A New Model for the Subatomic Particles the Fundamental Interactions and the Solution to the Millennium Problem of the Yang-Mills "Mass Gap"

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Abstract

With the discovery of the atoms by Einstein (1905), and the proof that atoms have subdivisions, Rutherford (1911), that is, they consist of other smaller particles, the formation of the Quantum theory, the theory of the particles found within the atom, began. Initially, it was discovered that each atom consists of a nucleus, which is also the solid part of the atom, which is composed of protons (particles with a positive electromagnetic charge) and electrons (particles with a negative electromagnetic charge) around which other electrons rotate. Then it was discovered that the assumption that atoms consist of a nucleus of protons and electrons, around which other electrons revolve, was not correct but it was discovered that the nucleus consists of protons and uncharged particles (not electrons), which the Quantum theory called neutrons, James Chadwick (1932). With the progress of the research, it was discovered that the protons and neutrons, of which the nucleus consists, also have subdivisions, the particles, up and down quarks, Murray Gell-Man (1970).

With the discovery of the up and down quarks, which together with the electron were considered to be the elementary particles, that is, the smallest subdivisions of matter, the foundation of the Standard Model theory began, that is, the theory for the investigation of elementary particles and antiparticles, as a branch of the Quantum theory. The Standard Model theory was completed with the discovery of the Higgs particle (2012), a particle that is not an elementary particle but has the property of contributing to the creation of the mass of the remaining elementary particles and antiparticles.

The calculations and the various elements of subatomic and elementary particles in the Quantum theory and the Standard Model are based on the Yang-Mills equations formulated in the 1970s and are based on the assumption that the same laws apply to subatomic and elementary particles in the microcosm[1] as they do in the macrocosm. The successful use of Yang-Mills theory to describe the interactions of elementary particles has relied on a subtle quantum mechanical property called the Yang-Mills "mass gap"[2]. Experiments and computer simulations suggest the existence of this "mass gap" in the solution of the Yang-Mills equations, but no theoretical proof of this property is known. The property has only been discovered by physicists in experiments and confirmed in computer simulations, but it has not yet been understood theoretically. Theoretical physicists believe that the explaining of the property of the

[1] In the Chain Reaction theory, divide the Universe into three parts: a) the microcosm, that is, the world that is within the atom, b) the macrocosm, that is, the world after the atom and up to the ends of the Universe, and c) the world of infinity, that is, the world that is beyond the boundaries of the Universe.

[2] As we will see in the third section, the Yang-Mills "mass gap" is the difference between the mass of absolute vacuum, which is considered zero, and the mass of the lightest particles predicted by the Standard Model theory.

Yang-Mills “mass gap” will require the introduction of new fundamental ideas, both in physics and mathematics. In fact, to stimulate scientists’ interest in solving the Yang-Mills “mass gap” problem, the problem was included as one of the seven unsolved problems of the Millennium Prizes, announced by the Clay Mathematics Institute, which offers a prize of one million dollars for the solution of each problem.

With the progress of science, it was found that while Quantum theory is based on very strong and correct scientific foundations, the Standard Model theory, in addition, have to clarify the case of the Yang-Mills “mass gap”, before its establishment, and many other weak points, such as, whether the electron and the up and down quarks are indeed elementary particles, whether quarks move or not inside the nucleus of the atom, whether bosons actually exist, what about the fundamental interactions, whether the Higgs mechanism for the origin of the mass of the elementary particles is the correct mechanism, etc. [5], [6] and [7]. However, regardless of the clarification of the above points of the Standard Model theory, in the section 5, I propose a New Model for describing elementary particles and fundamental interactions to replace the Standard Model. The New Model I propose clarifies all the unanswered questions of the Standard Model, includes the interaction of gravity[3] and, at the same time solves the problem of the Yang-Mills “mass gap”.

1. Introduction (the discovery of the atom)

With the word "matter" we define the substance with which the various material bodies are structured. Matter is perceived by humans, from a series of its properties, such as its weight, mass, volume, form, etc. Among the first to be concerned with the constitution of matter, were the Ancient Greek philosophers, among whom stand out the names of the Pythagoreans, Thales of Milesius, Anaximander, Heraclitus, Zeno of Eleat, Diogenes, and many others who each in their way interpreted the behavior and entity of material bodies.

Notable were the views of Aristotle (350 BC) who believed that matter in the Universe consists of four elements, earth, air, water, and fire. Two forces acted on these elements. These forces were gravity, manifested by the downward tendency of earth and water, and lightness, manifested by the upward tendency of air and fire. It is remarkable that this standard, of the separation of the components of the creation, evolution, and functioning of the Universe, into matter and forces, is still used to this day.

According to Aristotle, matter is continuous. That is, we could divide a piece of matter into small pieces, without any limit. In this sense there is a continuous division of matter, meaning that we will never meet a piece of matter that we cannot divide into smaller pieces. On the other hand, Democritus argued the opposite. That is to say that matter by its nature is granular and that every material body consists of a very large number of different atoms. In this case, with the word “atom” Democritus characterized exactly the last subdivision of matter, after this subdivision, matter could no longer be divided further.

The research and discussions on the different views of Aristotle and Democritus lasted for many centuries, without either side being able to present any theoretical or experimental proof that would confirm the correctness of their views. This lasted until 1803, when the famous British physicist Dalton, trying to explain the phenomenon of the constant ratio of elements in various chemical reactions, formulated the idea that this phenomenon is because matter con-

[3] Initially, the word gravity was used to describe the force of attraction of various material bodies from the Earth. Later, the same word was used for the force of attraction between all material bodies.

sists of small particles which he called "atoms", using the same name that Democritus had used twenty centuries ago.

The above dispute between the views of Aristotle and Democritus, as supplemented by Dalton, continued for another century until 1905, when Einstein made a very important observation about the existence of atoms: Einstein's observation was that, within a liquid, or a gas, there is a random continuous movement of various microparticles of dust. This movement, (to which physics has given the name of the scientist who observed it, calling it "Brownian motion"), as a natural phenomenon, could be explained, only by the movement of "atoms", in the liquid or into the gas and their collision with the dust particles. Thus, with Dalton's observations, on the phenomenon of the constant ratio of elements in the various chemical reactions, and then by Einstein on "Brownian motion", the experimental proof was given that matter is made up of various small particles, the "atoms", which were initially considered to be elementary particles, i.e. the last subdivisions of matter.

2. The subatomic[4] and the elementary[5] particles. The Quantum theory and the Standard Model theory

After the experimental proof of the existence of the atoms, there were already suspicions that atoms, in turn, must not be elementary particles, but must also be composed of other smaller elements of matter. Certain particles known today as "electrons", with a negative electrical charge, whose mass was much lower (about one to two thousand times) than the mass of the Hydrogen atom, had already been identified experimentally. The detection of electrons led scientists to the indisputable conclusion that there were other smaller subdivisions of matter after atoms. Therefore its division did not stop at atoms but continued even more.

In 1911 the British physicist Rutherford proved that atoms are subdivided into smaller particles, specifically that they consist of a nucleus which is positively charged around which revolve electrons, negatively charged particles which had already been discovered. The nuclei

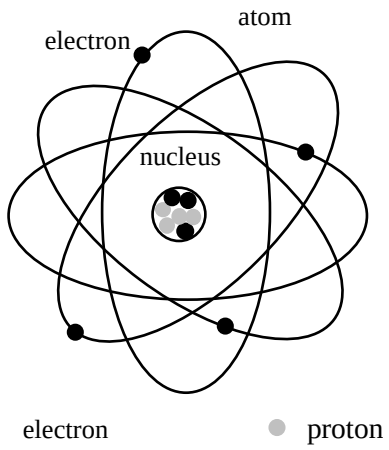


Figure 1: The figure of the atom after the discovery of the proton.

[4] Subatomic particles are all particles that are found inside the atom, or have a mass less than the mass of the Hydrogen atom.

[5] Elementary particles are the smallest subdivisions of matter and antimatter. They are also found within the atom and are part of the subatomic particles.

of atoms were then considered to be composed of electrons and protons, where protons were particles like electrons but with a positive electrical charge, and they got this name because they were considered to be, together with electrons, the elementary particles and the fundamental units of matter. This is how the Quantum theory of subatomic particles began to be established, with the atom taking the form of the **Figure 1**.

This model of the structure of the atom with the solid nucleus of protons and electrons and other electrons orbiting the nucleus lasted about 20 years only, until 1932, when James Chadwick discovered that the nucleus of the atom is not made of protons and electrons, but that it consists of two particles, one of which was indeed the proton particle which as we described above had already been discovered, but the other particle was not the electron but was a neutral, new particle without charge, with mass about equal to the mass of the proton which, because it was a neutral particle, was given the name "neutron". Thus, the new image of the atom at that time was formed as shown in **Figure 2**, that is, from a nucleus, which consisted of a set of protons and neutrons, (which constituted the solid part of the atom), around which revolve the electrons.

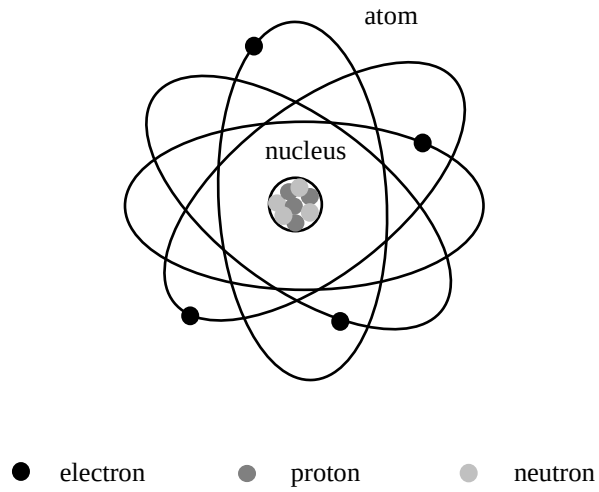


Figure 2: The figure of the atom after the discovery of the neutron.

With the discovery of the electron, proton, and neutron, which were also thought to be the elementary particles of matter and after the completion of the above model of the structure of atoms, scientists thought that research into the structure and origin of matter had finish. In fact, some scientists hastened to declare that in a very short time the research of the structure of the microcosm will be completed.

But once again the scientists were refuted since in the 1970s the theoretical physicist Murray Gell-Mann, proved theoretically that protons and neutrons are composed of triads of other particles that scientists called quarks. In the same decade, quarks were also discovered experimentally at the California Institute of Technology, where when high-speed protons collided with other protons, it was shown that protons and neutrons were not elementary particles. In particular, it was shown that protons and neutrons are complex particles and that they consist of triads of other particles, the up quarks and the down quarks. With the discovery of the up and down quarks which together with electrons were thought to be elementary particles began the formation of the Standard Model theory, of elementary particles, as an offshoot of the Quantum theory.

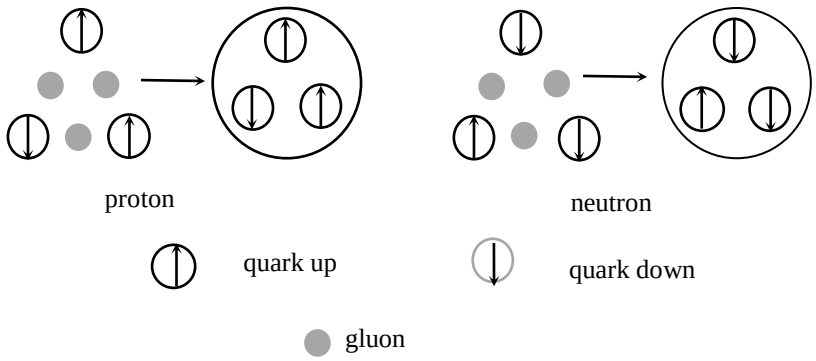


Figure 3: The formation of proton and neutron from quarks

In a few words, the Standard Model theory describes the elementary particles of matter and antimatter and the fundamental interactions from which the rest of the particles, matter, and material bodies were created. The elementary particles as described by the theory are divided into two large categories, namely: a) the elementary particles from which matter is created, the fermions, and b) the particles of the interactions, the bosons.

Fermions as the fundamental building blocks of matter and antimatter are grouped into two families which are:

The six quarks: Up quark (u) with charge 2/3e, and down quark (d) with charge -1/3e, charm quark (c) with charge 2/3e, and strange quark (s) with charge -1/3e, and top quark (t) with charge 2/3e, and bottom quark (b) with charge -1/3e.

And the six leptons: The electron (e) with charge -1e and the electron neutrino (ne), with charge 0e, the muon (μ) with charge -1e, and the muon neutrino (nm), with charge 0e, and the tau (t) with charge -1e, and the neutrino of tau (nt), with charge 0e.

Bosons are the carriers of interactions and are:

The photon (γ), carrier of the electromagnetic interaction, the particles, W+, W-, and Z, carriers of the weak interaction, the gluon (g) carrier of the strong interaction, and the Higgs particle that does not take part in interactions but creates the mass of elementary particles. The possibility of describing gravity through a boson is also being investigated, for which, although there is no evidence so far, it has already been named graviton. The corresponding theory that is being developed for the gravitons has already been called the Quantum Theory of Gravity.

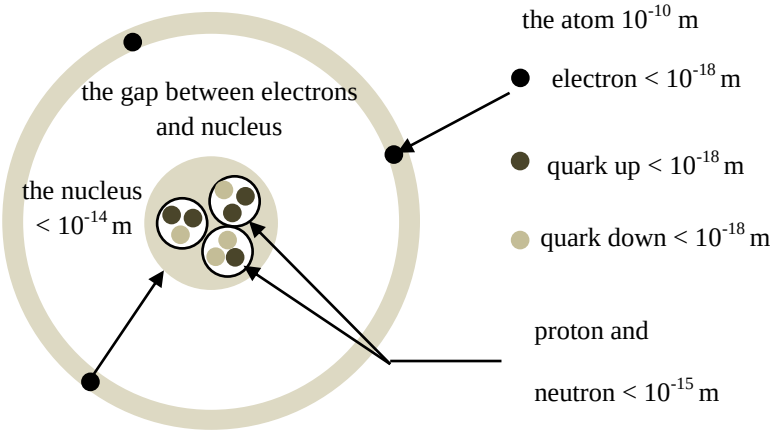
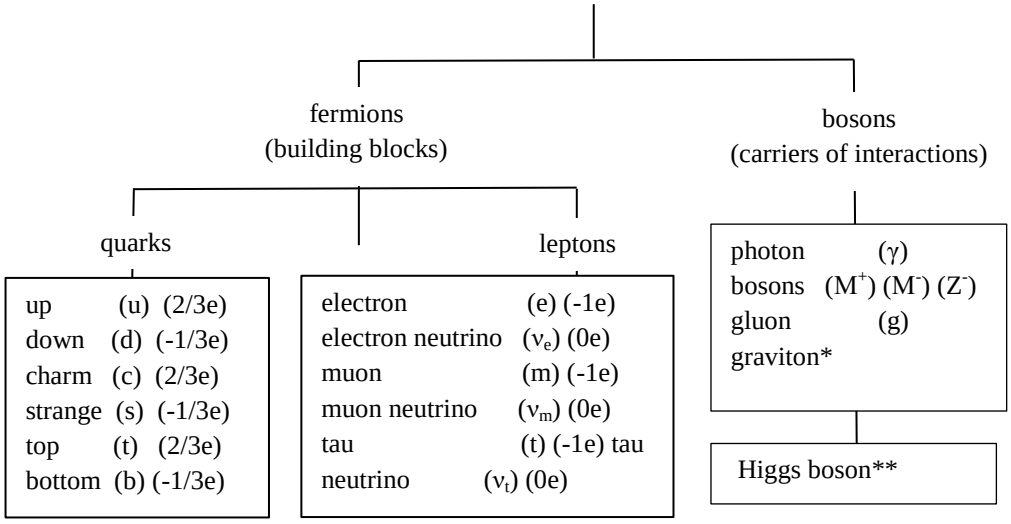


Figure 4. The form of the atom as of today.

From the fermions I described above, I will distinguish the electron and the up and down quarks which are the particles that contribute to the creation of matter and antimatter, as physics accepts today. The quarks have a charge, the up quark +2/3e, and the dawn quark -1/3e of the charge of the proton. The combinations of up and down quarks that made protons and neutrons are: Two up quarks and one down quark made a proton and two down quarks and one up quark made a neutron, as shown in **Figure 3** on page 5. The picture of the structure of the atom after the discovery of the quarks took the form that is valid until today as shown in **Figure 4**. In **Figure 4**, the dimensions of subatomic and subnuclear particles as they have been determined, from experiments and theoretical calculations, are also marked. These dimensions lead us to a better understanding of the size and the structure of the atoms. Each fermion has a corresponding antiparticle; bosons do not have antiparticles. **Diagram 1**, bellow shows the elementary particles according to the Standard Model theory.

Diagram 1. The elementary particles according to the Standard Model theory



Note: *The graviton particle has not yet been detected there is not any characteristic of it except that it must be a very weak boson. That is why it is not included in the Standard Model theory.
**The Higgs boson does not take part in interactions but contributes to the creation of the masses of the elementary particles.

3. The properties of the elementary particles, the Yang-Mills theory and the "mass gap" of the theory

The laws of Quantum physics, into the world of subatomic and elementary particles, i.e. into the microcosm, work in the same way as the laws of classical Newtonian mechanics work in the macrocosm. This remarkable framework was introduced by Yang and Mills in the 1970s to describe elementary particles, using structures of the Euclidean geometry. Thus Yang-Mills theory became the foundation of the theory for investigating the properties of elementary particles and interactions and its predictions have been verified in many experiments. But the success of the theory rested on a subtle quantum mechanical property called the "mass gap". This property has been confirmed in many experiments, but it is a property whose mathematical basis is still unclear.

However, to establish the Yang-Mills theory, the property of the "mass gap" must clarified, something that worries theoretical physicists and mathematicians. It is believed that progress in establishing the Yang-Mills theory and the existence of the "mass gap" will require the introduction of new fundamental ideas in both physics and mathematics. Today the Yang-Mills "mass gap" problem is considered as an unsolved problem in physics and mathematics and was included in the seven Millennium Prize problems set by the Clay Mathematics Institute, which has offered a one million dollar prize for its solution.

In May 2000, the prestigious Clay Institute of Mathematics proclaimed seven cash prizes, worth one million dollars each, for the solution of an equal number of mathematical problems, which a group of internationally renowned mathematicians had described as the most difficult and important unsolved problems of our time. These problems became known as the Millennium Problems. Among these problems is the Yang-Mills "mass gap" problem.

4. The remaining weak points of the Standard Model theory

But apart from the Yang-Mills "mass gap" presented by the Standard Model theory, there are many other weak points of the theory that must be clarified before its final establishment. But since the subject of this work is not the weaknesses of the Standard Model theory, I will only mention some of these weaknesses without describing them in detail, giving only indications in which references the reader can find their details to study them. Thus, the theory of the Standard Model must be explained before its final establishment:

1. How is energy transformed into matter [6]? Specifically how did energy create quarks and the electron [6]?
2. Are quarks and electrons elementary particles [1]?
3. If and how do quarks move, inside the nucleus of the atom [1]?
4. Who is and how did the mechanism work, which created the unified interaction that gave rise to the four fundamental interactions [6]?
5. Do bosons exist [2]? And if there are, how were they created [2]? And how do they integrate and cooperate with matter [2]?
6. What are the details of the operation of the Higgs mechanism and [6]?
7. How were the nuclei of atoms [1] been created?
8. How was so much more matter than antimatter created in the Universe [5]?
9. Does matter attract or repel antimatter [2]?
10. What are the causes that created gravity [2]?

5. A New Model for the Subatomic Particles and Fundamental Interactions. The New Model includes the Interaction of Gravity and solves the problem of the Yang-Mills "Mass Gap"

In section 2 we saw that with the discovery of the quark up and quark down which together with the electron were considered elementary particles, the theory of the Standard Model was established as an offshoot of the theory of Quantum. In the previous section, I described some weak points of the theory of the Standard Model, which need to be clarified before establishing the theory. However, in addition to the weak points I have described, there is also another weak point, which is that: there are many other worthy proposals for the renewal or replacement of the theory of the Standard Model, which, however, for unknown reasons are rejected, without being studied or are taken into account.

Perhaps after the discovery of the up and down quarks and the proposal of the Standard Model theory, established science forgot that Modern Theoretical Physics and Cosmology are new sciences and that is why all new views and new proposals concerning them must be studied and evaluated, from whatever place they come from. Whether come from major Universities, from large Research Centers, or from small researchers.

Among these proposals is the New Model, which I describe next for the origin of the structural components of matter and the strong, weak, and electromagnetic interactions between them. The New Model describes with greater clarity, simplicity and reliability the origin of the structural components of matter and the interactions between them, including the interaction of gravity, and clarifies the case of the Yang-Mills "mass gap". Also, the New Model that I propose is fully adapted to all the theoretical and experimental data of science for elementary particles and fundamental interactions, up to date.

So according to the New Model:

"Everything in the Cosmos[6] was created from two particles,
the Pointon, and the Antipointon,
and from a single interaction, the Electromagnetic Interaction!"

The *electromagnetic interaction* is created along with the creation of the pointons and antipointons particles, like an attraction or repulsion, between these particles without the need for the mediation of a boson to create this attraction or repulsion. With the creation of the pointons and antipointons a rapid chain reaction of production of pointons and antipointons began, which continues to produce particles to this day at the limits of the Cosmos. The particles produced by the chain reaction are elementary particles, the smallest subdivisions of matter and antimatter. They are simple +1/3e (pointon) and -1/3e (antipointon) charges, massless[7], with inertia, and have almost zero dimensions ($<10^{-30}$m) [1].

With the help of the electromagnetic interaction, the particles and the antiparticles are attracted or repulsed to each other and: a) or collide and destroy each other, b) or enter rotational orbits around their opposite particles [1]. In the second case, they create the next generation of particles, which are particles with mass and dimensions[8], namely: the up and down quarks, the electron, and their antiparticles, as shown in **Figure 5**. **Figure 5** also shows the structure of up and down quarks and the electron, which indicates that up and down quarks and the electron are not elementary, but are composite particles.

Then, without needing any other interaction, protons and neutrons are created from the up and down quarks, again with the help of the spin orbits as shown in **Figure 6**[9] next page. Together with the protons and neutrons the first primary gradation of the electromagnetic inter-

[6] According to the Chain Reaction theory [1], along with the Universe, the Anti-universe is also created. Many other Universes and Anti-universes are also created, which all together create the Cosmos.

[7] In the New Model theory, there is no Yang-Mills "mass gap", since the elementary particles pointons and antipointons in the absolutely void have no mass, and their mass and the mass of the remaining particles is created as a difference dF_e of the electromagnetic forces of their elementary particles when they enter in rotational orbits around the opposite charged particles, to form the next generations of particles [2].

[8] The details of the creation of mass and dimensions, of up and down quarks and of the electron are described in appendix 2.

[9] As we observe in Figure 6, the creation of the proton and neutron did not require a boson (the gluon) as accepted by the Standard Model theory.

action the *strong nuclear interaction*[10], was created which contributed and contributes to the creation of the nuclei of Helium, and the nuclei of the remaining atoms that were created later inside the stars. Hydrogen nuclei had already been created, since they consist of simple protons, so for their creation the electromagnetic interaction is sufficient.

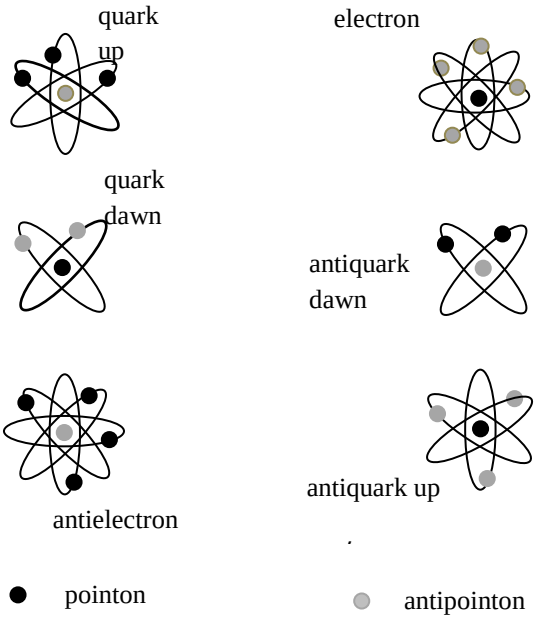


Figure 5: The combinations of pointons and antipointons that created the fundamental particles of matter and antimatter.

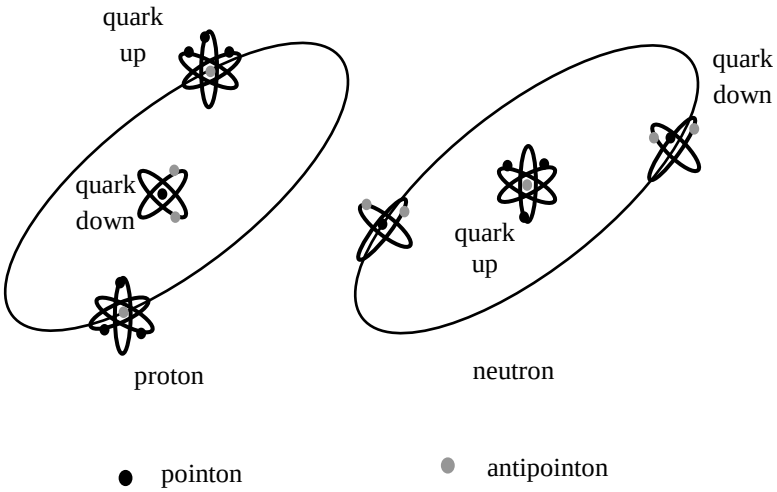


Figure 6: The suggested indicative structures of proton and neutron according to the New Model

From the nuclei of Hydrogen, Helium, and the electrons, the atoms of Hydrogen and Helium were created, in the known ways that we all know, without needing any other interaction except the electromagnetic interaction. But together with the creation of the atoms of Hydro-

[10] The details of the creation of the strong nuclear interaction, between neutrons and protons, are analogous to the details of the creation of gravity and the *dFe* mechanism, as I describe them in Annex 1.

gen, and Helium, the second primary gradation of the electromagnetic interaction, the *interaction of gravity*[11], was created which contributed and contributes to the creation of molecules,

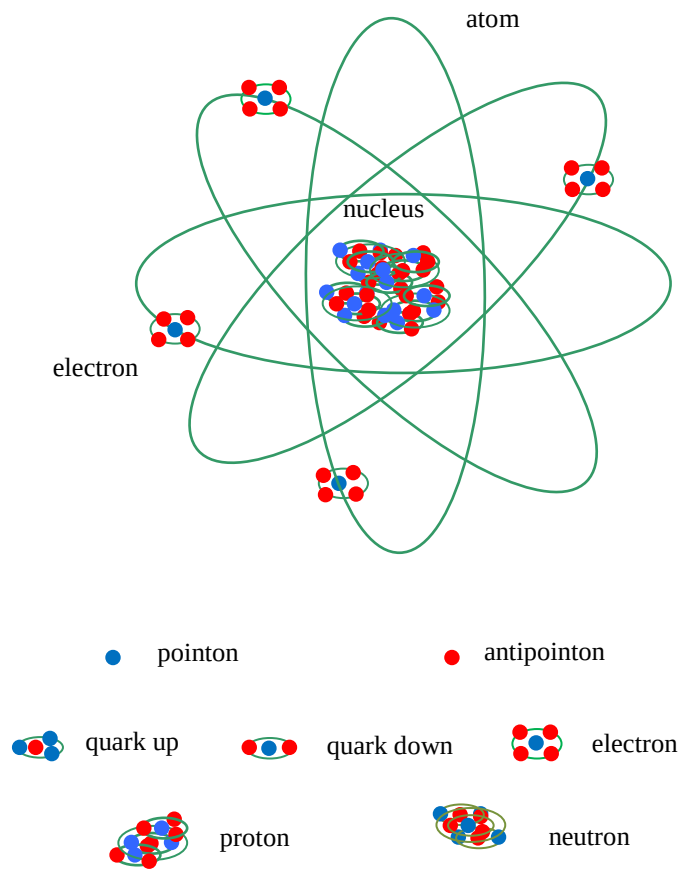


Figure 7: The proposed final structure of atom according to the theory of the "Chain Reaction"

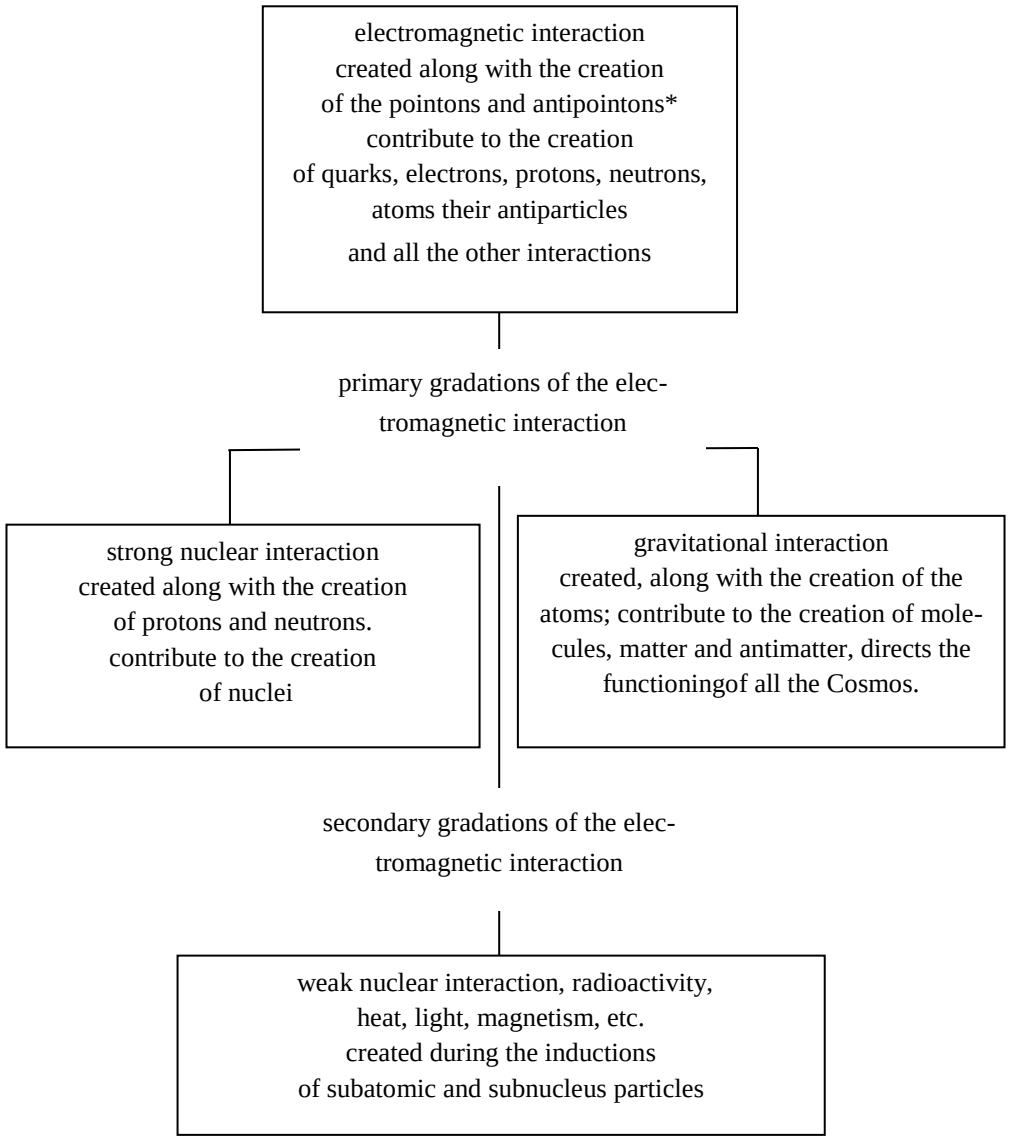
matter and antimatter, and then directs all the creation and operation of our Universe and the Cosmos. In **Figure 7**, I also give the proposed form of the atom as I describe in detail in my book "From Elementary Particles to the Limits of the Infinite Cosmos" [1].

All these, as I describe in my books "From Elementary Particles to the Limits of the Infinite Cosmos" [1], and "A Modern Theory of Everything" [2], happened within the first second after the beginning of the creation. The remaining interactions namely: *Weak nuclear force*, radioactivity, heat, light, magnetism, etc. are created during the accelerations of subatomic and subnuclear particles and are characterized by the New Model as secondary gradations of the electromagnetic interaction.

Diagram 2, next page summarizes the entire above process. But I have a feeling that I've tired you enough with my pointons and antipointons, the chain reaction, and the gradations of the electromagnetic interaction. This is why I am closing the work, leaving the rest of the details for readers, who want to delve deeper and study the subject of particles and interactions, to find and study them in my books, [1] and [2] and in references [5], [6] and [7].

[11] I describe the details of the creation of gravity in Appendix 1.

Diagram 2: The classification of the fundamental interactions
according to the theory of the Chain Reaction



Note: *According to the New Model, the elementary components of matter and antimatter as well as all interactions are limited to the two particles *pointon* and the *antipointon* and the *electromagnetic interaction*.

Comments: The idea of the chain reaction, came from the mere observation that all the matter and antimatter of our Universe and the other Universes and Antiuniverses was created by the elementary particles, pointons and antipointons. So the first step of our research was the discovery of the mechanism that created the pointons and the antipointons.

The discovery and establishment of the mechanism of the chain reaction that produced and still produces the pointons and the antipointons was a very successful mechanism as with the same mechanism that created the pointons and the antipointons, the electromagnetic force was created too and then all the other basic particles and all the fundamental forces that contributed to the creation. Then the success of the mechanism was sealed when by the develop-

ment of the theory of the Chain Reaction, the questions of the other theories were turned into answers etc.

6. Judgments, conclusions and proposals

If we recapitulate the properties and the function of the subatomic and elementary particles that we described in the previous sections we will notice that with the discovery of the divisibility of the atom began the formation of the Quantum theory, a theory that examines the properties and the behavior of particles that they are inside the atom. The theory was progressing very smoothly until the discovery of the up and down quarks.

With the discovery of the up and down quarks, which together with the electron were considered the elementary particles, i.e. the smallest subdivisions of matter and antimatter, the theory of the Standard Model began to be established, as an offshoot of the theory of Quantum for the study and the investigation of elementary particles. But the theory of the Standard Model, as I describe in sections 3 and 4 above, rested on faulty foundations and does not agree with much of the existing experimental and theoretical data of science. This is why science must: either been revise its existing data, which is probably impossible to happen: or readjust the Standard Model according to the existing data.

Unfortunately, however, the supporters of the Standard Model theory, who also represent the established views of science, oppose to the revision of the theory, or make wrong choices in their attempt to readjust the data of the theory, as for example: the de facto establishment of quarks and of the electron as elementary particles, while there are clear indications that these are not elementary particles and: the explanation of the phenomenon of the accelerated movement of the galaxies through the disputed concepts of “dark energy” and “dark matter”, etc., with resulting in the situation becoming even more confused.

At the same time, they reject, for unknown reasons, all the new opinions that come from small researchers, such as for example the New Model that I propose above, a proposal that I believe could offer very positive results in science[12]. In this sense, I consider it necessary that established science, in its research, in addition to the Big Universities and the Big Research Centers, should also include the small researchers that today it has ignored, thus excluding from its research, the greater part of scientists. Of course, the works of small researchers are very many and in the majority of them they are wrong works, but it is quite easy for science, as long as there is good will, to single out the correct works and study them. Let’s not forget that when Copernicus and Galileo proposed the theory of the Heliocentric System, on which the new current Cosmology was based, they were then characterized as insignificant and rather as heretical researchers.

By the establishment of the New Model, the problem of the “mass gap” will be automatically solved too, since all calculations of the Young-Mills theory will have to be re-examined, according to the views of the New Model. But in the New Model, the elementary particles pointons and antipointons have no mass, and their mass and the mass of the other subatomic particles is created when the elementary particles pointons and antipointons enter in spin orbits around their oppositely charged particles, to create the next generations of particles. In this case, a tiny small remainder of the sum of the electromagnetic forces, dF_e [2], between the

[12] I personally believe and have absolute certainty that by studying the New Model all the weak points of the theory of the Standard Model would be clarified and new horizons would be opened in the evolution of Physics.

pointons and antipointons remains, which creates their masses and the masses of the other subatomic particles.

Annex 1

The interaction of Gravity according to the New Model
The second primary gradation of the electromagnetic interaction

Atoms, although created from charged (protons and electrons) and neutral (neutrons) particles, in their original state, are presented as neutral elements of matter. But if we study carefully the electromagnetic forces created between protons and electrons in two atoms, we will notice some very small and slightly noticeable differences due to which the sum of the forces created, is not zeroed, but remains a very small (infinitesimal) remainder dF_e.

For a better understanding of this thought, I present **Figure 8**, where I note the forces created between protons and electrons in two Hydrogen atoms. Figure 10 shows that, due to the different distances between electrons and protons, these forces differ, albeit slightly, from each other.

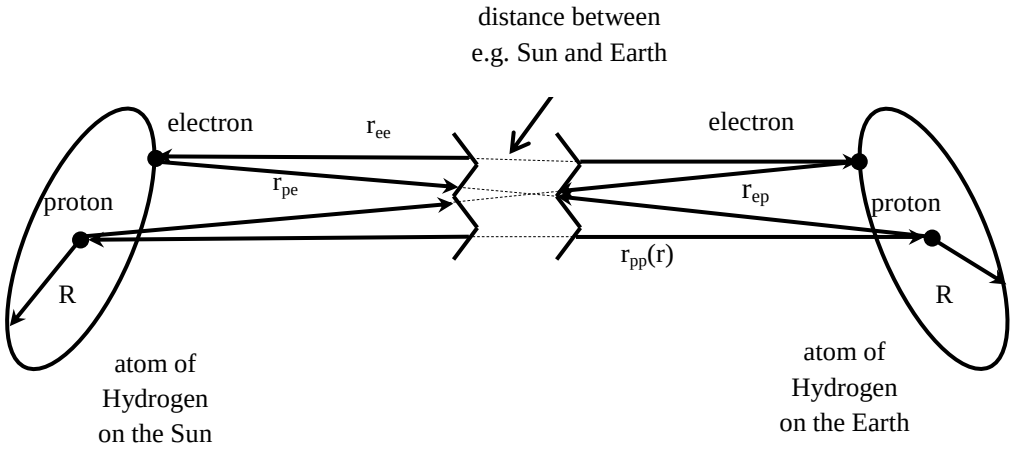


Figure 8: The attractive and repulsive forces between the protons and the electrons of two Hydrogen atoms.

I formulated the above thought in the following suggestion:

"When the negatively charged electrons, enter in rotational orbits around the positively charged nuclei, in order to form atoms, the difference between the attraction and repulsion forces exerted by the charges of the electrons and nuclei of those atoms, to the electrons and nuclei of the other atoms, are not totally zeroed, but remains a very small remainder dF_e. This remainder in conjunction with the existing masses of the protons, neutrons and electrons, generates the gravity of the atoms and furthermore the gravity of the material bodies."

In fact we can say that gravity of the atoms and material bodies is generated by two different causes that each one plays its own role in its formulation.

Specifically gravity is formulated by:

The attraction F_{Ng} of the masses of atoms, or material bodies, according to the law of Universal Gravitation:

$$F_{Ng} = G_{Ng}\frac{m_1 * m_2}{r^2} \quad (1)$$

and by the remainder dF_e according to the above suggestion.

So we have:

$$F_{Gg} = F_{Ng} + dF_e = G_{Ng}\frac{m_1 * m_2}{r^2} + dF_e \quad (2)$$

Where: with F_{Gg} we denote the new value of gravity which we will call Universal Gravity, to distinguish it from Newtonian gravity F_{Ng}. In my book "A Modern Theory of Everything" [2], I prove that the remainder dF_e indeed exists and is calculated by the following formula:

$$dF_e = 1.27.10^{36}\left\{\ln\left[\left(1+\frac{1}{f^2-1}\right)^{f^2-1} * \left(1+\frac{1}{2f^2}+\frac{1}{\chi f^4}\right)\right]-1\right\} * G_{Ng}\frac{{m_H}^2}{r^2} \quad (3)$$

In which for certain values of x in the interval (x = 2 to x = 4), the values of the above remainder dF_e coincide with the actual values of dF_e, as it is formed in nature. It is f the quotient $r/2R$, where r is the distance between the two atoms, R and m_H the radius and mass of the Hydrogen atom and G_{Ng} the constant of the law of Universal Gravitation.

If in the above formula we replace with:

$$G_{dF} = 1.27.10^{36}\left\{\ln\left[\left(1+\frac{1}{f^2-1}\right)^{f^2-1} * \left(1+\frac{1}{2f^2}+\frac{1}{\chi f^4}\right)\right]-1\right\} * G_{Ng}$$

We will yield the formula:

$$dF_e = G_{dF}\frac{{m_H}^2}{r^2}$$

And with similar reasoning for two atoms or two material bodies of masses m1and m2, at a distance r we will yield the formula:

$$dF_e = G_{dF}\frac{m_1 * m_2}{r^2}$$

So the formula (2) above becomes:

$$F_{Gg} = F_{Ng} + dF_e = G_{Ng}\frac{m_1 * m_2}{r^2} + G_{dF}\frac{m_1 * m_2}{r^2} = G_{Gg}\frac{m_1 * m_2}{r^2}$$

or

$$\boxed{F_{Gg} = G_{Gg}\frac{m_1 * m_2}{r^2}} \quad (4)$$

Where we have: F_{Gg} the new value of gravity, the Global Gravity, G_{Gg} the Global Gravitational Factor, which is the sum of G_{Ng} and G_{dF}, m_1 and m_2 the masses of the two atoms or the

two material bodies and *r* the distance between them. The formula (4) gives us the new value of gravity, the Global Gravity that applies with mathematical precision to the whole Cosmos[13], from elementary particles to infinity.

The investigation of the formula (3) of the dF_e remainder has a huge mathematical interest and plays a very big role in the investigation of gravity. But I think it is too early to describe this investigation (which is quite complicate), since this is a topic of mathematics and will get us away from the main purpose of this work. However it is very easy to distinguish and describe in advance three very basic and very important properties of the dF_e[14], namely:

- ✓ *For conventional distances r and conventional masses values, the dF_e, is infinitesimal and almost zero*[15].
- ✓ *For conventional distances and large masses, acquire small but measurable values of the dF_e and*
- ✓ *For very short, (atomic), distances, the dF_e, acquire measurable values, which affect Newton's gravity.*
- ✓

These properties of the dF_e remainder are very basic properties for explaining gravity. Especially if there was no the third property, there would be no the Cosmos too. The above properties, in addition to giving answers to all the weak points of Newtonian gravity and the law of Universal attraction, also give answers to the following questions, which have remained unanswered, from the existing theories up to date, namely:

-Why, in the long distances of the macrocosm, Newton's gravitational constant G_{Ng} is really constant?

-Why, at very short (atomic) distances, the gravitational constant G_{Ng} becomes even zero and even negative?

-Why, atoms do not destroy themselves, by their attraction when approaching, as with the charged elementary sub-atomic particles happen?

-Why, gravity and electromagnetic interactions have the same range (infinite), but a huge power difference, (10^{-36})?

-Why light is attracted by large masses?

-What is the cause that creates the anomalous precession of the perihelion of Mercury ? etc.

Annex 2

The creation of the mass of the subatomic particles according to the New Model

In this annex, I will describe a very interesting new proposal regarding the origin of the mass of subatomic particles and I would ask readers to take it very seriously since this proposal

[13] In my book, "From elementary particles to the limits of the infinite Cosmos", [2], I describe the "Theory of the Chain Reaction". According to the "Theory of the Chain Reaction", together with matter, antimatter is created and consequently, together with the Universe, the Antiuniverse is created too, and perhaps many other Universes and Antiuniverses that all together create Cosmos.

[14] At this stage of the research, we are not interested about the precise determination of the value of $dF_{e,}$, but what is of high significance is the presence of the dF_e, because as we shall see, it explains and completes all the weak points, in Newtonian gravity and in the law of the Universal Attraction.

[15] In this case the formula (4) that gives, the new value of gravity, the Global gravity, coincides with the formula (1) that gives the Newtonian gravity.

completely changes the current data of theoretical Physics regarding the creation of the masses of subatomic particles and leads us to new very interesting views. The proposal is that:

"The dF_e remainder mechanism can completely replace, more effectively, the Higgs particle mechanism, which has been proposed for the creation of the mass of the subatomic particles"

So, in very simple words we can say that, when subatomic particles enter into orbits around oppositely charged particles to form new particles, there is no complete neutralization of the forces between their charges, but a very small remainder remains (corresponding to the dF_e remainder, which creates gravity), which creates the masses of the subatomic particles.

Specifically, when pointons enter into orbits around antipointons, "or vice versa", to form up and down quarks, electrons and their antiparticles, the dF_e remainder creates the mass of quarks and electrons. Then when the quarks enter into rotational orbits, to form the nucleons, that is, the protons and neutrons, the remainder dF_e, added to the already existing masses of the quarks, creates the mass of the protons and neutrons. Then we have the case that we have already examined in annex 1, where the remainder dF_e contributes to the creation of gravity and the mass of atoms and material bodies.

I describe the above mechanism in the theory of the Chain Reaction, in my books "From Elementary Particles to the limits of the Infinite Cosmos" [1], and "A Modern Theory of Everything" [2]. As for the Nobel Prize awarded in 2013 for Higgs mechanism and Higgs particle [1], it is a matter of the Swedish Academy and Established Science whether they will choose to remain in unilateral support of the unconfirmed Higgs mechanism, for the creation of the mass of the subatomic particles, or they will take equal distances, giving the same opportunity to the dF_e remainder mechanism, which I believe is the correct mechanism.

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