

Original Research Paper

A Hypothesis Which Supports the Possibility of the Existence of Dark Matter with Negative Mass

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Abstract: The paper presents an algorithm for calculating the negative mass of an atomic electron, a fact that from a physical point of view shows the possibility of the existence of the matter with the negative mass that could constitute the dark matter that separated from the normal matter with the positive mass due to the huge masses of different matter with positive masses, respectively negative which between them is rejected at a macro level by gravitational forces of mass rejection having different signs. The work represents only a hypothesis proposed by the authors and not a real fact found, so it must be viewed as such and not as a physical conquest already demonstrated, but only as a possible hypothesis, because today we do not know too much about dark matter or about the real constitution of our universe.

Keywords: Matter, Dark Matter, Negative Mass of an Atomic Electron, Elementary Particle Dynamics, Condensed Matter

Introduction

In astronomy and cosmology, dark matter is currently an unknown type of matter that is considered to contain much of the total mass of the universe.

Dark matter does not emit or absorb light or electromagnetic or other radiation, so it cannot be directly observed with telescopes, Trimble (1987). It is estimated that dark matter constitutes 83% of the matter in the universe and 23% of its mass-energy (Hinshaw, 2010). Its existence has not yet been proven experimentally because it does not emit radiation.

For completeness, according to current theories (2010), the rest of the universe matter consists of:

- Dark energy: About 73% of the total mass-energy of the universe; this is also a substance, a matter, very little known, except that its name of "energy" is improper
- Baryons: About 5% - these constitute the ordinary material world that we perceive directly, including stars, planets, galaxies, etc.
- Neutrinos: About 0.1%
- Background radiation: Equals about 0.01% of the universe's matter

For the first time, in 1933, Fritz Zwicky a Swiss scientist issued a theory that the Sun is surrounded by

dark matter. At that time the theory was considered daring and because it could not be proved its existence that theory was forgotten.

Due to the fact that science has evolved, a team of Swiss specialists has set out to certify this theory. They simulated the Milky Way computer to be able to make the desired measurements and the first conclusion was as clear as possible.

"We are 99% sure that the Sun is surrounded by a huge mass of dark matter," said Silvia Garbari, one of the Swiss physicists. The study also shows that the disputes over the last 20 years have been wrong because the amount of dark matter in the Universe has always been underestimated.

Thus, for the first time, we have succeeded in demonstrating the existence of dark matter in our galaxy, as provided by the new theory of galaxy formation based on numerical simulation, or on the meaning of all dark matter in our galaxy is crushed by highlighting its density.

The new technique developed allows the measurement of the density of the dark matter surrounding the Sun. The next important step that researchers must take is to capture some particles from this mysterious matter in order to study it better.

Fritz Zwicky, the scientist who issued the theory of dark matter at the beginning of the last century, also claimed that all clusters of galaxies are filled with

mysterious matter that allows them to have a normal moving constancy.

He gained attention around 1933 when he coined the term ‘supernova’ and theorized that they were most likely the transition of normal stars into neutron stars. In order to prove his hypothesis, Fritz Zwicky began hunting for supernovae. By the later 1930s, he is believed to have discovered more than a dozen of them. In his whole life, it is assumed that Zwicky discovered more than 120 supernovae. During World War II, Fritz Zwicky began to get active in Pasadena in rocket engineering. Also, he was known to establish a program for academic libraries that suffered from the war. In the later 1940s, Zwicky became the scientific director of the company Aerojet and worked on the improvement of engines, which resulted in several patents.

Fritz Zwicky is by many remembered as the father of Dark Matter even though this has been a topic of discussion. Zwicky first recognized that in rich clusters of galaxies, a large portion of the matter is not visible. In 1933, he published scientific work, estimating that “the total mass of the COMA cluster of galaxies from the motions of the galaxies within that cluster. Using the virial theorem he came to the conclusion that the galaxies were on average moving too fast for the COMA cluster to be held together only by the mass of the visible matter:

“In order to receive an average Doppler effect of 1000 km/s or more, which is what we have observed, the average density in the COMA system would have to be at least 400 times greater than that of visible matter. If this can be shown to be the case, then it would have the surprising result that dark matter is present in the Universe is far greater density than visible matter.”

It has been argued that Fritz Zwicky’s analysis was deduced from limited statistics, but still, his estimation results were considered reasonable. Zwicky’s estimates were off by more than an order of magnitude, mainly due to an obsolete value of the Hubble constant.

The same calculation done today shows a smaller factor than the one Zwicky proposed back in the 1930s, based on greater values for the mass of luminous material. However, it is still clear that the great majority of matter appears to be dark.

Knowing the dark matter is an important step in finding out the mysteries of the Universe. This is the main cause for which scientists make superhuman efforts in this direction. It is estimated that dark matter constitutes 83% of the matter in the universe and 23% of its mass-energy.

In some papers (Halliday and Robert, 1966; Petrescu, 2012a; 2012b; 2012c; 2014; 2018; 2019; Petrescu *et al.*, 2017a; 2017b; 2017c; 2017d; Petrescu and Petrescu, 2018; 2019) it has been shown that dimensions of atoms and subatomic particles are measured at approximately average values and for low displacement rates of the particles. Dynamically, the dimensions of these particles vary greatly with the variation in their displacement speed. The same thing happens with the energies of these permanently moving particles.

Presented paper shows an algorithm for calculating the negative mass of an atomic electron, a fact that from a physical point of view shows the possibility of the existence of the matter with the negative mass that could constitute the dark matter that separated from the normal matter with the positive mass due to the huge masses of different matter with positive masses, respectively negative which between them is rejected at a macro level by gravitational forces of mass rejection having different signs.

This work represents only a hypothesis proposed by the authors and not a real fact found, so it must be viewed as such and not as a physical conquest already demonstrated, but only as a possible hypothesis, because today we do not know too much about dark matter or about the real constitution of our universe.

Materials and Methods

The calculations presented in this paper refer strictly to an atomic electron, they were determined by the authors many years ago, by chance, when several possibilities for quantifying atomic electrons were established (Petrescu, 2012c).

The kinetic energy of an atomic electron can be expressed directly in the formula (1) and as electrostatic energy (Colombian) in the Equation (2) and by their equalization it is deduced the form (3) that expresses the velocity of the atomic electron in orbit depending on the mass of the electron m , the charge that is, the radius of the orbit of the electron r , ϵ_0 (vacuum permittivity, permittivity of free space or electric constant or the distributed capacitance of the vacuum, is an ideal, baseline physical constant, which is the value of the absolute dielectric permittivity of classical vacuum) and the atomic number Z :

$$E_c = \frac{1}{2} m \cdot v^2 \quad (1)$$

$$E_c = \frac{1}{2} \frac{Z \cdot e^2}{\pi \cdot \epsilon_0 \cdot r} \quad (2)$$

$$v^2 = \frac{1}{4} \frac{Z \cdot e^2}{\pi \cdot \epsilon_0 \cdot r \cdot m} \quad (3)$$

Next we write the relation (4) of Niels Bohr regarding the quantized radius of the electron on its atomic orbit, where h is the Planck's constant and n is Bohr's quantum number:

$$r = \frac{n^2 \cdot \epsilon_0 \cdot h^2}{\pi \cdot e^2 \cdot Z \cdot m} \quad (4)$$

The value of the quantized radius from Equation (4) is introduced in the relation (3) and is thus obtained for the velocity (squared) of the electron in the atomic orbit its quantified expression (5):

$$v^2 = \frac{1}{4} \frac{Z^2 \cdot e^4}{\epsilon_0^2 \cdot h^2 \cdot c^2 \cdot n^2} \quad (5)$$

Next, it expresses the known Lorenz's relationship (6) in a convenient form (7), where c is the light speed in vacuum and m_0 the rest mass of the electron:

$$m = \frac{m_0 \cdot c}{\sqrt{c^2 - v^2}} \quad (6)$$

$$v^2 = \frac{m^2 - m_0^2}{m^2} \cdot c^2 \quad (7)$$

The expressions (5) and (7) are identified and thus the relation (8) is obtained, which is written successively in the appropriate forms (9) and then (10). Equation (10) supports the real solutions (11):

$$\frac{Z^2 \cdot e^4}{4\epsilon_0^2 \cdot h^2 \cdot c^2 \cdot n^2} \cdot m^2 = m^2 - m_0^2 \quad (8)$$

$$m^2 \cdot \left(1 - \frac{Z^2 \cdot e^4}{4\epsilon_0^2 \cdot h^2 \cdot c^2 \cdot n^2} \right) = m_0^2 \quad (9)$$

$$m^2 \frac{m_0^2}{1 - \frac{Z^2 \cdot e^4}{4\epsilon_0^2 \cdot h^2 \cdot c^2 \cdot n^2}} \quad (10)$$

Results and Discussion

The final Equation (10) supports two real solutions from the physical point of view, theoretically, as seen in the expression (11):

$$m_{1,2} = \pm \frac{m_0}{\sqrt{1 - \frac{Z^2 \cdot e^4}{4\epsilon_0^2 \cdot h^2 \cdot c^2 \cdot n^2}}} \quad (11)$$

In other words, the electron in an atomic quantum orbit can have a negative mass. If this happens, automatically the mass of the atomic nucleus will also be negative (for reasons of symmetry and physical existence). This can actually happen according to the presented physical model, which explains theoretically, physically, the possibility of the existence of ultra-light matter (that otherwise, we do not know how to tell to such a matter with negative mass) and probably with a negative energy as can be seen from the expression (12):

$$W_2 = m_2 \cdot c^2 = \frac{-m_0 \cdot c^2}{\sqrt{1 - \frac{Z^2 \cdot e^4}{4\epsilon_0^2 \cdot h^2 \cdot c^2 \cdot n^2}}} \quad (12)$$

If it were to imagine a dark matter with a negative mass that, on the astronomical scale, being concentrated, rejects each other gravitationally with our positive matter, we could have a partial picture of the composition of our universe, which presents for us even today a large amount of unknown.

This phenomenon could explain the existence of a large amount of concentrated antimatter that coexists with the negative matter due to gravitational rejection at the astronomical scale through their different masses as a sign.

It would also be possible that the small amount of positive matter that we know coexist with negative antimatter that will be gravitationally rejected at the astronomical scale with the known positive matter.

All these represent only hypotheses, based on the possible existence of the matter with negative mass, physically proved by the calculation algorithm presented in the paper.

There is theoretical evidence (established by researchers at the University of Pittsburg, Pennsylvania, USA, based on background radiation - residual radiation from the initial Big Bang explosion) about the existence of dark matter and dark energy, not yet detected. Thus, it was found that the photons in the background radiation are slowed down as they pass through the galaxies more than originally calculated, the delay being due to the passage through dark matter. The presence of dark matter is also deduced indirectly from the movement of astronomical objects, especially stars, galaxies and galaxy clusters ("superclusters").

There are also theories, based on the certainty of the presence of "black holes", which demonstrate the

existence of dark matter that is responsible for the accelerated expansion of the universe. For the first time, in our times, a black hole was observed that was caught throwing energy jets, although it was known that the black holes only aspirate and do not discharge the matter.

Other theories of the existence of dark matter are based on the gravitational deviations that have been detected regarding the movement of galaxies and galaxies in the universe, otherwise unexplained deviations.

The universe is in a permanent expansion that takes place at a higher speed than the researchers of the cosmic space expected; this speed is printed by a curious force called "quintessence" and generated by the cosmic vacuum. The cosmic vacuum, far from being empty, is the seat of some unexpected energies. In the universe, around the black holes, the so-called dark matter piles up, which are hitherto undetectable, although it constitutes 21% of the cosmic matter.

At the beginning of 2007 astronomers drew up a three-dimensional map of the dark matter on which the stars and galaxies are indicated. The study, published in the journal Nature, provides the most important evidence so far that the spread of galaxies largely corresponds to the distribution of dark matter.

Conclusion

The paper presents an algorithm for calculating the negative mass of an atomic electron, a fact that from a physical point of view shows the possibility of the existence of the matter with the negative mass that could constitute the dark matter that separated from the normal matter with the positive mass due to the huge masses of different matter with positive masses, respectively negative which between them is rejected at a macro level by gravitational forces of mass rejection having different signs.

Interesting is the hypothesis that authors are now launching with this paper, namely that the normal, positive matter known to us can be gravitationally attracted to the antimatter structured together with the dark matter of negative mass and at the same time gravitationally rejected by the dark negative matter. In other words, in the dark matter, there can be two types of matter, one positive but antimatter (with tasks opposite to the normal matter) and another negative but loaded with the same type of tasks as the known matter. For this reason, dark matter can act to the astronomical scale on our matter, both attractions and gravitational rejections, resulting in the current balance, which is not

completely immobile but in constant motion and expansion of matter known to us today.

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Ethics

This article is original and contains unpublished material. Author declares that are not ethical issues and no conflict of interest that may arise after the publication of this manuscript.

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Nomenclature

h	=>	The Planck constant: $h=6.626 \text{ E-34 [Js]}$
q	=>	Electrical elementary load: $q_e = -1.6021 \text{ E-19[C]}$ $q_p = +1.6021 \text{ E-19[C]}$
c	=	The light speed in vacuum: $c=2.997925 \text{ E+08 [m/s]}$
The	permissive constant (the permittivity):	$\epsilon_0 = 8.85418 \cdot 10^{-12} \left[\frac{C^2}{N \cdot m^2} \right]$
n	=	The principal quantum number (the Bohr quantum number);
Z	=	The number of protons from the atomic nucleus (the atomic number);
m0[kg]	=>	The rest mass of one particle
m0electron	=	9.11 E-31 [kg]
m0proton	=	$1.672621898(21) \text{ E-27 [kg]}$
m0neutron	=	$1.674927471(21) \text{ E-27 [kg]}$
m0deuteron	=	$3.34449 \text{ E-27 [kg]}$
m0triton	=	$5.00827 \text{ E-27 [kg]}$