Are the “quarks” and the “electron” elementary particles?

Abstract: The value of the charge of the “quark down” that is 1/3 of the value of the charge of the electron, limits the smallest charge subdivision has hitherto been identified. This means that all the particles with multiple charges, thus “quark up” and “electron”, are divisible particles. In this paper will identify the subdivisions of the quarks and the electron and will study how these particles are created from these subdivisions. In Fig. 2 of this work are given the structures of quarks up and down and of the electron. Extending for a bit the subject of the work, suggests in Figure 3, a new structure of the atom where the various stages of the creation of the sub-atomic particles are noted too.

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General

Before starting the analysis on whether the quarks and the electron are elementary particles, that is whether they are divisible particles or not, I would like to proceed with two clarifications. First, for those readers who are not familiar with the concept of the quarks that quarks are particles from which protons and neutrons, i.e. the particles of the nucleus

are builds. The second clarification concerns the definition of the term “elementary particles” with which we characterize those particles that constitute the last subdivisions of matter, i.e. the particles, which cannot be further cut, to other smaller particles.

About matter

With the word “matter”, we define the substance with which various material bodies are structured. Matter is characterized by a series of properties, such as weight, mass, volume etc. Initially, the meaning of matter was an adequately simple definition, because perceptions regarding matter were restricted to the macro world that man could observe unaided. However, slowly, specific questions arose, such as, of which elements matter is created? Greek philosophers were among the first who engaged themselves with the philosophical meaning of matter and among them: Pythagoreans, Thales of Miletus, Anaximander, Heraclitus, Zenon the Eleatis, Diogenis and many other philosophers. Each one of them interpreted the behavior and the entity of material bodies in their own way.

Aristotle for example believed that matter consists of four elements, earth, air, water and fire and that there are two forces that affect these elements. These forces were gravity, that revealed itself by a downward movement of earth and water, and lightness that revealed itself by the upward movement of air and fire. It is noteworthy that this model of Aristotle still stands up in the present days. According to Aristotle, matter is continuous. That is to say, we could divide a piece of matter to small parts without any lower limit. In this sense, there is a continuous division of matter which means that we will never encounter a piece of matter that we will be unable to divide into other smaller pieces.

From the other side, Democritus held a different view in which nature is granular and each material body consists of a very great multitude of different atoms. In this case, with the word “atom” he exactly characterized the smallest particle that could not be divided further.

The elementary particles

Research and discussions on the models of Aristotle and Democritus did continue for many centuries, without any side to be able to present some theoretical or experimental

proof that would one of them prevail. This dispute continued until 1803, when British physicist Dalton, trying to explain the phenomenon of the constant analogy of elements in their various chemical reactions. He suggested that this phenomenon is due to the fact that matter consists of small particles, named by him “atoms” which he considered the elementary particles.

However, the dispute between the models of Aristotle and Democritus, supplemented by Dalton, continued for one more century until 1905, when Einstein proceeded to a very serious observation regarding the existence of the atoms. The observation of Einstein was that the “Brown movement”, a phenomenon of the random irregular movement of various tiny particles of dust inside a liquid or gas, could be explained only by the movement of the atoms inside the liquid or gas and their collision with the tiny dust particles. Thus, with the observations of Dalton and Einstein provided the experimental proof that matter consists of various tiny particles, the “atoms” that were initially considered as elementary particles.

With the discovery of the “atoms”, raised new questions regarding the nature of these atoms and whether they were indeed elementary particles. At that time, about 1910, Thomson experimentally discovered, a new particle, the “electron” with a negative electric charge and a mass that was much smaller, –approximately one to two thousand times– than the mass of the atom of Hydrogen. Thus, the discovery of the electron led scientists to the indisputable conclusion that there were smaller subdivisions of matter and, consequently, the atom was not the smallest indivisible particle. In 1911, British physicist Rutherford proved that atoms may be subdivided into smaller particles and, specifically, that they consist of a nucleus, which is positively charged, around which electrons, are rotating. It was considered that the nuclei of the atoms consisted of electrons and protons, were particles similar to electrons but with positive electric charge, and they were named protons because it was considered that, together with electrons, they formed the fundamental particles and the fundamental units of matter.

This model of the structure of the atom with a compact nucleus and electrons rotating around nucleus lasted approximately 20 years, until 1932, when James Chadwick found that even nucleus, in its turn, does not consist of electrons and protons but of two parti-

cles of which one was, indeed, the “proton”, mentioned before. However, the other particle was not the electron but was a neutral “charge less” particle having a mass approximately equal to the mass of the proton. That particle was named “neutron”. Thus, the depiction of the atom at that time was formed from the nucleus, which was the compact part of the atom, consisting of a set of protons and neutrons, around which electrons were rotating.

The discovery of quarks as the elementary particles

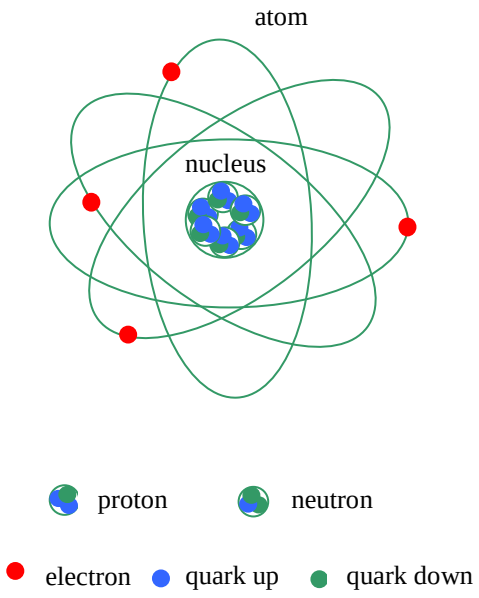

Fig. 1. The atom as it is today.

However, the story of the discovery of the structure of the atom did not end with the discovery of proton, neutron and electron. Using a cyclotron in which high velocity protons collide with other protons, it was established that protons and neutrons were not elementary particles. Experiments by physicist Murray Gel-Mann in the California Technological Institute around 1980 demonstrated that protons and neutrons are composite particles that consist of triads of other particles, called the “quarks”. Since then, several variations or additions to quarks have been locate, such as the “quarks up” and “quarks down”, the “paradox”, the “peak” and the “bottom”. There were also found the “colours” quarks with

variations such as the “red”, the “green”, the “blue” etc. However, in the case under consideration, we will focus, on the “quarks up” and “quarks down” which are the particles from which nucleons were generated i.e. protons and neutrons. The combinations that form protons and neutrons are: two quarks up and one quark down constitute a proton and two quarks down and one quark up constitute a neutron. From the characteristic sizes of the two mentioned particles, “quark up” and “quark down”, we will note the size of their charges which equals for the “quark up” +2/3 times and for the “quark down” -1/3 times the charge of the proton. Thus, the image of the structure of an atom after the discovery of the quarks took the form, as shown in fig. 1. This model still holds in the present days.

A very basic question, on the divisibility of quarks

With the discovery of quarks, a great and very essential question pops up again. Are quarks elementary particles or is there any further division of matter even beyond quarks? So far experiments have not been able to answer that question. But there is also something else. Because the wavelength of light is bigger than the size of the atoms and therefore even bigger than the size of the particles that constitute the atom, we cannot hope that by means of a usual way we will be able to “see” these particles or their subdivisions, in case they really exist. Perhaps, an experimental answer to this question, if are quarks dividable or not, is many hurdles to overcome and might not happen in the near future. But for the time being, a theoretical model will be the answer that might shed some light on the question at hand. Such a model would have to pass certain criteria in order to clarify our question for the divisibility of quarks and not complicate the question any more.

The answer to the above question, if quarks are elementary particle or not, and the proposal for the new elementary particles, “pointons” and “antipointons”

However, where science many times, is unable to drive us, with the experiments, nature itself and maybe our instinct, lead us into the right way, by means, of much simpler rules and reasoning. Let us try to form mentally a probable mechanism with which particles with a particular charge and particles with “exactly double charge” can be produced, –as it happens with the quarks “up” and the quarks “down” –; we shall then discover that the simplest and most possible and reasonable way is to create a mechanism that will produce

the smallest particles and the bigger ones will be produced by the doubling of the smallest particles that we have already produced. This is also the way in which nature, that always takes the simplest and most reasonable course of evolution, selected a similar mechanism for the formation of the quarks up by doubling the quarks down. Thus, we can assume that at least the quarks up are "divisible particles".

At this point I shall remind the readers the case of the discovery of the divisibility of the atom, when, around 1910, Joseph Tomson noted that there are particles, the "electrons", which have a mass much smaller than the mass of the atom of Hydrogen. So the same question rises here again; could we have a similar case with the quarks up, like the one we had with the atom and the electron, leading us to the indication that quarks up, and perhaps all types of quarks, as I describe in the "theory of the chain reaction" are, in their turn, divisible particles? Indeed, in this case of the quarks, we have a clearer and more reasonable indication that they really are divisible particles.

There is also another indication that leads us once again to the same conclusion, that the quarks are divisible particles. This indication is that several combinations of quarks and antiquarks joins forming a kind of unstable particles named mesons. Those mesons, in turn are immaterialized among themselves producing electrons and various other unstable particles. The production of mesons and electrons from quarks and antiquarks is α more confirmation that quarks and antiquarks are divisible particles.

However, our research does not end with the conclusion that quarks are dividable particles, or saying that quarks have subdivisions, but research continues in locating these subdivisions and studying, even theoretically, which is the possible mechanism that, in the continuity, under these subdivisions, this mechanism creates quarks. In that case, I will propose a new particle with an electric charge equal to 1/3 of the charge of the proton, to which I will give the temporary name "pointon". In addition of the pointon I will also propose the antiparticle of it; the "antipointon", with a corresponding electrical charge equal to 1/3 of the charge of the electron.

The selection of the pointon and antipointon "was not randomly made", but it was done, because these particles constitute the smallest subdivision of charge that up to now has been found, but, also, because they will constitute, the "smallest", "mass less", "dimen-

sionless" and "undividable" unit of the charge and the mass, as described in the "theory of the chain reaction" in my book, "From the inside of quarks and up to beyond the Universe". By the selection of pointons and antipointons, as we will see in the "theory of the chain reaction", the constituents of matter were already restricted to the above two elementary particles "charges" and to their mutual interaction, the "electromagnetic interaction", that according to the theory is the unique interaction inside the World. These components together with the establishment of the rotational tracks of the particles even inside the nucleus are the only necessary elements that describe the creation of the Cosmos from the elementary particles and up to infinity.

Some brief comments regarding the divisibility of quarks and the selection of "pointons" and "antipointons" as the elementary particles. The proposed new, perhaps the final structure of the atom.

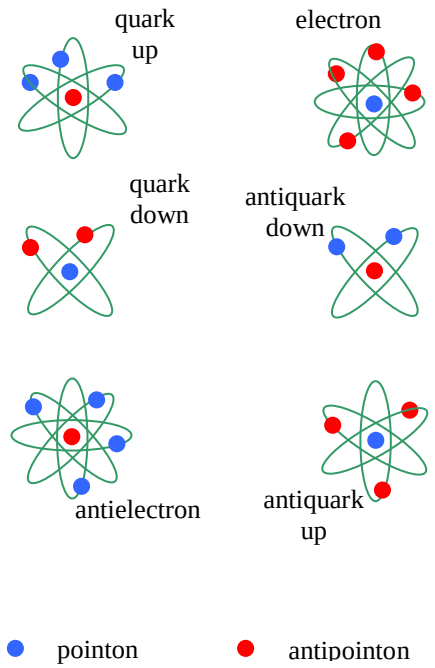

Fig. 2 The combinations that creates the fundamental particles of matter and antimatter from pointons and antipointons

The combinations that creates, the next generation of particles, -after the creation of the pointons and antipointons-, gives us the confirmation that, we correctly accepted

"pointons" and "antipointons" as subdivisions of quarks and as elementary particles. These combinations are shown in Fig. 2. In this figure are drawing "all" possible combinations have been depicted, with a total up to five particles, that could be created between pointons and antipointons. Perhaps, the probabilities tell us that combinations with more than five particles should have also been created. However, in that case, the quantities of these combinations that were created, with more than five particles, must have been very small so that they did not play any significant role in the initial stages of the creation. The emerging combinations have at their center only one particle, because if there were in the centre more than one particle, in case that they were heteronymous they would be self-destroyed and in case they were homonymous they would mutually repel each other and therefore they could not stand together in the center of the combination.
With great surprise, we will observe in our drawing that all combinations, that result between pointons and antipointons, form the basic particles from which matter, antimatter, the Universe, the other Universes and Antiuniverses and the whole Cosmos consist, i.e. quarks up and down, the electrons and their antiparticles.

Closing this work I have the feeling that pointons and antipointons possess all the preconditions so that they may be selected as elementary particles of matter and antimatter. On the other hand, the selection of the "pointons" and "antipointons" as elementary particles of matter and aantimatter, together with the circular orbits of the particles inside nucleus, constitute the most probable and absolutely logical proposal, regarding the way in which the creation started, a proposal that completely unifies the start of creation, with all contemporary theories. During the study of the "theory of the chain reaction", I have gathered many other supplementary arguments that support the idea that the pointons and antipointons, are indeed elementary particles. However I will finish because goes beyond the purpose of this paper to describe all these arguments.
With the above explained rational, I will integrate my thoughts regarding the divisibility of quarks, proposing a new structure for the operation of the microcosm, –which I analytically describe in the "theory of the chain reaction" in my book "From the inside of quarks and up to beyond the Universe" —, having the feeling that the new structure, which I propose, will certainly be the final structure of the atom.

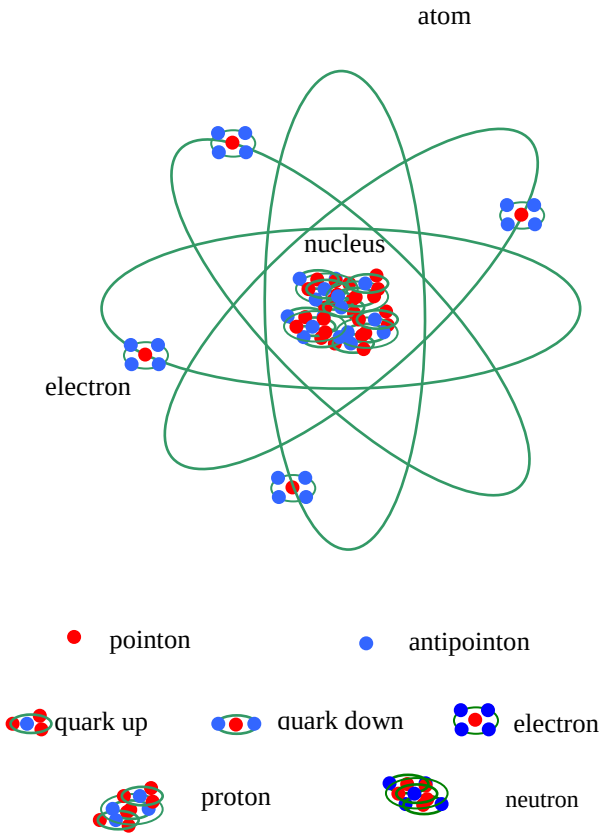

Fig. 3 The proposed of the final structure of the atom according to the "theory of the chain reaction"

P.S

Please do not hesitate to ask me for any question. I will answer all the questions.

References

S. Hawking, *"A Brief History of Time",* Bantam Dell Publishing Group. (1988).

V. Talios, *"From the Inside of Quapks and up to Beyond the Universe"*, Nova Science Publishers, Inc. (2011).

V. Talios, *"The Real Grand Unification"*, Laplambert Academic Publishing (2016).