The Neutron and Dark Matter in the Standard Model of Particle Physics

Leandro Meléndez Lugo*, Esteban Chávez Alarcón

Instituto Nacional de Investigaciones Nucleares, Centro Nuclear de México, Departamento de Física, La Marquesa Ocoyoacac, Estado de México, México
Email: *leandro.melendez@inin.gob.mx

Abstract

The existence of the neutron, originally postulated to justify the stability of the nucleus, is very similar to the postulation of Dark Matter to give stability to galaxies and galaxy clusters. However, the existence of the neutron has been proven as an important part of the nucleus that is linked within its integral structure in the Standard Model of Particle Physics. The Standard Model that began with the electron and the proton, currently, with more than one hundred particles, shows in some parts, cracks that induce to reconsider the veracity of the theories and models. Here it is established that all theories are to some extent false and therefore, so will any model, which is always a specific part of the theory. Also, like several other things, by means of a mathematical calculation, it is clarified why, it has not been possible to incorporate the Dark Matter within the Standard Model. Furthermore, it is reliably demonstrated that the introduction of the Dark matter postulate is superfluous and that the high speeds of stellar rotation determined experimentally are analytically explained with the stellar dynamics described here.

Keywords

Neutron, Standard Model, Dark Matter, Rotational Speed, Stellar Dynamics

1. Introduction

The story in this part of knowledge can be said to begin with the atom of Democritus. For a long time, it has been thought that there should be something that constituted the fundamental part of matter, something that all the material things in the universe are made of [1]. Although this ancient idea continues in a certain way, its essence has been modified in such a way that it is now thought that there are several partitions, several bricks, elements that would have to be

combined and that could configure the material structures of things existing in nature. At the beginning of this description the fundamental part was as "simple" as the atom. Now, there are some complications [2]. The Standard Model of Particle Physics, before being called that way, turned out to be made up of electrons and protons, now it has hundreds of particles and several deficiencies and inconsistencies that have not been able to be solved. Let's look at something from the beginning [3].

At that time, surely many other researchers intuited the existence of something that gave atomic nuclei the stability that they manifested. The Coulombian rejection of the protons in the nucleus would be enough so that the great majority of the nuclei did not exist. However, it is recognized that it was Ernest Rutherford who, in June 1920, proposed the existence of something to neutralize this repulsive force [4] [5]. This increased the interest in knowing the basic composition of matter. As early as 1897 J.J. Thomson had discovered the electron and Rutherford himself in 1918 had discovered the proton. After this, at the end of 1932 the English physicist James Chadwick, carried out a series of experiments after which the scientific community still took about two years to accept the existence of a third subatomic particle, as a constituent of the atom, specifically forming part of the nucleus, the neutron [6] [7] [8] [9] [10]. Originally, these particles were considered elemental, that is, they were believed to have no parts. Even today, the electron, is considered that it has no parts, which turns out to be indivisible, although this sounds like a contradiction, it would be something, a body that has no dimension. In experiments carried out around 1970 it was found that the proton and the neutron were not elementary particles, but that they had parts, they had consequently smaller internal constituents.

In this way it was complicated what, at first, with the electron and the proton, it was said, the basic constituents of the material world were had. It was accepted that the basic constituents had a polarization. A positive part, the proton and a negative part, the electron. Now the Standard Model, so called after 1974, turns out to be a theoretical and experimental structure already of more than 100 particles. It has become so complicated that there are those who doubt that it is the most correct explanation of this part of nature.

The neutron, although it was proposed to solve a structural problem, gives stability to the nucleus, in fact, came to introduce noise by modifying not only the table of elementary particles, but also affected the plurality of the basic elements. It is convenient here to highlight the fact that the existence of the neutron was introduced in order to justify the stability of a good part of the atomic nuclei in nature [4] [11].

In another order of things, here it should be noted that, also at the interstellar level, just as the existence of the neutron was proposed, now in galaxies, the existence of "something" has been proposed that provides stability to these gravitational systems. Since the early 1930s, the existence of a foreign matter that is supposedly only perceived through its gravitational interaction has been post-

ulated [12] [13] [14] [15] [16]. For just under 90 years material particles have been eagerly sought that could configure what has been called Dark Matter. Experimentally, it was determined that a large part of the stars in various galaxies rotate around the galactic centers at speeds well above the values predicted by the Newtonian gravitational potential model. This was tried to explain by postulating the existence of what is now known as Dark Matter. This strange extra "mass" in the galaxies would provide the gravitational force necessary to prevent the breakdown of these gravitational systems, ultimately providing them with stability that could not be theoretically justified.

As can be seen, there is a parallel between the proposition of the existence of the neutron and the postulation of the existence of Dark Matter. In the same way that Rutherford postulated the existence of the neutron seeking to justify nuclear stability, thus, the existence of Dark Matter is also postulated, seeking to give stability to galaxies and galaxy clusters.

In this work, some generalities about the Standard Model of particles are established, also highlighting some of its inconsistencies. In the end, the great similarity of the stabilizing neutron is raised, as part of the Standard Model of particles, with the existence of the postulate of the existence of Dark Matter. In the end it is demonstrated, contrary to the existence of the experimentally demonstrated neutron, the superfluity of introducing this strange substance that only interacts gravitationally, with which an enigma is tried to be solved, which only complicates the original problem of the great speeds of stellar rotation in the galaxies. Under these circumstances, two things would have to be explained now, the unexpected stellar rotational velocities and Dark Matter, rather than just justifying galactic stability.

2. The Neutron Has Parts

Experimental investigations carried out around 1970 indicated that both the proton and the neutron are not elementary particles. They turn out to be made up of other smaller entities. Now the particles made up of these entities called quarks are identified by the name of hadrons. Hadrons can be two quarks or three quarks, although some researchers speak of the possible existence of particles with more quarks, to date they have not been found. The three-quark particles are called baryons. Those with two quarks are called mesons [11].

In some experiments, neutrons were bombarded with subatomic projectiles, in fact they were electrons and also protons. The structure of the interior of the neutron is not known for sure. What has been found is that the projectiles are scattered as if the neutron had three charge centers. Unlike the idea obtained from the disintegration of the free neutron into a proton and an electron with an additional antineutrino, with which the neutron was supposed to be a kind of electric dipole. The image it presents, before the projectiles, is really that of a triplex. A quark u (up) apparently with an electric charge of 2/3 of the charge of the proton and two quarks d (down) each with −1/3 the charge of the proton, in

total the sum of the electric charges is zero.

The force that keeps quarks integrated in hadrons is called the strong force. Although in the decay of the neutron the weak force is said to act [11]. The neutron decays in the free state, but appears to be stable within a good part of the atomic nuclei. There is also talk of intermediate particles in the interactions of the different forces. The strong force is also assumed to govern the interaction between the proton and the neutron in the nuclei. Something that is still not very well understood is that protons and neutrons constitute many of the stable nuclei through the strong interaction, however, establishing the relative intensities of the strong, electromagnetic and weak interactions which are approximately $1:10^{-3}:10^{-7}$ respectively, this relationship indicates that the intensity of the strong force is a thousand times greater than the electromagnetic force, so it is not well understood why two protons are not linked with the strong force, overcoming the Colombian rejection of for example two protons. Neutrons are required to perform this bond in a stable manner. The Coulombian rejection of two protons in the nucleus about 2×10^{-15} m apart is about 60 Newtons, enough force to lift an object weighing just over 6 kilograms into the air. The strong force should be a thousand times stronger. However, there are no structures with two or more protons only, nor structures with two or more neutrons only. They are always combined. This is one of the results, what is worth noting, that has no explanation within the Standard Model. However, it is argued that there are neutron stars, a set of large numbers of particles, but there, it is speculated that the force that drives these possible structures stable could really be the gravitational force, beside the strong force.

Neutrons turn out to be very penetrating and in many cases this characteristic is used in several practical processes, among which the obtaining of energy from nuclear fission in nuclear reactors can be highlighted [11] [17].

With all this baggage on the neutron, it was the Second World War and the fission of uranium in the atomic bomb. Physics, from then on, begins to explore the "pieces" that result from the destruction of the atom. More and more particles are discovered (up to a couple of hundred), giving rise to a chaos that has been described as the "particle zoo".

It was Murray Gell-Mann, Professor of Physics at Caltech and Nobel Laureate 1969, one of those who tried to bring order to this zoo, introducing the idea of what has been called the "standard model of particles." The essence of the model is somewhat simplified, although there are details that are complicated even for specialists and professionals. After a refining, it was provisionally had and it could be said that the particles are divided into two large groups: those that have mass and those that transmit some of the forces of nature. Particles with mass are what make up the protons and neutrons in the atomic nucleus and also make up the electrons that revolve around the nucleus. At present this is no longer so true, it is now said that there are also mediating particles that have mass. The W and Z bosons, intermediaries in the weak interaction, were found to have mass.

3. The Standard Model and Some Complications

In the conceptualization of scientific research there is a hierarchy that is stratified as follows:

<div align="center">

Laws

Theories and

Models

</div>

This, put specifically, means that the laws in scientific research have the highest hierarchy, in several senses, it can be said that the laws are a fact. In nature, laws tend to be universal, that is, their validity is generally maintained, although the rule turns out to be that they are not circumstantially valid. When man interprets these laws, circumscribes them with a mathematical expression, it is highly probable that this interpretation is not universal, as will be shown later, in the case of the Law of universal gravitation.

On the other hand, of the Theories it can be affirmed that all are false. In the definition of what Theory means, there are phrases such as: It is a set of knowledge of speculative origin. It can be seen that only man speculates. That is, man invents theories. In this case, seeking to obtain a kind of representation of a part of nature. It is obvious that representation is not the thing. For example, the word table has five letters and in many cases represents a table, but it is not the table. The word is not the thing. In this sense, any representation turns out to be false. Adding these two forces would have a much more compact structure than the atomic nuclei where the Coulombian rejection also exists.

Finally, the Model turns out to be normally a part of the Theory. Therefore, it has much of what theory has.

Here it should be noted that the Standard Model is not considered or is not considered as a theory, among many other things because it does not incorporate one of the supposed four forces of nature that is Gravity, it seems to be only a model.

Two areas in the universe, separated by some distance, occupied by individual observers, it is stated that these observers can only communicate by means of waves or by means of particles. For a description without clothing, considering waves and particles, in this universe it would only be necessary to include the stage, that is, empty space. Of course, this void might not be completely void, with nothing at all. In this brief description of interactions, you can introduce a set of elementary parts that constitute the basis of everything that exists.

If you want to describe nature, see that everything there is structured, in a somewhat informal way and in an outlined way, it can be said that the most basic components would be:

Void	Waves (fields) and	Particles
Albert Einstein	James C. Maxwell	Isaac Newton

3.1. Void

Among many others, one of the highly regarded researcher who formally

addressed the void, it can be said, was Albert Einstein. It is very likely that Einstein, influenced by the "null" result of the Michelson-Morley experiment of 1887, has decided to disappear from the scene the so-called the hypothetical luminiferous ether, a medium in space proposed to carry light waveslight, ether and replace it with the now famous Space-Time. It should be said here that, in fact, according to the 1887 article, the result obtained by Michelson and Morley was not exactly null, they measured a small displacement of the interference pattern in the interferometer, which corresponded to approximately 10 miles per second of the speed from the wind of the ether. Another detail that is important to note here is that Einstein, by removing the ether from the scene, also perhaps influenced by Aristotle who claimed that matter only interacted where it was, felt compelled to introduce something that acted locally and this turned out to be Space-Time. Einstein's idea is that space curves, where a kind of grooves are generated through which bodies move in space. In this way Einstein tried to get rid of the idea of force, introducing something to replace it, the grooves of space-time that force bodies to follow certain trajectories. For all this, it can be considered that the vacuum is not only the scenario of events, but that it has some substance that does not have molecules or electrons but is something that is disturbed at least with electromagnetic fields. That is, nothing is not precisely nothing, but space would be pervaded by this unique substance that allows electromagnetic disturbances to propagate. Which in the end gives rise to electromagnetic waves.

3.2. Waves

Although there can be several types of disturbances that propagate, in fact, we are especially interested in precisely those that propagate in a vacuum.

James Clerk Maxwell was the one who focused the most on electromagnetic disturbances, who in the end established the bases of electromagnetic theory, where the conceptualization focuses precisely on waves, fields and sources of fields, such as charges and electric currents. It should be noted that there are electromagnetic waves such as photons that do not depend on field sources. This somehow indicates that the field turns out to be more fundamental than the sources themselves. The hierarchy could go this way: first is the void. The vacuum is disturbed and this disturbance when it propagates becomes a wave motion. Then there are the particles that apparently interact with waves, but also with a vacuum, since at high speeds the field of the particles is deformed.

3.3. The Particles

In Newton's Classical Mechanics there is also a different conceptualization. There the interaction of point particles is established, but, although it seems a contradiction, they are macroscopic interactions. Erwin Schrodinger and many other researchers dealt with the mechanics of subatomic particles, also changing the conceptualization where we now have probability waves to represent the

particles. Here it should be noted that there are no fieldless particles. Earlier it was stated that the field exists without particles as it happens with photons. Therefore, the hierarchy states that the field turns out to be more fundamental than the particles.

It can be seen with all this that any theory or model of particle physics should comply with and include this hierarchy of parts as fundamental as they are: The vacuum, the waves and the particles.

Experience indicates that scientific researchers focused primarily on studying particles, although there is evidence that fields and waves are of a higher hierarchy.

The component particles of protons and neutrons, as mentioned earlier, are called "quarks" and are thought to be elementary particles, that is, they are not made up of smaller pieces. There are three families or groups of quarks with names as peculiar as: up and down, enchanted and strange, top and bottom. All three families have increasing amounts of mass. The most common particles in nature are up and down. Furthermore, each family has its own electron and its corresponding neutrino. The electron of the second family is called a muon and that of the third family is called a tau.

Some of the force-transmitting particles do not have mass in principle and their generic name is bosons. Each of the forces of nature has its specific transmitting particle: photon (electromagnetic force), gluon (strong nuclear force) and W-w+ and Z-zero bosons (weak nuclear force). The graviton, corresponding to the force of gravity, has not been found so far. In large part this is the reason that the Standard Model of Particles does not include gravitational interaction. Gravity has turned out to be the most "difficult" of the four existing classes of force and has not been included in any model. What has been called "The Theory of Everything" (it would be something like the unification of the four forces) is today a chimera. Albert Einstein himself was unsuccessful in his search, although he dedicated the last decades of his life to it.

A peculiarity of the W and Z bosons is that they do have mass, a mass that is believed to give them the famous Higgs boson, discovered at CERN in 2012, when crossing them in the Higgs field [18]. It is said to be the product of a break in the symmetry of a standard model, which is otherwise quite symmetrical. The mass that the Higgs boson would provide, it is said, would be a kind of friction that would make it difficult for the particle to move. This idea does not finish curdling since any friction would prevent the law of inertia from manifesting itself. The massive bodies would sooner or later stop.

As knowledge, on the purely theoretical plane, sometimes there is talk of a supersymmetry, a model similar to the standard, where each particle would have its corresponding partner, but with greater mass and therefore heavier. None of these heavy super-particles have been found so far. This super-symmetric model would serve, among other things, to explain the additional dimensions of hyper-space or the very nature of the so-called dark matter. All of this is still under

discussion.

The word "model" in the name of this topic comes from the 1970s when there was not enough experimental evidence to confirm the model. To date, "almost" all experimental tests of the three forces described by the Standard Model are said to agree with its predictions. However, the Standard Model falls short of being a complete theory of fundamental interactions due to several unresolved issues.

4. The Standard Model and Dark Matter

Among others, the most frequently mentioned particles to configure what would be Dark Matter are the so-called wimps (weakly interacting massive particles) [19]. Definitely these particles could not be detected. In fact, it has not been possible to understand what Dark Matter could be, despite the fact that it has been sought insistently since its postulation almost 90 years ago [20] [21] [22]. Because it has not been detected by conventional means, Dark Matter has not been incorporated into the Standard Model of Particle Physics either.

Here is presented a mathematical treatment to show that there is no need to introduce something like the Dark Matter postulate into the discussion. It is affirmed in the end, that this postulate turns out to be superfluous, as it will be known. Here the proposal, for this purpose, is based on a paragraph written by Vera Rubin, an American astronomer who said the following in an article published in 2006 [23]:

"High school students learn that, in a gravitationally bound system like our solar system, a planet moves in a closed orbit, such that $MG = v^2 r$ where M is the mass of the sun, G is the gravitational constant, and v and r are the speed of a planet and its distance from the sun. In M31 (Andromeda), the same relationship between mass, speed, and distance holds" [23].

This thesis of Vera Rubin will be shown not to be true. The expression that she exhibits, which comes from the traditional Newtonian potential, has no validity at the galactic level. The main reason for making this statement has to do with the fact that the mass in a galaxy is distributed in practically the entire volume, unlike the Solar System where the mass is practically restricted to the central part, the Sun. From this expression, which Vera Rubin describes and which is valid in the solar system, solving for the velocity v it is obtained that

$$v = \sqrt{MG/r} \tag{1}$$

That is, for the planets of the solar system $v \propto 1/\sqrt{r}$.

In contrast to this, in galaxies, several of the measurements that have been obtained indicate that there is another relationship for the rotation speed of the stars, it turns out that at galactic level:

$$v = cte \tag{2}$$

As there is no agreement between the expression for the rotation speed of planets and the speed of stellar rotation in galaxies, Vera Rubin and other re-

searchers have postulated the existence of the so-called Dark Matter to give stability to gravitational systems [12] [13] [14] [15] [16]. Like Ernest Rutherford, he postulated the existence of the neutron, to give stability to the nucleus.

Comparing the expressions, for certain values of r, the velocity in (2) would be well above the values in (1). According to measurements in galaxies, such large stellar rotation speeds would result in these gravitational systems being unstable, in fact, they should shatter [12] [13] [14] [15] [16].

The solution to this enigma is obtained when the correct calculation for the galactic dynamics is performed. A galaxy does not have the same stellar dynamics as planetary dynamics, as will be seen later. For this, Gauss's law is used for the flow of a field, in this case gravitational. The Gaussian law for a field in a medium where there are field sources, says that the net flux through a surface is proportional to the sources inside a Gaussian surface, see **Figure 1**. Sources outside the Gaussian surface produce a net flow equal to zero [24] [25].

Gauss's law is normally used when there is symmetry and calculations can be simplified [24] [25]. Galaxies are of various shapes where elliptical galaxies and spiral galaxies stand out. In order to simplify the calculations, a spherical galaxy will be assumed, at least in its luminous part. To use the expression of Gauss's Law now for the gravitational case, it is enough to substitute GM instead of $q/4\pi\varepsilon$ in the equation of **Figure 1**, with this substitution the equation, in **Figure 1**, remains as

$$\oint_S \overline{g} \cdot \mathrm{d}\overline{s} = -4\pi GM \tag{3}$$

In this equation $\overline{g}$ is the gravitational field, M is the mass contained within the Gaussian surface S. With the negative sign we want to generalize that the gravitational force is attractive since there are no negative masses as in the electrical case where there are charges negative.

Normally, to study the dynamics of gravitational systems, the procedure consists of equating the gravitational force with the centrifugal force or more correctly with the centripetal force.
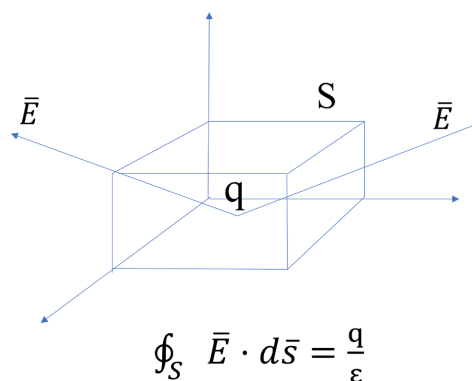

$$\oint_S \overline{E} \cdot d\overline{s} = \frac{q}{\varepsilon}$$

Figure 1. A parallelepiped-shaped Gaussian surface S is shown, although it can have any other shape. A source q of the field in the interior is assumed. At the bottom of the figure we have the expression for Gauss's Law in the case of the electric field. This turns out to be one of Maxwell's laws.

$$gm = mv^2/r \tag{4}$$

From here we obtain the expression for the velocity

$$v = \sqrt{gr} \tag{5}$$

The important point here in this description is that the strength of the gravitational field of a system where, unlike the solar system, now the mass is scattered, distributed in practically the entire volume of the galaxy will have a different mathematical expression.

For a spherical galaxy with star density $\rho(r)$, **Figure 2**, the mass contained within the Gaussian surface is given by the expression

$$M = \oint \rho(r) r^2 \mathrm{d}r sen\theta \mathrm{d}\theta \mathrm{d}\varphi \tag{6}$$

With the differential element of volume expressed in spherical coordinates.

The example that reproduces the measurements of Vera Rubin, is the case of

$$\rho(r) \propto 1/r^2 \tag{7}$$

Calculating M from Equation (6) with Equation (7), we have

$$M = cte\, r \tag{8}$$

With this value of M substituted in Equation (3) and integrating the first member on the Gaussian surface of **Figure 2**. Here, when integrating on the Gaussian Surface, the field remains constant. After that, it is found that the value of the gravitational field varies from the galactic center as one on the distance r to the first power. With this value of the field in Equation (5) it is found that the rotation speed is a constant, such as the expression of Equation (2) measured experimentally by Vera Rubin.

Now it can be seen that, by making the correct calculation for the stellar dynamics in a galaxy, the values of the experimental stellar rotational speeds, originally assumed to be excessive, can be reproduced with a good approximation. In this way it is shown that the introduction of the postulate of the existence of
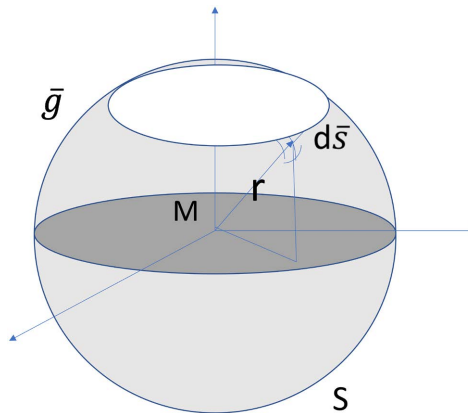

Figure 2. A Gaussian Surface S is shown with a spherical shape, although it can have any other shape. A source M of the field is assumed in the interior, with a distribution ρ(r) within the Gaussian volume. With this symmetry, given a value of r, the field remains constant on the Gaussian surface.

Dark Matter is superfluous.

Here, also it can be shown that galaxies can exist where stars have about a rotation speed as predicted by the Newtonian potential. That is, the speed of rotation in that case would be as in Equation (1). For that, the mass distribution of the galaxy would be practically that of a Solar System, in this case approximately $M = cte$. With this value of M in Equation (1) we have that the stellar rotation speed is almost like that of the planets in the Solar System. It could then be said that such a galaxy would lack Dark Matter in fact at all.

5. Numerical Calculation

In addition to the previous analytical demonstration, we perform a numerical calculation by simulating a spheroidal gravitational structure of n particles of mass m, located according to a more or less arbitrary pattern. Inside a spheroid of unit radius, we place a particle at the center, which is in turn the origin of the Cartesian coordinates x, y, z, and continue placing particles on the spheroids of radii $r = 1/3$, 2/3, and 1.0, so that the angular spacing between them, with respect to the azimuthal and polar angle, is $\pi/4$. Thus, azimuthally they are placed at $\phi = 0$, $\pi/4$, $\pi/2$, $3\pi/4$, π, $5\pi/4$, $3\pi/2$ and $7\pi/4$ on the polar angle in $\theta = 0$. $\pi/4$, $\pi/2$, $3\pi/4$, π. In this way we place 79 particles in total, avoiding repetitions (Figure 3). The gravitational field is calculated at different points located along a test radius
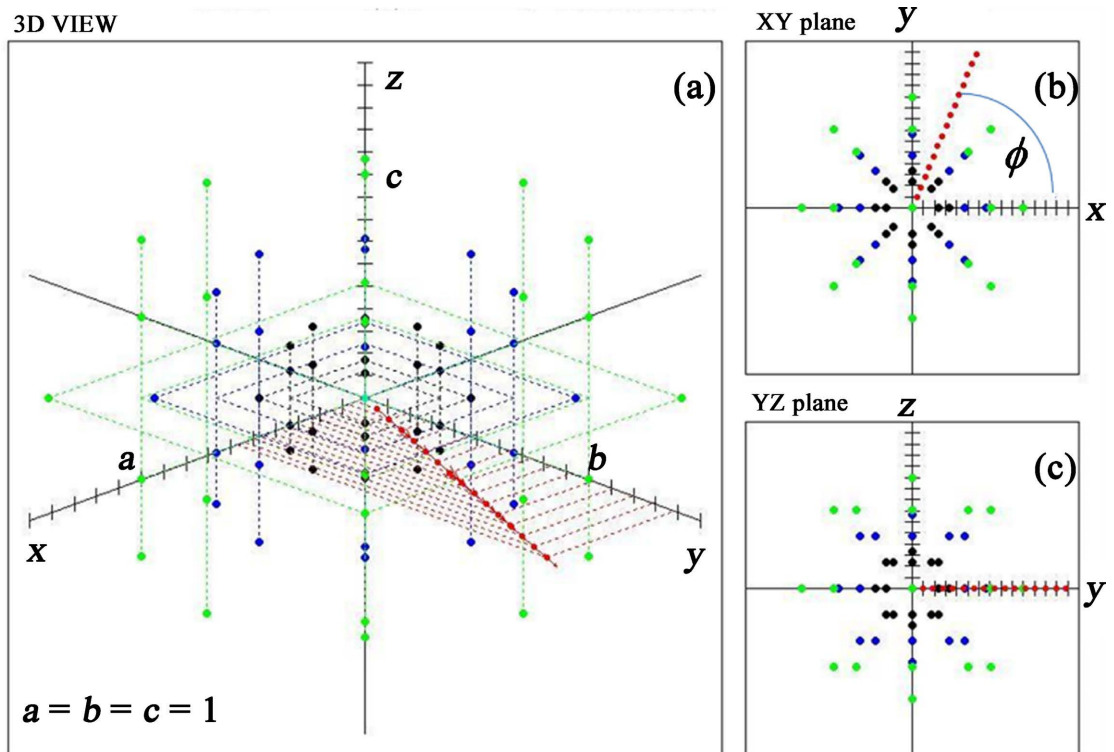

Figure 3. The discrete distribution of $n = 79$ particles for the spherical case is shown in figure (a), that is, when the semi-axes in x, y, z are $a = b = c = 1.0$, located in three layers of radii r = 1/3 (black), 2/3 (blue) and 1.0 (green). Their angular positions at ϕ and θ are shown in figures (b) and (c) respectively. Also shown in figure (b) are the calculation points (red), along the test line at r_0 and on the x-y plane.

r_0 on the *xy* plane, forming an azimuthal angle of $3\pi/8$ (67.5°) with respect to the *x* axis, to prevent the calculation points from coinciding with the particles of the distribution. The semiaxes of the spheroid along each coordinate axis *x*, *y*, *z* are *a*, *b* and *c* respectively.

The gravitational field at each specified point is calculated by superimposing the contributions to the field of each particle of mass *m* from the distribution, that is,

$$\overline{g} = \sum_{i=1}^{n} \overline{g}_i = Gm \sum_{i=1}^{n} \frac{\overline{r} - \overline{r_i}}{\left|\overline{r} - \overline{r_i}\right|^3}, \tag{9}$$

where $\overline{r}$ is the position of the calculation point and $\overline{r_i}$ the position of the i-th particle of the distribution. Thus, the scalar components of the gravitational field at the point (x, y, z) are given by:

$$g_\mu = Gm \sum_{i=1}^{n} \frac{\mu - \mu_i}{\left|\overline{r} - \overline{r_i}\right|^3}, \quad \mu = x, y, z \tag{10}$$

From here we get that $g = \sqrt{\sum g_\mu^2}$ and, therefore, from Equation (5) $v = \sqrt{gr}$, we obtain the speed that a test mass m would have located at the different points along r_0. **Figure 4** shows the results obtained, using graphs of velocity calculated along r_0 for different values of the vertical semi-axis c. Starting from the case where $a = b = c = 1.0$, we approach a disk-shaped distribution by reducing the vertical semi-axis to $c = 0.5$ and then to $c = 0.1$, keeping $a = b = 1.0$. It is observed that the velocity profiles are almost constant, in all three cases,
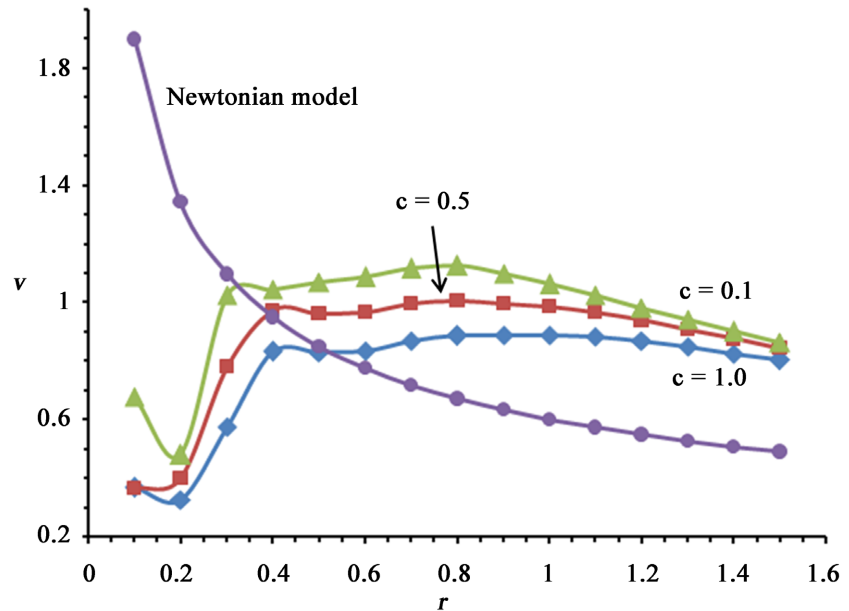

Figure 4. Velocity profiles are shown, obtained along the test radius r_0 for a discrete spheroidal distribution of particles. The spheroids consist of 79 particles located in three layers of radii 1/3, 2/3 and 1.0 on a normalized scale, and whose vertical semi-axis is c = 1.0, c = 0.5 and c = 0.1 in each case. In contrast to the velocity distribution for the Newtonian model, it is observed that they maintain an almost constant profile from $r \cong 0.4$ to r = 1.0.

from $r \cong 0.4$ to the end of the distribution at $r = 1.0$, in contrast to the velocity profile for a Newtonian potential that decreases the velocity as r grows.

The above shows that the gravitational field produced by a discrete mass distribution is very different from the field produced by an equivalent mass located in the center of the distribution. Furthermore, the thinner the disk, the greater the difference from what the Newtonian model predicts. In this way, we show that a velocity profile different from that predicted by the Newtonian model is natural when considering a discrete mass distribution.

6. Conclusions

The postulate of the existence of the neutron, by Ernest Rutherford, had its reason for being. It was sought to justify the stability of a good part of the nuclei in nature, against Coulomb's rejection. In the end, the existence of the neutron turned out to be a fact. What started as a suspicion was later confirmed experimentally.

Discovering that the atom was not indivisible, but turned out to be an entity that had parts, triggered the search for the fundamental brick, as a basic part of all existence, a search that also ended up configuring what is now called the Standard Model of Particles. It was shown that, in a sense, all scientific theories that describe part of nature are false. This is because a theory is not nature but only a representation. The hierarchy: Laws, Theories and Models indicates that consequently the Standard Model also suffers from this qualifier. It is to be recognized that even with this appreciation this Model seems to be the best of what is available to describe this part of nature. We believe that any more general description of what exists should include something from the hierarchy: Void, Waves, and Particles. Regarding the wave-particle duality, it is a fact that particles can be accelerated, but waves cannot, unless the characteristics of the medium that propagates them are modified. This is indicative that waves and particles are entities that are in the end different. Although quantum mechanics indicates that they can be given the same mathematical treatment. Two distant observers can only communicate by means of waves or particles. Any theory in the Physics of particles will have to do this consideration.

The existence of the neutron as a new particle took approximately two years to be accepted. In particular in the Standard Model, among several other things, it has not been possible to include the fourth force, which is gravity. This is mainly because the graviton does not appear anywhere. Neither Dark Matter nor Dark Energy has been able to be incorporated. A point that was highlighted in the argument of this work is that the description of the forces is not only incomplete but also has no explanation that the strong force is so strong and there are no structures made up of two or more protons exclusively or composed of this way by neutrons. Neutron stars are assumed to be driven by gravitational force, although the strong nuclear force should be present. Structures with a lower number of neutrons do not appear.

As a part of conclusion, the existence of Dark Matter as a foreign substance that could provide stability to galaxies, has not been incorporated into the Standard Model either. As demonstrated in this work, there is a mathematical treatment for stellar dynamics in galaxies that shows that this postulate of the existence of Dark Matter can be dispensed with.

It is noteworthy that there may be galaxies in which this influence called Dark Matter is not found. This will undoubtedly be a consequence of the fact that the mass distribution in that galaxy will be something very similar to the mass distribution in the solar system. Almost all of the mass is in the center of the distribution and only a faint distribution in the rest. The profile of their speed of stellar rotation will be roughly the profile of the speed of the planets.

It is, therefore, superfluous, that is, it is unnecessary to introduce this strange and inexplicable matter to try to make sense of the high speeds of stellar and galactic rotation of galaxies in clusters. With a direct and rigorous mathematical calculation, it is shown that the experimentally measured rotational speeds are obtained directly, using the stellar dynamics displayed here.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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