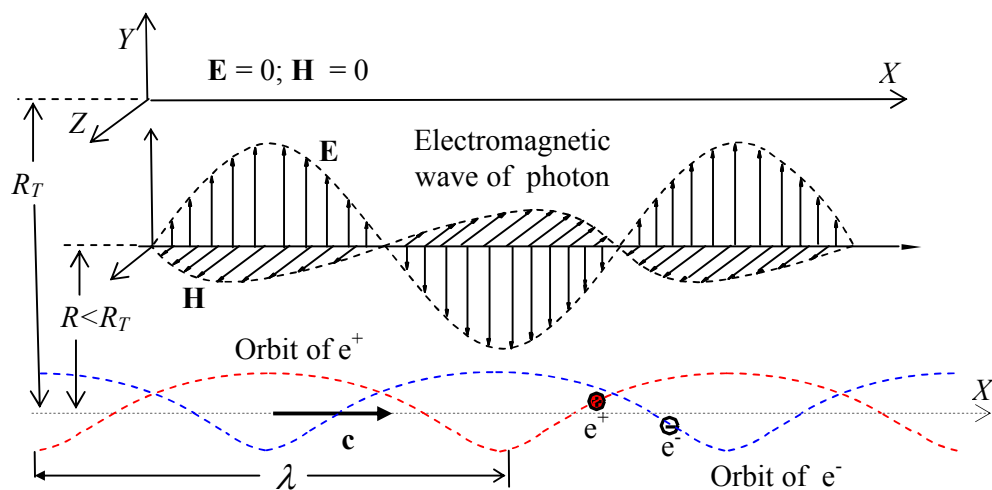

Figure 3. Motion of a photon created the "Electromagnetic wave".

For this phenomenon the author assumed a following postulate:

"*Electron and positron are two fundamental particles, of which action of positron is active and conventionally call as "positive charge", while action of electron is passive and conventionally call as "negative charge"*; *these particles have only electric interaction rather than gravitational interaction.*

There are some experimental evidences proving the point above.

+ Firstly, mass of electron and positron having through experiment as follows:

$$m_{e+} = m_{e-} = m_e \approx 9{,}109548 \times 10^{-31} \, \text{kg}$$

that may be determined single in a manner is applying their inertia phenomenon in electromagnetic field, then only their *inertial mass*, but not gravitational mass, is determined!

+ Secondly, the so-called "gravitational mass" of electron and positron itself, if it exist(?), may only cause "gravitational" interaction weaker then the electric interaction between them about 4×10^{40} times,.therefore, gravitational interaction, of which error (if any) is 10^{-40} at most, may theoretically be ignored.

+ Thirdly, inertial mass of electron and positron is the smallest among inertial mass of elementary particles measured in experiments. That mass of neutrino is less than 10^{-35} kg is theoretically concluded, and has not been proved through any reliable experiments, and in fact, it can not be identified, because neutrino electrically neutralizes, neither electric field nor magnetic field is used for this purpose, and the direct measurement is impossible.

+ Fourthly, among hight energy collision, only these two particles are not decay. And more then, that particles may mysteriously "disappear" and become so-called "energy" of "nothing!"(?) – particle annihilation, or combine with some elementary particles to creation other elementary particles, but absolute leaving no jast "debris".

3. Photon is just "the dark matter" in order to change the rotary speed of galaxy

Up to now, the modern physics still assume that photon do not have the rest mass, its relative mass is too small and calculated as per the formula of Einstein:

$$m_{ph} = \frac{h v}{c^2} \tag{1}$$

where $h \approx 6{,}63 \times 10^{-34}$Js – Planck constant; $c \approx 3 \times 10^8$m/s – the speed of light in the vacuum; v – frequency of photon. They estimate that there are about 500 microwave photon in each cm^3 in the space among galaxies or $N = 5 \times 10^8$ photon/m^3 [4]. While, the density of photon as per the mass is only by:

$$\rho_{p0} = N m_{ph} = \frac{N h v}{c^2}. \tag{2}$$

$$\rho_{p0} = \frac{5 \times 10^8 \times 6{,}63 \times 10^{-34}}{9 \times 10^{16}} v \approx 3{,}68 \times 10^{-42} v$$

If the frequency of microwave photon is average about 10^{10}Hz, in each m^3 have ~4×10^{-32}kg photons. While, the average matter density of universe is ~10^{-27}kg/m^3 [4], ie, is bigger than thousand times. May be because of that reason, photons have been ignored?

However, in [6], the author proofed that photon in every frequencies have the gravitational mass $m_{ph} \approx 4m_e \approx 3,6 \times 10^{-30}$kg with $m_e \approx 9,1 \times 10^{-31}$kg – mass of a electron, that means, the density of microwave photon $\rho_{p0} \sim 2 \times 10^{-22}$kg is bigger than the matter density of thousand times. While, the influence of photons to the rotary process of galaxies is very big. Normally, the matter is distributed essentially in the stars or black hole in the centre of galaxy, but photons are distributed almost evenly around universe so their influence will be weaker in comparison with the matter form in the small scope. We will evaluate concretely: Assuming that the matter distribution in the galaxy with the simple form is the black hole in the center with the mass of M_0, the stars and interstellar dust with the density ρ_s = const up to the radius R_s (see the Fig. 4). While, the gravitational mass of the matter quantity contain in the globe with the radius $r < R_s$ will be:

$$M_s = M_0 + M_r = M_0 + \frac{4}{3}\pi r^3 \rho_s . \tag{3}$$

At R_s, we have:
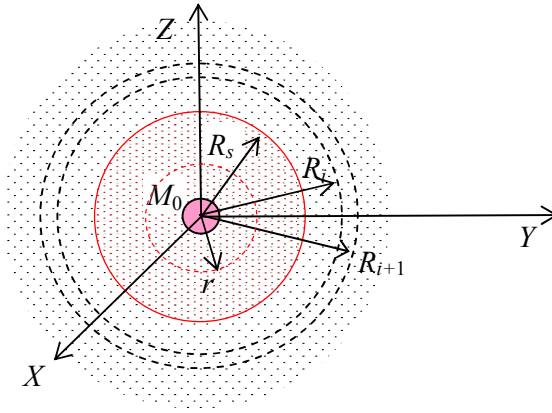$$M_m = M_0 + \frac{4}{3}\pi R_s^3 \rho_s . \tag{4}$$

Figure 4. Matter distribution model in the galaxy

From this radius $(R > R_s)$, assuming that the matter density reduce as per the formula:

$$\rho_{sx} = \rho_s \exp\left[-\frac{a(R - R_s)}{R_s}\right] \tag{5}$$

where a – any constant. Simply, we can divide the galaxy into the globe thin-layers with the thickness of $(R_{i+1} - R_i)$ and assuming that the matter density in the scope of each thin-layer $\rho_{si+1} \approx$ const, so we can calculate the matter mass contain in each thin-layer as per the normal way but cannot to use a complex integral:

$$M_{si} = \frac{4}{3}\pi(R_{i+1}^3 - R_i^3)\rho_{si+1} . \tag{6}$$

Thus, the total mass in the globe with the radius $R > R_s$ will be:

$$M_{sR} = M_0 + \frac{4}{3}\pi\left[R_s^3 \rho_s + \sum_{i=1}(R_{i+1}^3 - R_i^3)\rho_{si+1}\right] . \tag{7}$$

On the other hand, we also assume that the density of photon ρ_{ps} = const in the radius R_s, and outside this radius it also reduce as per the exponential function rule as per the distance to the center of galaxy from the value $\rho_{ps} \approx 2 \times 10^{-22}$kg/m^3 as above mentioned:

$$\rho_{pR} = \rho_{p0}\left\{1 + A\exp\left[-\frac{b(R-R_s)}{Rs}\right]\right\}. \tag{8}$$

Where $A = (\rho_{ps} - \rho_{p0})/\rho_{p0}$ with ρ_{p0} – is the density of photons in the space among galaxies; b – constant. In the scope of galaxy ($<R_s$) where the stars and interstellar dust concentrate essentially, photon density is higher in comparision with its density in the space among galaxies because photons always produced from the stars and reduce their dencity as per the distance. While, similar to the matter form as above mentioned, we also have the gravitational mass of photon contain the globe with the $r < R_s$:

$$M_{ps} = \frac{4}{3}\pi r^3 \rho_{ps}, \tag{9}$$

At the radius R_s:
$$M_{ps} = \frac{4}{3}\pi R_s^3 \rho_{ps}, \tag{10}$$

In the scope of outside radius R_s, we also do similar to the type of other matter and so the mass of photon in the globe with the radius R will be:

$$M_{pR} = \frac{4}{3}\pi\left[R_s^3\rho_{ps} + \sum_{i=1}(R_{i+1}^3 - R_i^3)\rho_{psi+1}\right]. \tag{11}$$

While, we can calculate the total matter quantity of matter and photons in the globe with the radius R as well as centripetal force due to that total quantity effects to a star with the mass M.

a) In the distance $r < R_s$

- From (3) and (9), we have the total mass $M_{r\Sigma}$:

$$M_{r\Sigma} = M_s + M_{ps} = M_0 + \frac{4}{3}\pi r^3(\rho_s + \rho_{ps}), \tag{12}$$

- Centripetal force F_{htr}:
$$F_{htr} = \gamma\frac{MM_{r\Sigma}}{r^2} \tag{13}$$

- Centrifugal force F_{lyr}:
$$F_{lyr} = \frac{MV_r^2}{r}. \tag{14}$$

- From the balance condition between centripetal force F_{htr} (13) and centrifugal force F_{lyr} (14), we take out the rotary speed V_r of the star in the radius r:

$$V_r = \sqrt{\gamma\frac{M_{r\Sigma}}{r}} = \sqrt{\frac{\gamma}{r}\left[M_0 + \frac{4}{3}\pi r^3(\rho_s + \rho_{ps})\right]}. \tag{15}$$

b) At R_s

- From (4) and (10) we have the total mass $M_{s\Sigma}$:

$$M_{s\Sigma} = M_s + M_p = M_0 + \frac{4}{3}\pi R_s^3(\rho_s + \rho_{ps}), \tag{16}$$

- Centripetal force F_{hts}:
$$F_{hts} = \gamma\frac{MM_{s\Sigma}}{R_s^2} \tag{17}$$

- Centrifugal force F_{lys}:
$$F_{lys} = \frac{MV_s^2}{R_s}. \tag{18}$$

- From the balance condition between centripetal force F_{hts} (17) and centrifugal force F_{lys} (18), we take out the rotary speed V_s of star in the radius R_s :

$$V_{Rs} = \sqrt{\gamma \frac{M_{s\Sigma}}{R_s}} = \sqrt{\frac{\gamma}{R_s} \left[M_0 + \frac{4}{3} \pi R_s^3 (\rho_s + \rho_{ps}) \right]} . \tag{19}$$

c) In the distacne $R > R_s$

- From (7) and (11), we also have the total mass $M_{R\Sigma}$:

$$M_{R\Sigma} = M_{sR} + M_{pR} = M_0 + \frac{4}{3} \pi \left[R_s^3 (\rho_s + \rho_{ps}) + \sum_{i=1} (R_{i+1}^3 - R_i^3)(\rho_{si+1} + \rho_{psi+1}) \right] \tag{20}$$

And the rotary speed:
$$V_R = \sqrt{\gamma \frac{M_{R\Sigma}}{R}} . \tag{21}$$

The calculation result of rotary speed of galaxy is implemented by the computer for the cases which count the mass of photon (V_A) out and count that mass but with the different density distribution level of matter and the photons, we have V_B correspondence to the case when $a = 7$; $b = 0,05$ and V_C correspondence to the case when $a = 1,5$; $b = 0,035$ while the other dimensions are the same.

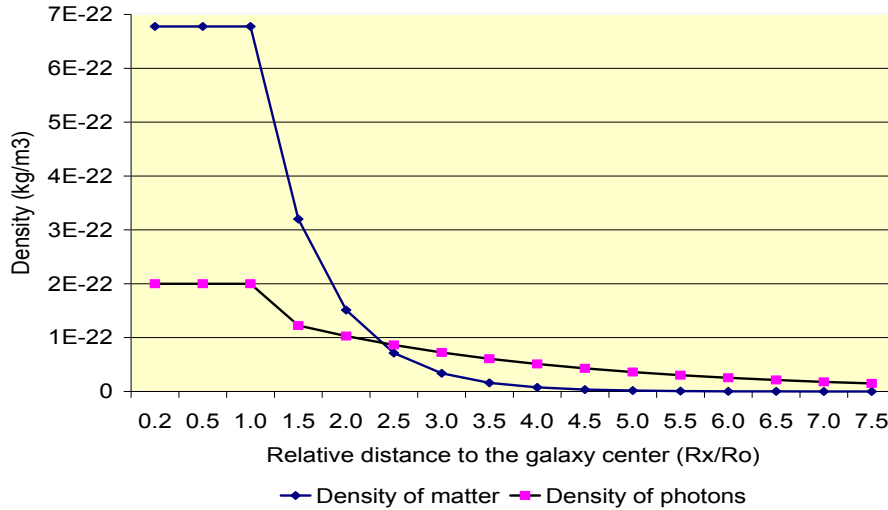In the fig. 5, the density distribution of matter and photons in galaxy is demonstrated.

Figure 5. The density distribution of matter and photon in galaxy

In the Fig. 6, the dependence of that rotary speed of the stars on the distance to the galaxy center is demonstrated, that is the result running by Excel program in a computer. From here, we know that the theory calculation of gravitational mass of photon as per this new way is completely suitable to the observation result of astronomy: The shape of V_B is coincided with the shape of B on the Fig 1a, the shape of V_C coincided with the shape of B on the Fig 1b.
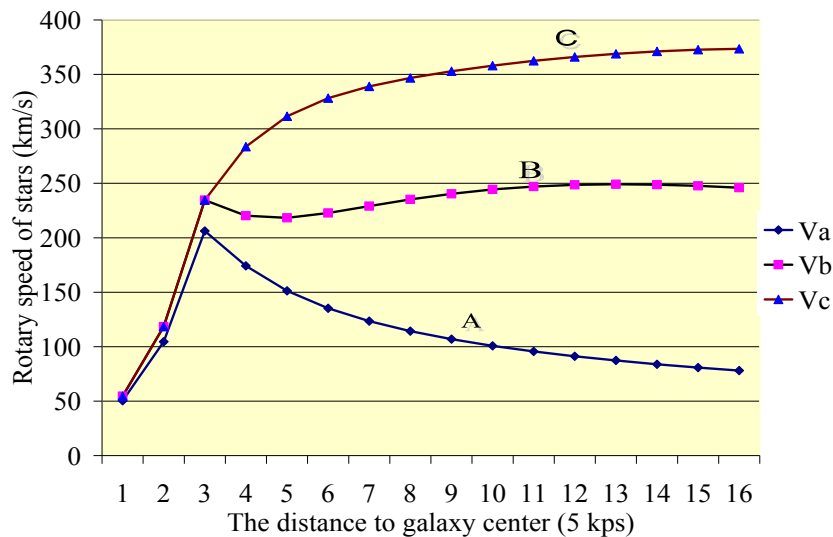
Figure 6. Dependence of rotary speed of stars on the distance to the galaxy center

3. Conclusion

It is clear that, the so-called "dark matter" has been shown one's face: It is just the photons flooding in the Universe with the density of 500 photon/m^3 or ~2x10^{-22}kg/m^3 made the galaxies rotating much more extraordinarily with the different modes depend to the distribution characteristic of matter as well as photons in that galaxies.

Once again, this result confirms the correct of "The New Way for Physics" [7] such as the unification physics theory for all scales of universe: From microscopic to macroscopic, and in this case it has supported to abandon 22% of the so-called "dark" matter, has existed for this 80 years old in the thinking of humankind.

4. Acknowledgments

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