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An Assumption Regarding the way Matter is Constituted and Structured from Light

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Abstract: The paper briefly presents some basic ideas on how matter is constituted and structured, based on permanent light as intrinsic energy. The fact that photons cannot be stored directly inside matter has not prevented it from having multiple hearts of energy springing from light, in the form of positive and negative electrical charges, which form the energy base of matter as it is structured and as we already know it (in its most important dimensions) molecules and molecular chains. The atoms of the various elements bind to each other and make up the molecules and then the molecular chains. Inorganic matter is practically structured in atoms, molecules, and molecular chains, while organic matter, which represents life, is structured in basic cells, which in turn are also composed of molecular chains. Here is the difference between living and inorganic matter, the elementary cell which is building the various organs and then will bind in the body. The author's ideas do not contradict those already known in the literature, even if they bring a new light on the way matter is constituted. The author wants to emphasize in this mini paper that the basis of the entire structure of matter is the energy from light. Now we can better understand the matter at its base, wherein the atom we have a nucleus and electrons. Heavy but concentrated nuclei play the basic role of matter while lighter electrons orbiting nuclei play the essential role of linking atoms together to form molecules and molecular chains. The nuclei of atoms are the massive and stable part of basic matter and electrons are its easiest part in constant permanent motion, which has the role of making and breaking the bonds between atoms and molecules. It follows that the base of nuclei, whether protons or neutrons, is made of portions of three coupled quarks, each of which is a heavy scaffold charged with photon energy in the form of one or two negative or positive yolks. Electrons or positrons are light scaffolds each charged with three similar charges. So logically, all matter is charged at its base with energetic hearts, which constantly guard it and interact with each other. Instead of using huge amounts of energy in the manufacture of antimatter as is currently the case when antimatter is obtained by colliding super accelerated particles at huge energies, we will be able to make antiprotons from neutrons with the help of accelerated electrons. A massive energy supplement will result from these processes anyway.

Keywords: Light, Electrical Charge, Nucleon, Proton, Neutron, Electron, Positron, Electronic Neutrino, Quarks, Massive Energy Supplement

Introduction

Neutrino (also called neutrino) is an extremely light elementary particle with spin 1/2, extremely light, yet with a mass greater than 0, which participates only in the processes mediated by weak and gravitational interactions. The neutrino is a lepton. Its symbol is the Greek letter ν.

Its existence was postulated by the physicist Wolfgang (1930).

Pauli postulated in 1930 the need for a particle to reproduce some of the characteristics observed in the β (beta) decay of neutrons, which called into question the laws of conservation of energy and kinetic momentum.

At the 1933 Solvay Congress, Pauli argued that this was explained by the fact that the radioactive nucleus emitted at the same time as the electron another particle which, at Enrico Fermi's suggestion, was called a neutrino, which in Italian means "small neutron." Experimentally, the ν neutrino and the associated antiparticle, the $\bar{\nu}$ antineutron, were discovered in 1956 by Tsung-Dao Lee and Chen Ning Yang (Cherenkov industrial applications, Wikipedia; Einstein, Wikipedia; Thomson, Wikipedia; Bohr, Wikipedia; Lorentz, 2022 transformation, Wikipedia; Bose-Einstein, Wikipedia; Rutherford, Wikipedia; Compton, 2022; Wikipedia; Pauli, Wikipedia; Louis de Broglie, Wikipedia; Dirac, Wikipedia; Halliday and Robert, 1966; Petrescu and Calautit, 2016 a-b; Petrescu and Petrescu, 2011, 2012a-b, 2015; Petrescu and Petrescu, 2011, 2012; Petrescu *et al*., 2017 a-g, 2016 a-c; Durand *et al*., 2000; Aversa *et al*., 2017 a-c, 2016 a-e; Laming, 2022).

Today we already know that a neutrino has an important role in the binding and clotting of matter at its base. These small particles, neutrinos, are freely found everywhere like electrons or photons, only they, like photons, have no electric charge, being electrically neutral, so they can participate in the composition of matter at its base, in the form of an elementary particle cement.

The particles at the base of matter known today are atoms coupled into molecules and molecular chains. The atoms of the various elements bind to each other and make up the molecules and then the molecular chains. Inorganic matter is practically structured in atoms, molecules, and molecular chains, while organic matter, which represents life, is structured in basic cells, which in turn are also composed of molecular chains. Here is the difference between living and inorganic matter, the elementary cell which is building the various organs and then will bind in the body.

The author wants to emphasize in this mini paper that the basis of the entire structure of matter is the energy from light.

So we have cells made up of atoms, molecules, and molecular chains to form living matter, or lifeless matter made up directly of molecular chains, molecules, and atoms.

Well, let's focus on atoms now to see what they are basically made of and especially how they are formed (composed).

An atom is the smallest constituent of common matter that has the properties of a chemical element. Any solid, liquid, gas, or plasma is composed of neutral or ionized atoms. Atoms are very small; Typical dimensions are around 100 pm (tenth billionth of a meter). Atoms do not have well-defined limits and there are different ways to define the size, which each give different but close values.

According to De Broglie's hypothesis, atoms are small enough that try to predict their behavior using classical physics-for example, as if they were billiard balls-gives visibly incorrect predictions due to quantum effects. Through the development of physics, atomic models have incorporated quantum principles to better explain and predict this behavior.

Each atom consists of a nucleus and one or more electrons bound to the nucleus. The nucleus consists of one or more protons and usually a similar number of neutrons. Protons and neutrons are called nucleons. Over 99.94% of the mass of an atom is concentrated in the nucleus. Protons have a positive electric charge, electrons have a negative electric charge and neutrons have no electric charge. If the number of protons is equal to the number of electrons, then the atom is electrically neutral. If an atom has more or fewer electrons than protons, then it has a total negative or positive charge, respectively, and is called an ion.

The electrons of an atom are attracted to the protons in the atomic nucleus by this electromagnetic force. Protons and neutrons in the nucleus are attracted to each other by another force, the nuclear force, which is usually stronger than the electromagnetic repulsive force acting between positively charged protons. Under certain circumstances, the repulsive electromagnetic force can become stronger than the nuclear force and nucleons can thus be removed from the nucleus, leaving behind a different element: Nuclear decay results in nuclear transmutation.

The number of protons in the nucleus defines the chemical element to which the atom belongs: For example, all copper atoms contain 29 protons. The number of neutrons defines the isotope of the element. The number of electrons influences the magnetic properties of an atom. Atoms can attach to one or more other atoms through chemical bonds to form chemical compounds, such as molecules. The ability of atoms to associate and dissociate is responsible for most of the physical changes observed in nature and is the subject of chemistry.

The idea that matter is made up of discrete units is a very old idea, which appears in many ancient cultures, such as Greece and India. The word "atom" was coined by ancient Greek philosophers. However, these ideas were based more on philosophical and theological reasoning than on evidence and experiments. As a result, their views on how atoms look and behave were incorrect. They couldn't even convince everyone so that atomistic current was just one of the many hypotheses that existed at the time about the nature of matter. However, since the nineteenth century, this idea has been taken up and rearranged by several experts, but only when the emerging science of chemistry managed to generate some discoveries that only the concept of atoms could explain.

In the early part of the 19th century, John Dalton used the concept of atoms to explain how elements react in small integer ratios (namely, the law of multiple proportions). For example, two types of tin oxide can be defined: One is 88.1% tin and 11.9% oxygen and the other is 78.7% tin and 21.3% oxygen (tin oxide) (II) and tin dioxide, respectively. For this reason, 100 g of tin can be combined with either 13.5 g or 27 g of oxygen. It is seen that 13.5 and 27 are in a 1:2 ratio. In this way, based on these chemical observations, Dalton was introduced to the idea that elements react in whole numbers only to discrete units - in other words, to atoms. The test for tin oxides, where a tin atom will combine with one or two oxygen atoms appeared together with (van Melsen, 1952).

Dalton was convinced that atomic theory could also explain why water can absorb different gases in different proportions (thus, he discovered that water absorbs carbon dioxide much better than nitrogen. Dalton's hypothesis is based on the differences in mass and conqauration between the respective gas particles, given that the molecules of carbon dioxide (CO_2) are heavier and larger than the molecules of nitrogen (N_2).

In 1827, botanist Robert Brown, using a microscope to look at dust particles floating in the water, discovered that they were moving practically chaotically, an extremely important phenomenon that later became known as the "Brownian motion." At the time, this chaotic motion was thought to be caused by water molecules hitting the granules. It was not until 1905 that Albert Einstein demonstrated the chaotic motion of molecules by producing the first statistical analysis of Brownian motion (Einstein, 1905; Mazo, 2002; Later, the French physicist Jean Perrin used Einstein's discoveries to experimentally determine the mass and size of atoms, thus making the first practical confirmation of Dalton's atomic theory. Physicist J.J. Thomson measured the mass of cathode rays, showing that they are made of particles, but that they are about 1800 times lighter than the lightest atom, the hydrogen atom. Therefore, they were not atoms, but a new particle, the first subatomic particle to be discovered, which he originally called a "corpuscle," and later an electron, after the particles postulated by Johnstone Stoney in 1874. He also showed that they are identical to particles emitted by photoelectric and radioactive materials (Thomson, 1897). It was immediately recognized that these are the particles that carry electric currents through the metal wires and those that carry the negative electric charge in the atoms and Thomson received the Nobel Prize in Physics in 1906 for this extremely important discovery. Thus the old idea that atoms are the indivisible final particles of matter has finally disappeared (Thomson, 1897). At the same time, Thomson postulated (but incorrectly) that the reduced mass of negatively charged electrons is distributed throughout the atom uniformly like a large charge (a model known as a "raisin cake").

In 1909, Hans Geiger and Ernest Marsden, practically coordinated by Ernest Rutherford, bombarded a metal foil with alpha particles to track how they spread. According to the Thomson model, all alpha particles would be expected to penetrate directly through the foil, with minimal deviation, as Thomson's model postulated that the charge in the atom is so diffuse that their electric fields could not affect the alpha particles. Geiger and Marsden found that some alpha particles were deflected at angles greater than 90°C, which according to the Thomson model could not have happened. Following this experiment, Rutherford proposed the atomic model in which the positive charge of the atom is practically concentrated in a small nucleus located right in the center of the atom (Rutherford, 1911). The discovery was extremely important for physics and chemistry alike.

When he experimented with the products of radioactive decay, in 1913, radiochemist Frederick Soddy realized that there were several types of atoms for each position in the periodic table, but their name isotopes were coined by Margaret Todd. Thomson then created a technique for separating the types of atoms in his experiments on ionized gases, which later led to the discovery of stable isotopes (Thomson, 1913).

It was not until 1913 that the physicist Niels Bohr proposed the correct model in which the electrons of an atom orbit the nucleus, showing that they can do so only in a finite set of orbits and can jump between these orbits (extremely important) only in discrete jumps, the energy that practically corresponds to the absorption of radiation of the energy of a photon. This quantification could explain why the orbits of electrons are stable (accelerated charges, including circular motion, lose kinetic energy emitted in the form of electromagnetic radiation) but also what elements can absorb and emit electromagnetic radiation but only in discrete spectra.

Shortly afterward, Henry Moseley was able to donate some new experimental evidence to support Niels Bohr's theory. All of this succeeded in constructing a much more accurate atomic model than Ernest Rutherford's original model (Rutherford, 1911), or even compared to Antonius van den Brook’s model, which advanced the idea that the atom contained several positive nuclear charges in its nucleus, equal to the (atomic) number in the periodic table. It should be noted that until these experiments, the atomic number was not known as a physical and experimental quantity, but theoretically, it was already known and henceforth imposed, according to Niels Bohr's theoretical, quantum theoretical model (Bohr, 1922).

Only now has it been possible to explain more clearly the chemical bonds between atoms, made by the electrons put together (attached) to the respective atoms (bound), which was theorized at that time by Gilbert Newton Lewis in 1916, as interactions between the bonding electrons between the atoms. It was already known that the chemical properties of elements are repeated according to a periodic law and with the help of the latest discoveries we just talked about, in 1919, the American chemist Irving

Langmuir proposed the theory that the electrons in an atom are linked or grouped in a certain way was due to the Bohr quantum model. It was still suspected that electron clusters occupy a large number of electron shells around the nucleus (Lewis, 1916; Langmuir, 1919).

Now we can better understand the matter at its base, wherein the atom we have a nucleus and electrons. Heavy but concentrated nuclei play the basic role of matter while lighter electrons orbiting nuclei play the essential role of linking atoms together to form molecules and molecular chains. The nuclei of atoms are the massive and stable part of basic matter and electrons are its easiest part in constant permanent motion, which has the role of making and breaking the bonds between atoms and molecules.

The Stern-Gerlach experiment of 1922 provided further evidence of the quantum nature of the atom. When a beam of silver atoms passed through a specially shaped magnetic field, the beam was divided according to the direction of the kinetic moment of the atom, called the spin. With the random direction, the beam was expected to produce a line as it spread, but the beam spread in two parts, as was the orientation of the atomic spin, either up or down.

In 1924, Louis de Broglie came up with a new hypothesis that absolutely all particles behave similarly to electromagnetic waves. In 1926, Erwin Schrödinger used de Broglie's hypothesis to design a mathematical model of the atom, which described electrons as three-dimensional waveforms, not as point particles. The first consequence of this theory was that it is mathematically impossible to obtain precise values simultaneously for both the position and momentum of a particle at a given time (Schrödinger's principle became known as the uncertainty principle) being described and modeled mathematically by Werner Heisenberg in the same year, 1926. The new principle as well as its mathematical model could explain the observations of atomic behavior that previous models had failed to explain (for example, certain structural and spectral models of atoms larger than Since that year, Bohr's planetary model of the atom has been abandoned in favor of a probabilistic atomic model, which describes the atomic orbital areas around the nucleus where a certain electron is most likely to be observed (Scully *et al*., 1987).

There followed a period of development of mass spectrometry which gave rise to the possibility of a much more accurate measurement of the mass of atoms. The mass spectroscopy device uses a magnet to bend the trajectory of an ion beam, the amount of deformation is determined by the ratio given by the mass of an atom and its charge. It is now extremely important to discover the chemist Francis William Aston, who used the new mass spectroscopic instrument to prove that isotopes have different masses, which will become a basic application in nuclear techniques, an application also used by the author of this study. It is Francis William Aston's discovery and observations that can help in the future to better understand and control with greater precision the controlled nuclear reactions, even on an industrial scale. Francis William Aston discovered that the atomic mass of these isotopes varied more accurately with integer multiples of a value (called the integer rule). However, the different behavior of isotopes could only be more clearly understood after 1932, when physicist James Chadwick described the neutron (1932, as the uncharged particle that has a mass close to that of a proton and which in the free state does not last very long combinations with protons play an extremely important role in the atomic nucleus and isotopes of an element). The isotopes could then be explained as elements with the same number of protons, but with different numbers of neutrons within the nucleus (Aston, 1920).

In 1938, a German chemist, Otto Hahn, who had been a student of Rutherford, conducted personal experiments based on directing neutrons to uranium atoms to obtain transuranic elements. In these experiments, the barium element was obtained, among others. Only a year later, Lise Meitner and her nephew Otto Robert Frisch, conducting their experiments, confirmed that Hahn's result was the first experimental nuclear fission. In this way, in 1944, Hahn was able to gain international recognition for performing the first nuclear fission reactions, receiving the Nobel Prize in Chemistry, even if the support and efforts of Meitner and Frisch were not recognized by the community of physicists and chemists.

During the years 1950-1960, due to the development of particle accelerators as well as improved particle detectors, it was possible to study the effects of the movement of atoms at high energies. Now both neutrons and protons are beginning to take shape as hadrons, meaning particles made up of other smaller particles called quarks. The standard model of particle physics has now been developed, which has so far successfully explained the properties of the nucleus concerning these subatomic particles but also the forces that govern their interactions (Meitner *et al*., 1939; Crawford and Sime, 1997).

Although the word atom originally referred to a particle that could not be divided into smaller particles, in modern scientific usage the atom is composed of various subatomic particles. The constituent particles of an atom are electrons, protons, and neutrons; all three are fermions. As an exception, the hydrogen^{-1} atom has no neutrons and the hydrogen ion has no electrons.

Materials and Methods

General Presentation of the Topic

The electron is by far the smallest of these particles, at 9.11×10^{-31} kg, with a negative electrical charge and a size that is too small to be measured using available techniques. It is the lightest particle with a positive resting mass measured. Under normal conditions, the electrons are connected to the positively charged nucleus by the attraction created between the electric charges of the opposite sign. If an atom has more or fewer electrons than its atomic number, then it becomes negatively or positively charged as a whole. An electrically charged atom is called an ion. Electrons have been known since the late 19th century, especially thanks to J. J. Thomson.

Protons have a positive charge and a mass 1836 times that of the electron, at 1.6726×10^{-27} kg. The number of protons in an atom is called the atomic number. Ernest Rutherford (1911) observed that nitrogen, under the bombardment of alpha particles, radiates what appeared to be hydrogen nuclei. In 1920, he accepted that the hydrogen nucleus is a distinct particle inside the atom and named it a proton.

It has now been shown that neutrons have no electric charge and have a free mass of 1839 times the mass of an electron (1.6929×10^{-27} kg), the neutron being the heaviest of the three constituent particles (neutron, proton, electron), the mass that can be reduced by nuclear binding energy. Neutrons and protons (known as nucleons, the basic components of the atomic nucleus) have comparable dimensions-of the order of 2.5×10^{-15} m-even if the "surface" of these particles is not clearly defined. Let us remember again that the neutron was discovered in 1932 by the English physicist James Chadwick.

We will now point out that in the standard model of physics, electrons are considered to be elementary particles without an internal structure, unlike the author's model of this study. However, of the three basic particles currently known to form matter, both protons and neutrons are composite particles made up of elementary particles called quarks, and only the third base particle, the electron is considered to be an elementary one (differentiation) which, however, creates some additional questions, still unanswered, obviously until the new theory proposed in this study). There are two main types of quarks in atoms, each with a fractional electric charge (according to the classical theory that the electron considers the elementary particle indivisible and its charge as the elementary one; the new theory considers the elementary charge as a third of that of the electron). in single or double quartz and triple electron, the electron no longer being an elementary particle but a basic one also made up of quartz, only as one not inflated with mass-energy, similar to protons and neutrons). Protons consist of two quarks above 2 (u) (each with a charge +⅔ of that of the electron) and a quark down 1 (d) (with a charge of −⅓ of that of the electron). Neutrons have one quark up 1 (u) and two quarks down 2 (d), which explains the difference in mass and electric charge between the two basic particles, the proton, and the neutron.

It is believed today that quarks are held together by the strong interaction (strong nuclear force), which is mediated by gluons, while protons and neutrons are held together by a nuclear force which is a remnant of a strong force with somewhat different properties. The gluon is a member of the gauge boson family, elementary particles that mediate physical forces.

All protons and neutrons bound in the atom form a small atomic nucleus and are collectively called nucleons. The radius of the nucleus is approximately equal to 1.07 3 √ A fm, where A is the total number of nucleons. It is much smaller than the radius of the atom, which is of the order of 105 fm. Nucleons are bound together by an attractive short-range potential called the residual strong force. At distances less than 2.5 fm this force is much stronger than the electrostatic force that causes each other to reject positively charged protons.

It is known that atoms of the same element all have the same number of protons, called the atomic number. For the same element, however, the number of neutrons can vary, determining the isotopes of that element. The total number of protons and neutrons is what determines the nuclide and the number of neutrons relative to that of the protons will practically determine the stability of the nucleus and therefore of that isotope, which leads to the situation in which certain isotopes are suitable for radioactive decay. This is exactly what can be speculated when we choose a certain nuclear reaction.

Today, protons, electrons and neutrons are classified as all fermions. It is known that fermions obey Pauli's exclusion principle, which forbids identical fermions, such as several protons, from occupying the same quantum state at the same time. Thus, each proton in the nucleus must occupy a different quantum state than all the other protons and the same is true for the neutrons in the nucleus and for all the electrons in the electron cloud. However, a proton and a neutron are allowed to occupy the same quantum state.

For atoms with a low atomic number, a nucleus that has more neutrons than protons tends to decrease to a lower energy state by radioactive decay, so the neutron-proton ratio is close to one. However, as the atomic number increases, a higher proportion of neutrons is needed to compensate for the mutual repulsion between protons. Thus, there are no stable nuclei with an equal number of protons and neutrons from the atomic number Z = 20 (calcium) upwards and as Z increases, so does the neutron-proton ratio of stable isotopes. The stable isotope with the highest proton-neutron ratio is lead-208 (about 1.5).

The number of protons and neutrons in the atomic nucleus can change, although this may require a lot of energy due to the strong force. Nuclear fusion occurs when several atomic particles come together to form a heavier nucleus, such as by colliding two nuclei at high energy. For example, in the center of the Sun, protons require energies of 3-10 keV to overcome rejection-the Coulomb barrier - and fuse into a single nucleus. Nuclear fission is the reverse process, causing a nucleus to break into two smaller nuclei-usually by radioactive decomposition.

The nucleus can also be modified by bombardment with subatomic particles or high-energy photons. If the number of protons in the nucleus of an element changes then, the atom turns into another chemical element.

If, as a result of a fusion reaction, the mass of the nucleus is less than the sum of the masses of the separated particles, then the difference between these two values can be emitted as the type of usable energy (such as gamma rays) or the kinetic energy of a beta particle), as described by Albert Einstein's formula for the mass-energy equivalence $E = mc^2$, where m is the loss of mass and c is the speed of light. This deficit is part of the binding energy of the new core and is the loss of spiral energy that keeps the welded particles together in a state that requires that energy separate.

The fusion of two nuclei that form larger nuclei with smaller atomic numbers than iron and nickel-a total of about 60 nucleons-is usually an exothermic process that releases more energy than is needed to bring them together. This process of releasing energy makes nuclear fusion into stars a self-sustaining reaction. In heavier nuclei, the binding energy on each nucleon in the nucleus begins to decrease. This means that fusion processes that produce nuclei with atomic numbers greater than about 26 and atomic masses greater than 60 are endothermic processes. These heavier nuclei cannot undergo an energy-producing fusion reaction that can sustain the hydrostatic balance of a star.

Obviously, the electrons in an atom are always attracted to the protons in the nucleus of the atom due to the electromagnetic force. This force binds the electrons into a pit of electrostatic potential that surrounds the smaller nucleus, which means that an external source of energy is needed for the electron to escape. The closer a nucleus electron is, the greater the force of attraction. Therefore, the bound electrons near the center of the potential pit require more energy to escape than the farthest ones.

Electrons, like other particles, have both particle and wave properties. The electron cloud is a region inside the potential pit, where each electron forms a kind of three-dimensional standing wave-a waveform that does not move relative to the nucleus. This behavior is defined by an atomic orbital, a mathematical function that characterizes the probability that an electron appears to be in a certain place when its position is measured. Only a discrete (or quantified) set of orbitals exists around the nucleus, as other possible wave patterns degrade rapidly into a more stable shape. Orbitals may have one or more ring or node structures and differ in size, shape and orientation.

Each atomic orbital corresponds to a certain energy level of the electron. The electron can change its state to a higher energy level by absorbing a photon with enough energy to move it to a new quantum state. Also, through spontaneous emission, an electron from a higher energy state can decrease to a lower energy state, while radiating excess energy in the form of a photon. Basically, the characteristic energy values (defined by the energy differences of the quantum states) are those that define the atomic spectral lines.

It should be noted that the amount of energy required to remove or add an electron (electron binding energy) is always much lower than the binding energy of nucleons. Thus, only 13.6 eV of energy is needed to remove an electron from the ground state of a hydrogen atom, compared to 2.23 MeV to be able to divide the deuterium nucleus. Atoms are electrically neutral if they have an equal number of protons and electrons. Atoms that have a deficit or a surplus of electrons are called ions. Electrons that are farther from the nucleus can be transferred to other nearby atoms or shared between atoms. Through this mechanism, atoms are able to form bonds within molecules and in other types of chemical compounds, such as ion and covalent crystal networks.

By definition, any two atoms with the same number of protons in their nuclei belong to the same chemical element. Atoms with the same number of protons but different numbers of neutrons are different isotopes of the same element. For example, hydrogen atoms admit exactly one proton, but there are isotopes without neutrons (hydrogen-1), by far the most common form, also called protium), one neutron (deuterium), two neutrons (tritium) and more than two neutrons. The known elements form a set of atomic numbers, from the one-proton element, hydrogen, to the 118-proton element in one night. All known isotopes of elements with an atomic number greater than 82 are radioactive.

About 339 nuclides occur naturally on Earth, of which 254 (approximately 75%) have not been observed to degrade and are referred to as "stable isotopes". However, only 90 of these nuclides are stable to all degradations, even theoretically. Another 164 (reaching a total of 254) were not observed to degrade, even though in theory it is energetically possible. They are officially classified as "stable". Another 34 radioactive nuclides have a half-life of more than 80 million years and have a life long enough to have been present at the birth of the solar system. This collection of 288 nuclides is known as primordial nuclides. Finally, another 51 short-lived nuclides are known to occur naturally, as products of the decomposition of primordial nuclei (such as uranium radium), or as products of natural energy processes on Earth, such as bombardment with cosmic rays (e.g., carbon-14).

It is known that for 80 chemical elements there is at least one stable isotope. As a rule, there are only a few stable isotopes for each of these elements, the average value being 3.2 isotopes per element. Twenty-six elements have a single stable isotope, while the largest number of isotopes observed for any element is ten for the tin element. Elements 43, 61, and all elements with numbers 83 and higher have no stable isotopes.

The stability of isotopes is affected by the ratio of protons to neutrons and the presence of "magic numbers" of neutrons or protons, which are closed and filled quantum shells. These quantum shells correspond to a set of energy levels in the sheathed core model; solid coatings, such as 50 proton tin coating, give the nuclide unusual stability. Of the 254 known stable nuclei, only four have both an odd number of protons and an odd number of neutrons: Hydrogen-2 (deuterium), lithium-6, boron-10, and nitrogen-14. Also, only four natural, radioactive nuclides, with a uniform appearance, have a half-life of over one billion years: Potassium-40, vanadium-50, lanthanum-138, and tantalum-180m. Most odd nuclei are very unstable concerning beta decay because the decomposition products are equal and therefore more strongly bound, due to the effects of nuclear pairs.

The mass of an atom comes mostly from protons and neutrons. The total number of nucleons (protons and neutrons in the atomic nucleus) in a given atom is called the mass number. It is a positive and dimensionless integer (instead of the mass size) because it expresses a number. An example of the use of a mass number is "carbon-12", which has 12 nucleons (six protons and six neutrons).

The mass of an atom at rest is often expressed using the unified atomic unit of mass (u), also called dalton (Da). This unit is defined as twelve parts of the free mass of a neutral carbon-12 atom, which is about 1.66×10^{-27} kg. Hydrogen-1 (the lightest isotope of hydrogen, which is also the smallest mass nuclide) has 1.007825 u, a number called atomic mass. A certain atom has an atomic mass approximately equal (about 1%) to the mass number multiplied by the atomic mass unit (for example, the mass of nitrogen-14 is about 14 u). However, this number will not be exactly one integer, except for carbon-12. The heaviest stable atom is lead-208, with a mass of 207.9766521 u.

Because even the most massive atoms are too light to work with directly, chemists use the mol unit instead. A mole of atoms of any element always has the same number of atoms (about $6{,}022 \times 10^{23}$). This number was chosen so that if an element has an atomic mass of 1 u, a mole of atoms of this element has a mass of almost one gram. To define the atomic unit of mass, each carbon-12 atom has an atomic mass of exactly 12 u and so one mole of carbon-12 atoms weighs exactly 0.012 kg.

Atoms lack a well-defined outer boundary, so their size is usually described in terms of atomic radius. This is a measure of how far the electronic cloud extends from the core. However, this assumes that the atom has a spherical shape, which is true only for atoms in a vacuum or free space. Atomic radii can be calculated from the distances between two nuclei when two atoms are joined in a chemical bond. The radius varies depending on the location of an atom in the atomic structure, the type of chemical bond, the number of neighboring atoms (coordination number), and the quantum mechanical property called spin. In the periodic table of elements, the size of the atoms tends to increase as we move down the columns, but decreases as we move in rows (from left to right). As a result, the smallest atom is the helium, with a radius of 32 pm, while one of the largest is the cesium, with a radius of 225 pm.

If an atom is subjected to external forces (such as electric fields), its shape can deviate from spherical symmetry (the atom deforms). The deformation of an atom depends on the size of the field (electric, or electromagnetic) and the orbital type of the outer electrons, which is shown by some considerations of group theory. Aspheric deviations can be caused, for example, in crystals, where large electric fields can appear at points with low grid symmetry. Significant ellipsoidal deformations with sulfur ions and other chalcogens have been shown to occur in pyrite-like compounds.

Because the atomic dimensions are thousands of times smaller than the wavelengths of light (400-700 nm), atoms cannot be seen with an optical microscope. However, individual atoms can be seen using a tunnel scanning microscope. To understand how small an atom is, let's imagine that a human hair has a thickness of about 1 million carbon atoms, a drop of water contains about 2×10^{21} oxygen atoms and two or more hydrogen atoms, while a one-carat diamond with a mass of 2×10^{-4} kg contains about 10^{22} carbon atoms. If an apple could grow to the size of the Earth, only then would the atoms in the apple become about the size of the original apple.

Each element has one or more isotopes with unstable nuclei that are subjected to radioactive decay, causing the nucleus to emit particles or electromagnetic radiation. Radioactivity can occur when the radius of a nucleus is large compared to the force field, which acts only at distances of the order of 1 fm.

Today we know of some more common forms of radioactive decay, such as.

Alpha decay: This process is caused when the nucleus emits an alpha particle, i.e., a nucleus of helium, consisting of two protons and two neutrons. The emission result is a new element with a smaller atomic number.

Beta-decay (and electron capture): These processes are regulated by a weak force and result from the transformation of a neutron into a proton or a proton into a neutron. The neutron-proton transition is accompanied by the emission of an electron and an antineutrino, while a proton-neutron transition (except for electron capture) causes the emission of a positron and a neutrino. Electron or positron emissions are called beta particles. Beta-decay increases or decreases the atomic number of the nucleus by one. Electron capture is much more common than positron emission because it requires less energy. In this type of degradation, the nucleus absorbs an electron rather than emitting a positron. In this process, however, a neutrino is emitted and a proton is transformed into a neutron (Durand *et al*., 2000).

Gamma decay: this process results from a change in the energy level of the nucleus to a lower energy state, which results in the emission of electromagnetic radiation. The excited state of a nucleus that produces gamma emission usually occurs after the emission of an alpha or beta particle. Thus, gamma degradation usually follows alpha or beta decay.

Other rarer types of radioactive decay are the ejection of neutrons or protons or groups of nucleons from the nucleus or more beta particles. An analog gamma emission that allows excited nuclei to lose energy differently is the internal conversion-a process that produces high-speed electrons other than beta radiation, followed by the production of high-energy photons in which there is no energy, gamma radiation. Several large nuclei can explode into two or more electrically charged fragments of various masses, plus a few neutrons, in a degradation called spontaneous nuclear fission.

Each radioactive isotope has a period that characterizes the decomposition-the half-life-which is determined by the time required for half of a sample to disintegrate. This is an exponential decrease process that decreases the ratio of the remaining isotopes by 50% every half time. Therefore, after twice the half-life, 25% of the present isotope will remain so.

All particles considered today to be elementary have a quantum (intrinsic) mechanical property called spin. This is analogous to the kinetic moment of an object rotating around the center of mass, although, strictly speaking, these particles are considered to be point-shaped and can no longer be rotated. Spin is measured in units of reduced Planck constant (ħ), electrons, protons, and neutrons, all with spin ½ ħ, or 'spin-½'. In an atom, electrons moving around the nucleus have an orbital kinetic moment in addition to the spin, while the nucleus itself has a kinetic moment due to the nuclear spin.

The magnetic field produced by an atom-its magnetic moment-is determined by these different forms of the kinetic moment, just as an electrically charged object usually produces a magnetic field. However, the most important contribution comes from the spin of electrons. Due to the nature of the electrons to respect Pauli's exclusion principle, according to which two electrons cannot be found in the same quantum state, the bound electrons are pairs, each member of the pair rotating upwards and the other in slow rotation. Thus, these rotations cancel each other out, completely reducing the momentum of the magnetic dipole to zero in some atoms with an even number of electrons.

In ferromagnetic elements such as iron, cobalt, and nickel, an odd number of electrons leads to the existence of an unpaired electron and the presence of a clear magnetic moment. The orbits of neighboring atoms overlap and reach a lower energy state when the spins of the unpaired electrons are aligned with each other, a spontaneous process known as the exchange interaction. When the magnetic moments of the atoms of the ferromagnetic materials are aligned, the material can produce a measurable field on a macroscopic scale. Paramagnetic materials have atoms with magnetic moments intertwined in random directions when no magnetic field is present, which aligns in the presence of a field.

The nucleus of an atom will not rotate when it has both an even number of neutrons and protons, but in other cases with odd numbers, the nucleus can rotate. Rotary cores are normally aligned in random directions due to thermal equilibrium. However, for certain elements (such as xenon-129) it is possible to polarize a significant proportion of nuclear spin states so that they are aligned in the same direction-a condition called hyperpolarization. It has important applications in magnetic resonance imaging.

The potential energy of an electron in an atom is negative, its position dependence reaching a minimum (maximum absolute value) inside the nucleus and disappearing when the distance from the nucleus tends to infinity, approximately inversely proportional to the distance. In the quantum-mechanical model, a bound electron can occupy only a set of states centered on the nucleus and each state corresponds to a certain energy level; see the time-independent Schrödinger equation for a theoretical explanation. An energy level can be measured by the amount of energy required to release the electron from the atom and is usually given in units of electron Volts (eV). The lowest energy level of a bound electron is called the ground state, or steady state, while a transition of an electron to higher-level results in an excited state. The energy of the electrons increases when n increases because the (average) distance from the nucleus increases. The energy dependence of ℓ is caused not by the electrostatic potential of the nucleus, but by the interaction between electrons.

For an electron to move from one state to another, for example from the ground state to the first excited level (ionization), it must absorb or emit a photon at an energy equal to the potential energy difference between these levels, according to the study or Niels Bohr Model, which can be accurately calculated by Schrödinger's equation. Electrons pass between orbitals in a similar way to particles. For example, if a single photon strikes electrons, only one electron would change state in response to the photon; see the properties of electrons.

The energy emitted by a photon is proportional to its frequency, so these specific energy levels appear as distinct bands in the electromagnetic spectrum. Each element has a characteristic spectrum that depends on the nuclear charge, the sub-shells occupied by electrons, the electromagnetic interactions between electrons, and other factors.

When a continuous spectrum of energy is passed through a gas or plasma, some of the photons are absorbed by atoms, causing the electrons to change their energy level. These excited electrons that remain bound to the atom spontaneously emit this energy in the form of a photon, which goes in a certain direction and thus descends back to a lower energy level. Thus, atoms behave like a filter that forms a series of dark absorption bands in the production of energy. (An observer who sees atoms from a perspective that does not include the continuous spectrum in the background sees a series of emission lines produced by photons emitted by atoms). Spectroscopic measurements of the intensity and width of atomic spectral lines identify the composition and physical properties of a substance.

Careful examination of the spectral lines shows that some show a division of the fine structure. This is due to the spin-orbit interaction, which is an interaction between the spin and the movement of the outermost electron. When an atom is in an external magnetic field, the spectral lines become divided into three or more components, a phenomenon called the Zeeman effect. This is caused by the interaction of the magnetic field with the magnetic moment of the atom and its electrons. Some atoms may have multiple electron configurations with the same energy level, which appear as a single spectral line. The interaction of the magnetic field with the atom moves these electron configurations to slightly different energy levels, resulting in several spectral lines. The presence of an external electric field can cause a comparable level of division and displacement of spectral lines by changing the energy levels of electrons, a phenomenon called the Stark effect.

When a bound electron happens to be excited, then a photon that interacts with the excited electron and has adequate energy can cause the stimulated emission of a photon with the right energy level. But for this to happen, the electron will be forced to descend into a lower energy state so that the energy difference is identical to the energy of the photon it interacts with. Then the emitted photons and the interacting photons enter in parallel and phase, or in other words, the wave patterns of the two photons are synchronized. This well-known physical property is widely used in the construction of lasers that can emit coherent beams of light (whose energy is in a narrow frequency band).

Valence represents the combining power of an element, being equal to the number of hydrogen atoms with which the atom can combine or dislodge in the formation of compounds. The outer electron shell of an atom in its uncombined state is well known as the valence layer, while all electrons at that level can be called valence electrons. In practice, the number of valence electrons determines the behavior of the atom relative to other atoms. Atoms tend to react chemically with each other in a way that would fill (or empty) their valence layer. For example, the transfer of a single electron between atoms is a useful approximation for the bonds formed between atoms that have a single electron more than the entire outer layer and another that lacks an electron to complete its last layers, as is the case in the compound sodium chloride and other ionic salts. However, many elements have multiple valences or tend to combine a different number of electrons into different compounds. Thus, the chemical bonds between these elements take many forms of electron pooling, which are more than just electron transfers. Examples include the element carbon and organic compounds.

The chemical elements are often displayed in a periodic table that highlights the recurring chemical properties. Elements with the same number of valence electrons form a group that is aligned on the same column of the table. (Horizontal rows correspond to the filling of a certain quantum level of electrons). The elements on the far right have the outer layer completely occupied by electrons, which makes them chemically inert. They are called noble gases.

Quantities of atoms are found in different states of matter that depend on physical conditions, such as temperature and pressure. By changing these conditions, materials can switch between solid, liquid, gaseous, and plasma. In one state, a material may exist in various allotropic forms. An example of this is solid carbon, which can be as amorphous as graphite and crystallized as diamond. Gases can also have multiple allotropic forms, such as oxygen and ozone.

At temperatures close to zero, atoms can form a Bose-Einstein condensate, at which point the effects of quantum mechanics, which are usually observed only on an atomic scale, become apparent on a macroscopic scale. This supercoiled collection of atoms behaves like a single super atom, which can allow the fundamental verification of behaviors in quantum mechanics.

A tunnel scanning microscope is a device for visualizing surfaces at the atomic level. Uses the quantum tunneling phenomenon, which allows particles to pass through a barrier that would normally be insurmountable (vacuum tunnel electrons between two flat metal electrodes, each with an adsorbed atom, providing a measurable tunnel current density). Scanning an atom when it passes the other (sample) allows the representation of the displacement of the first concerning the lateral separation for a constant current. The calculation shows the extent to which the images obtained with the tunneling microscope are visible. It is confirmed that, for low polarization, the microscope has the spatially mediated dimensions of the electronic orbitals through closely related energy levels-the local state density at the Fermi level.

An atom can be ionized by removing one of its electrons. Electric charge causes an atom's trajectory to curve as it passes through a magnetic field. The radius with which the trajectory of an ion is transformed by the magnetic field is determined by the mass of the atom. The mass spectrometer uses this principle to measure the electrical mass-to-charge ratio of ions. If the sample contains several isotopes, the mass spectrometer can determine the proportion of each isotope in the sample by measuring the intensity of the various ion beams. Atomic vaporization techniques include inductively coupled plasma atomic emission spectroscopy and inductively coupled plasma mass spectrometry, both of which use plasma to vaporize the samples for analysis.

A spatially selective method is electron energy loss spectroscopy, which measures the energy loss of an electron beam in a transmission electron microscope when it interacts with a part of a sample. Atomic probe tomography has a sub-nanometric resolution in 3-D and can chemically identify individual atoms using flight time spectrometry.

Excited spectra can be used to analyze the atomic composition of distant stars. Certain wavelengths of light in the light observed from stars can be separated and related to the quantized transitions in free gas atoms. These colors can be reproduced using a gas discharge lamp containing the same element. Helium was thus discovered in the spectrum of the Sun 23 years before it was identified on Earth (Lochner *et al*., 2007).

New Hypotheses of the Author

We will mention again that in the standard model of physics, all electrons are considered elementary particles.

Atoms represent about 4% of the total energy density in the observable universe, with an average density of about 0.25 atoms/m^3. In a galaxy, such as the Milky Way, atoms have a much higher concentration, with Interstellar Matter Density (ISM) ranging from 10^5 to 10^9 atoms/m^3. The sun is considered to be inside the local bubble, a region of strongly ionized gases, so the density in the region of the Sun is only about 103 atoms/m^3. Stars are formed from dense clouds in the interstellar environment and the evolutionary processes of stars result in the constant enrichment of this environment with much more massive elements than hydrogen and helium. Up to 95% of the atoms in the Milky Way are concentrated inside the stars and the total mass of the atoms is about 10% of the mass of the galaxy (the rest of the mass is an unknown dark matter).

Under these conditions, we can believe that even a little matter in the universe is a form of manifestation of energy, otherwise established and structured. The heaviest part, the nuclei of atoms, made up of nucleons, protons, and neutrons, are massive, heavy scaffolds, to which are attached some yolks of elemental energy, each carrying a positive or negative charge. At the base of such a construction is a rosette consisting of three identical quarks (each with an identical massive scaffolding), but each of them is generally charged differently from the yellows of elementary energy, any quark being thus differentiated.

The elementary charge, whether positive or negative, is exactly one-third of the charge of an electron. It will load each of the three quarks bound together differently. For example, it can charge a quark with two positive yolks, the second the same, and the third with a single negative yolk, resulting in the basic structure of a proton, consisting of two quarks up and one down. At such a structure the total charge will be 4 positive yolks and one negative so that the structure will appear as if it had only three positive yolks, the equivalent of charging a positron (antielectron).

Another possible common structure is that in which the scaffolding of the three identical quarks is energetically charged differently as follows: One with two positive yolks and the other two with a negative yolk. Thus, from the skeleton of the three quarks is obtained a neutron with four yolks in total, two positively charged and two negatively charged, which will generally interact with matter as if it had no electric charge.

Another structure that can be obtained is the one with two charged quarks each with two negative charges and the third quark charged with a single positive charge so that in total there are four negative yolks and one positive one because the obtained antiproton would react. with the surrounding matter through three negative yolks, the equivalent of the charge of a single electron. In general, such an antiproton, if not taken immediately and stored under special conditions, will fuse with the nearest proton and both will return to a purely energetic state (light). They were made of light and will return to the light.

In a recent paper, we showed that an accelerated electron at a sufficient level can penetrate inside a proton and turn it into a neutron and if the energy level of an accelerated electron is sufficient, it can react with a neutron, penetrating it and rotating it can lead to the antiproton state (Petrescu and Petrescu, 2021). In the first case, the three yolks belonging to the accelerated electron will enter a single upper quark, annihilating both positive yolks and charging it with the remaining third negative yolk, so that the upper quark will turn into a down quark. In the second situation where the accelerated electron enters a neutron and turns it into an antiproton, the scheme imagined in the previous work will not work, with the transformation of a single quark up by the electron into a down quark, so that the particle newly obtained to possess three quarks down, but rather the electron will react in this case with all three quarks of the neutron by adding a yolk to each of them so that the two down quarks will each double as a negative charge, passing into the antiquark state upwards (each with two negative yolks) and the up quark receiving a negative yolk will annihilate it and keep only a positive yolk, passing into an antiquark down (with only one positive yolk). The charge equal to that of an electron of the antiproton thus obtained will consist of two antiquarks up and one down.

It turns out that the base of nuclei, either protons or neutrons, consists of portions of three coupled quarks, each of which is a heavy scaffold charged with photon energy in the form of one or two negative or positive yolks. Electrons or positrons are light scaffolds, each charged with three similar charges. So, logically, all matter is charged at its base with energetic hearts (yolks), which constantly guard it and interact with each other.

In the standard model of physics, electrons are considered elementary particles without an internal structure. However, both protons and neutrons are composite particles made up of elementary particles called quarks. There are two types of quarks in atoms, each with a fractional electric charge. Protons consist of two quarks upwards (each with a charge +⅔) and a quark down with a charge of −⅓. Neutrons consist of one quark up and two quarks down. This distinction explains the difference in mass and electric charge between the two particles.

Quarks are held together by a strong interaction (or strong nuclear force), which is mediated by gluons. In turn, protons and neutrons are held side by side in the core of the nuclear force, which is a remnant of a powerful force with properties somewhat different from its range. The gluon is a member of the gauge boson family, elementary particles that mediate physical forces.

Therefore, the electrons bound near the center of the potential pit require more energy to escape than the farthest ones. Electrons, like other particles, have both particle and wave properties. The electron cloud is a region inside the potential pit, where each electron forms a kind of three-dimensional standing wave-a waveform that does not move relative to the nucleus. This behavior is defined by an atomic orbital, a mathematical function that characterizes the probability that an electron appears to be in a certain place when its position is measured. Only a discrete (or quantified) set of orbitals exists around the nucleus, as other possible wave patterns degrade rapidly into a more stable shape. Orbitals may have one or more ring or node structures and differ in size, shape, and orientation.

Now we can better understand the matter at its base, wherein the atom we have a nucleus and electrons. Heavy but concentrated nuclei play the basic role of matter while lighter electrons orbiting nuclei play the essential role of linking atoms together to form molecules and molecular chains. The nuclei of atoms are the massive and stable part of basic matter and electrons are its easiest part in constant permanent motion, which has the role of making and breaking the bonds between atoms and molecules (Durand *et al*., 2000).

It follows that the base of nuclei, whether protons or neutrons, is made of portions of three coupled quarks, each of which is a heavy scaffold charged with photon energy in the form of one or two negative or positive yolks. Electrons or positrons are light scaffolds each charged with three similar charges. So logically, all matter is charged at its base with energetic hearts, which constantly guard it and interact with each other.

New Courageous Hypotheses of the Author

A new hypothesis that the author proposes in this study will now be presented very briefly. It's about how matter is structured.

We believe that matter is practically made up of some elementary particles called quarks, which are the basis of all matter seen in the universe.

To better understand the new hypothesis formulated by the author, in which only quarks are the basis of visible matter, we will first briefly present some known aspects of quarks.

Quark is an elementary particle that interacts through strong nuclear force and is "heavy" matter (also called baryonic). The quark hypothesis was proposed by theorist Murray Gell-Mann in 1964.

After a long series of experiments and discoveries, it is now known that matter is made up of molecules and molecules in atoms that define the chemical elements, discovered at the end of the 18th century by Lavoisier. After discovering the periodicity of Mendeleev's elements and table in the second half of the 19th century, an image of atoms with a dense, dotted, massive nucleus around which electrons "oscillate" was arrived at in the early 20th century.

However, the atomic nucleus later proved to be divisible and also contained nucleons (protons and neutrons). In the early 1970s, however, it was experimentally shown that nucleons are compounds and their components, dubbed "quarks" by theoretical physicist Murray Gell-Mann, are thought to be indivisible, that is, elementary particles like electrons.

Quarks (Fig. 1) are 1/2 spin particles, from the fermion family (one fermion, two fermions), a generic name given to particles that have the property that they cannot be found in the same quantum state, unlike bosons, whole or zero spin particles. 0, 1, 2, ...), which often act as a mediator or "carrier" of radiation (Electric field or Force carrier) and which can accumulate (or "condense") in the same quantum state.

Quarks exist in six types: Up (u), down (d), tight (s), charm (c), bottom (b) and top (t). Their masses increase from low values (quark up, only one-thousandth of the mass of the proton) to very heavy, the top quark is as massive as a gold atom, which is remarkable for any elementary particle.

Another typical characteristic of quarks is the fractional electric charge: +⅔ for u, c, t and -1/3 for d, s, b.

Six of the particles in the standard model (Fig. 1) are quarks (shown in purple). Each of the first three columns forms a generation of matter. The massive and visible matter, as we know it today, is practically made up only of the basic elements of column I of the first generation and from time to time it still appears in it, more by chance and the quark s (strange) who is included in the second column of the second generation of matter. Other basic elements in columns II and III are found by chance, coming from outer space, from distant galaxies, or accidentally produced in the accelerators of large particles of the latest generation after collisions at very high energies, but their life is still ephemeral.

Hundreds of different known particles are now either coming from the distant cosmos or forming into state-of-the-art particle accelerators following extremely high-energy collisions and they generally have an ephemeral life.

In other words, the basic particles are only those presented in the table in Fig. 1 and of these, the most common on our planet and in the near universe are only those of the first generation, a total of four basic elementary particles, to which are added a fifth particle, namely the photon.

So at the base of the visible and massive matter encountered are five basic elements: The up quark, the down quark, the electron, the electronic neutrino, and the photon.

However, to these basic elements must be added those opposite to them in the antimatter zone, i.e., an antiquark up, an antiquark down, an antielectron (positron), and an electronic antineutrino.

The Standard Model (MS) is the theoretical system formulated in 1974 that describes all the elementary particles known to date, plus the Higgs boson. This model contains 6 types of quarks, which are called: Up, down, charm, strange, top, and bottom.

The mass of elementary particles would result from the interactions of elementary particles with Higgs bosons when they are moving in the physical vacuum occupied by these "fundamental" bosons. To remove them, or 'generate' them from the vacuum, the required energies are of the order of 1 Tera electron-Volt (1 TeV) estimated with values different from several theoretical variants. It is anticipated that Higgs bosons will soon be highlighted for the first time at one of the two peak accelerators at CERN and in the US-two Tetons, capable of such high energies and boson detection (Higgs?).

Most particles discovered at high energies, in particle accelerators, or in cosmic radiation (a long series of over 150 different particles, among which the proton and neutron are best known) are made up of combinations of quarks. These particles are classified into two broad categories: Mesons (consisting of two quarks) and baryons (consisting of three quarks, such as proton and neutron). The proton (the nucleus of the hydrogen atom) consists of two "up" quarks and one "down" quark (UUD).

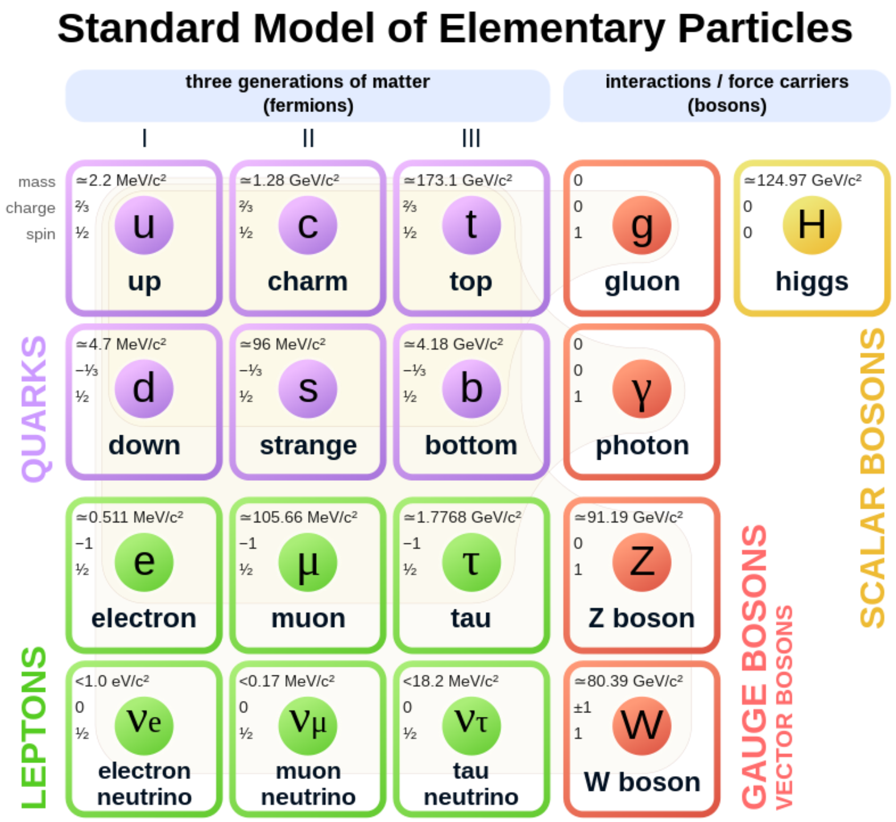

Fig. 1: Six of the particles in the Standard Model are quarks (shown in purple). Each of the first three columns forms a generation of matter. Source: https://upload.wikimedia.org/wikipedia/commons/0/00/Standard_Model_of_Elementary_Particles.svg

The neutron, the neutral partner of the proton in the formation of heavier nuclei, consists of three quarks, two down quarks, and another up quark: Add. Thus, the proton charge is u (+⅔) + u (+⅔) + d ($-^1/_3$) = +1 and the neutron charge is u (+⅔) + d ($-^1/_3$) + d ($-^1/_3$) = 0, as measured experimentally.

In 2001, five-quartz particles (pent quarks) were reported in high-energy physics experiments. Because the experimental situation is not very clear, some theories would allow the existence of this type of particle.

The structure of quarks is a thing that is often talked about from a theoretical point of view, but regarding the fine structure of the proton spin, there are recent experimental data that attest to partial contributions of polarization of "strange" quarks from physical vacuum. There are several proposals for a possible structure, but these proposals are based rather on logical and well-inspired considerations, only with indirect links to experiences. Examples include the Rishon, Parthenon, and Priest models proposed in the 1980s. We can therefore say that their exact structure is not yet well known, nor is their mass, especially since they cannot yet be isolated and studied individually. Quarks are practically already bound in the heavy visible matter, two or three at a time and very rarely (accidentally) four or five times maybe even more. The coupling of quarks still makes it impossible to study them individually, so their individual properties are currently being studied on assemblies and through riddles (Ho-Kim and Phạm, 2013; Hughes, 1985; Pickering, 1984; Staley, 2004).

We now return to the new courageous hypothesis promised, which refers to the fact that a base quark (up or down), has practically no mass (his mass is extremely small), the mass of heavy particles formed by a combination of three or two quarks, being due to their swelling with the help of other heavy particles. For this first reason, I assumed that the also electron consists of three quarks, which are no longer filled with other heavy particles so that the electron will remain as light as the quarks that make it up plus the mass of an absorbed light particle. Moreover, even an electronic neutrino consists of three light quarks (not filled with other heavy particles), so an electronic neutrino, which is a very stable elementary particle like the electron, is no longer practically a basic particle but a composite particle, similar to the nucleons (protons, neutrons), with the only difference that neutrino electronic are not filled with an additional mass as is the case with nucleons. Since the main hypothesis is based on the principle that first-generation quarks have no mass (consistency), it follows that light basic particles (the electron and the positron) are made up of the three corresponding quarks and a light particle that donates its mass to the system made up.

In this case, in the table from Fig. 1 to the first generation, only two elementary particles of the four already presented remain, namely, a quark up (u) and a quark down (d). In the case of the new hypothesis, unlike the first hypothesis, when the elementary particles, quarks, were made up of two yolks of identical charge or only one and the electron from three identical yolks, now there is only the elementary charge of 1/3 e, that is a third of the charge of an electron, which will be concentrated in a quark once or twice, otherwise, all the heavy or light visible matter being composed only of quarks, combined by three (quarks) and in rare cases by two (quarks).

Results

In the "results and discussions" section we will briefly present how the visible, heavy, and light matter is made up, only of three combined (bound) quarks (filled or not filled with other heavy matter), (Note, however, only with the specification, that this is only a theoretical hypothesis of the author of this study).

It should also be noted that the hypothesis of the formation of the whole matter from light remains valid because now the whole matter is made up of quarks of one or two yolks of identical elementary charge each, yolks that also come practically from photonic light. These elementary quarks, up or down, made up at their base from photon light, one or two yolks of elementary charge (1/3 of the charge of an electron), are practically the basis of all visible matter. On the other hand, we will specify that we call visible matter the one that can be observed today with various known radiations, while invisible or dark matter is the largest part of our universe, even if it is still at a distance huge compared to our current location.

The table in Fig. 2 are presented the basic particles formed by quarks, in the vision of the author of the paper, so we are only talking about a new hypothesis.

Quarks are produced permanently from light, by a continuous mechanism still unknown to us, and immediately after production two or three are caught forming light base matter (electrons, positrons, electronic neutrinos, electronic antineutrinos) and if they are filled with other matter (heavy particles) it forms the basic heavy matter (protons, antiprotons, neutrons, antineutrons). The most plausible hypothesis is the one in which the connections between two quarks I(d)-I(d) or I(d)-II(u) made with low energy are considered and the connection between two quarks II(u)-II(u) is obtained with a higher energy equivalent to the mass of the electron (positron).

Light particles are made up of first-generation quarks (2 plus 2 antiquarks, a total of 4), there are just four basic light particles of visible matter presented now in this table, while heavy particles belonging to visible matter are formed similar to light particles (from the same quarks) but at they also are added some heavy mass particles that give the density, mass, and consistency of heavy particles, thus distinguishing them from light ones. The heavy particle that is added to a light one to fill it is the same in all basic situations. Thus, by filling an antielectron (positron) with a heavy particle, a proton is born. When an electron is filled with a heavy particle, an antiproton is born. When an electronic antineutrino fills with a heavy particle, a neutron is formed and when an electronic neutrino fills with a heavy particle an antineutron is born.

The diagram (table) in Fig. 2 can also explain the balance between matter and antimatter. Electrons are more stable and filling them with heavy particles to result in antiprotons can be difficult and rarer. Antielectrons are more unstable but they easily fill with heavy particles permanently forming the protons that are the basis of visible matter. An electron neutrino is more stable and can rarely fill with a heavy particle to form an unstable antineutron. Instead, an electronic antineutrino is the most unstable, having a permanent tendency to capture a heavy particle and swell to form a neutron, which explains the abundance of neutrons along with protons. In short, abundance is in electrons and protons, but also electronic neutrinos and neutrons.

I will now propose another new hypothesis regarding the quarks of generations II and III, which already have mass, unlike those of the first generation, very light, practically without mass.

It is possible that the second and third generations of quarks resulted from the first generation after capturing particles of different masses that gave them a certain density, mass, and consistency.

The quarks of the first generation, very light, produced from the energy of the stars (suns), the couple together two or three, forming light particles, various, elementary, practically without important mass. If these light, basic particles, through attraction or collision, succeed in incorporating a heavy cosmic particle, they turn into heavy basic particles. Already heavy quarks can in turn couple two or three to form only heavier, more special particles.

The visible heavy matter in our universe is a little abundant (only a few percent in the whole universe) even if in our case it represents almost everything we know and meet. This visible heavy matter consists of the known light and heavy basic elements that together form atoms. Thus, protons and neutrons couple to form atomic nuclei of various kinds, from the lightest and most stable (with only one proton per nucleus) to the heaviest and most unstable atoms with nuclei made up of many protons and neutrons gathered together in a huge ball, very heavy and unstable, generally having an unstable equilibrium.

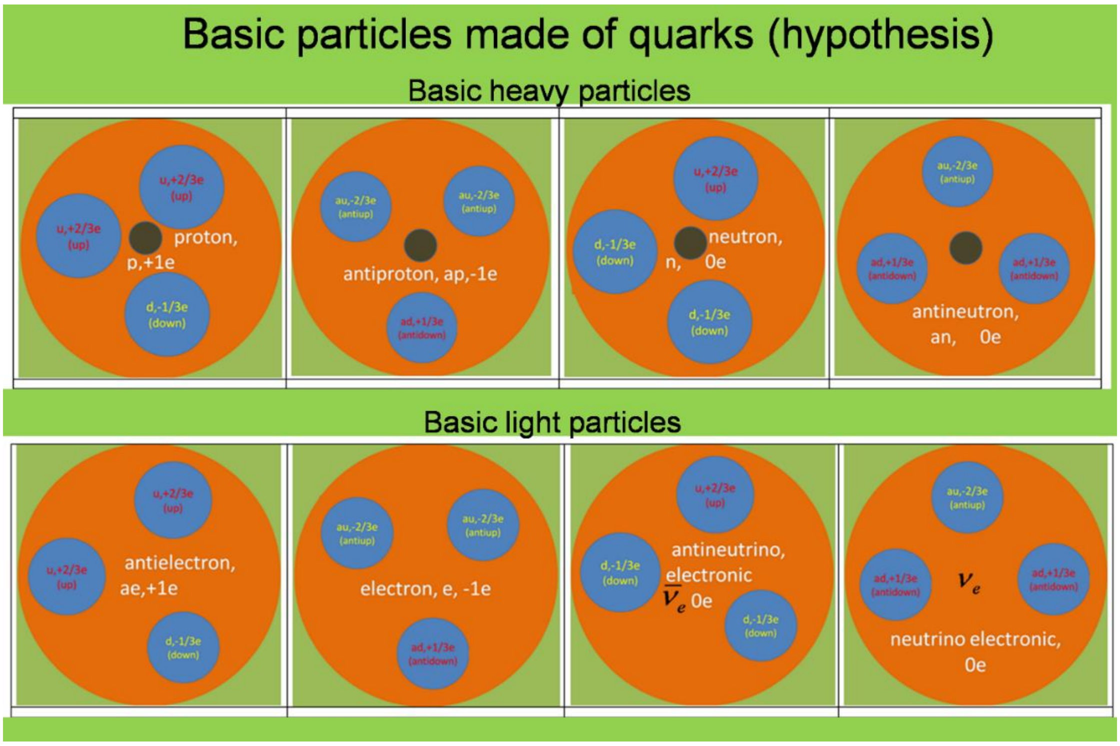

Fig. 2: Basic particles formed by quarks, in the vision of the author of the paper, so we are only talking about a new hypothesis

These very heavy atoms tend to decompose themselves into smaller ones by breaking (natural radioactivity) with the release of energy. The first thing the intelligent man did was to obtain energy from this natural fission (radioactivity) of heavy nuclei, trying to enrich them so that they would break even more easily at their collision with fast neutrons inserted into the reactor's system.

The next step, simpler and smarter, is to obtain sustainable energy, indefinitely, with the help of lighter atoms, by causing various controlled reactions to light nuclei. A dream close to realization is the fusion of light nuclei by merging them, into an induced and controlled phenomenon, which results in a single nucleus slightly denser and more massive and a lot of energy released in the form of radiation and/or heat (thermal energy, easier to capture). Interesting and new is the fact that we can maneuver here, in the area of light nuclei and/or lighter heavy base particles (consisting of few neutrons and protons), various nuclear fission, radioactivity, or fusion reactions, through various controlled collisions, using particles basic accelerated to higher energies well calculated and determined. One can also use neutrons, protons, but also light base particles: Electrons, positrons, etc.

Another possible hypothesis would be that the mass of the first generation quarks is small and is transferred to the electron (positron) and in the case of light particles without charge, which by capturing a heavy particle is then transformed into a neutron (antineutron), they also consist of three low-mass quarks but do not represent the electronic neutrino (or electronic antineutrino), or if so, then they are formed with the addition of a small particle that has a small negative mass. Quarks are produced permanently from light, by a continuous mechanism still unknown to us, and immediately after production two or three are caught forming light base matter (electrons, positrons, electronic neutrinos, electronic antineutrinos) and if they are filled with other matter (heavy particles) it forms the basic heavy matter (protons, antiprotons, neutrons, antineutrons).The most plausible hypothesis about the masses of the light particles (small at one electron and insignificant at one electronic neutrino), is the one in which the connections between two quarks I(d)-I(d) or I(d)-II(u) made with low energy are considered and the connection between two quarks II(u)-II(u) is obtained with a higher energy equivalent to the mass of the electron (positron).

Beta Decay Reaction, β−

An energy-donating reaction is the decay of the free neutron (beta β-decay, Eq. 1). Unlike the proton, outside the nucleus, the neutron is unstable and has an average lifespan of about 15 min. Its decay gives rise to a proton, an electron, and an antineutrino (Cole, 2000):

$$\left\{ {}_0^1n \to {}_1^1p + e^- + \bar{\nu}_e + E \right. \tag{1}$$

Considering the resting mass of the electron, proton, and neutron and that of an electronic antineutrino (very small, negligible here), the energy released by this beta decay reaction is obtained by decreasing (by subtraction operation Eq. 2):

$$\begin{cases} E = {}_0^1n - {}_1^1p - e^- \\ E[MeV] = 939.565378\,(21)\text{-}938.272013(23) \\ \text{-}0.51099895000(15) = 0.78236603 \end{cases} \tag{2}$$

Experimental measurements indicate a Q energy released as a result of such decay of a value (3) (Heyde, 2004):

$$\left\{ Q = 0{,}782 \pm 0{,}013\ MeV \right. \tag{3}$$

Considering only the first three decimals, it is clear that both the theoretical and the experimental calculation methods lead to the same result.

This reaction is quite simple to provoke because free neutrons do not last in an enclosure for more than about 15 min. However, to control this reaction, large amounts of electronic neutrinos could be used to bombard the free neutrons clustered in an enclosure with the obvious purpose of increasing the efficiency of the reaction (4) and the number of reactions that take place in that enclosure. The weakest part of the reaction (4) is obtaining and controlling electronic neutrinos:

$$\left\{ {}_0^1n + \nu_e \to {}_1^1p + e^- + E \right. \tag{4}$$

pp Reaction

A known basic fusion reaction in stellar processes is between two hydrogen protons (5). It is estimated that approximately 99.77% of the basic fusion processes in the sun are based on this reaction pp:

$$\left\{ {}_1^1p + {}_1^1p \to {}^2H + e^+ + \nu_e + E \right. \tag{5}$$

The discrepancy (binding energy) resulting from the mass defect in a deuteron is 2.22452 MeV from the known tables, but the exact value resulting from the equation (binding energy for deuteron=Ep + En-Ed = 2.22462869 MeV) will still be considered.

Here, however, in Eq. (5) we are interested in energy other than the binding energy, namely the energy obtained from the pp fusion (6), which is calculated directly from Eq. (5), and the value E = 0.42026476 MeV is obtained:

$$\begin{cases} E = {}_1^1p + {}_1^1p - {}^2H - e^+ = 2\,{}_1^1p - {}^2H - e^+ = \\ 2 \cdot 938.272013(23)\text{-}1875.612763 \\ \text{-}0.51099895000(15) = 0.42026476\ MeV \end{cases} \tag{6}$$

As a first observation, this stellar pp fusion reaction, which is difficult to obtain on Earth, directly donates (without other side reactions), less energy than even the Beta-decay reaction, β-(0.42 MeV instead of 0.78 MeV).

On the other hand, no matter how much heat is obtained in thermonuclear reactors today, it is impossible to reach and especially keep the huge temperature inside a star for too long, so the particles inside a thermonuclear fusion reactor will not be able to get enough thermal energy so that the efficiency of the pp reaction is satisfactory and for a long period, which is why it is necessary to introduce additional energy into the reactor system by pre-accelerating the protons to sufficient energy to ensure a good pp fusion reaction, but this fact will probably be studied and discussed in detail in a future paper.

dp Reaction

The reaction between a deuteron and a proton (7) takes place in stars, including our sun, in a proportion estimated by specialists at about 100%, thus being an extremely important nuclear reaction, which must also occur in nuclear reactors in which we want to obtain energy by nuclear fusion. The calculations show an energy of 4.471494063 MeV:

$$\begin{cases} {}^2H + {}^1_1p \to {}^3He + \gamma \\ \gamma[MeV] = {}^2H + {}^1_1p - {}^3He = \\ 1875.612763 + 938.2720132\text{-} \\ 2809.413282 = 4.471494063 \end{cases} \tag{7}$$

The realization of the reaction (dp) on Earth on an industrial scale and with a good yield, can be undertaken only by accelerating the protons with a certain energy, which will be theoretically calculated exactly and presented in a future paper.

^{3}He-^{3}He Reaction

The ^{3}He-^{3}He reaction (8) is estimated to take place in the sun in an important proportion of 84.92%, representing the reaction called ppI which produces 4He. It is known that the main material (fuel) of star fusion is hydrogen and the result is 4He:

$$\begin{cases} {}^3He + {}^3He \to {}^4He + 2{}^1_1p + E \\ E[MeV] = 2\,{}^3He - {}^4He - 2{}^1_1p = \\ 2 \cdot 2809.413282\text{-}3728.401028\text{-} \\ 2 \cdot 938.2720132 = 13.8815089 \end{cases} \tag{8}$$

The ppI nuclear reaction produces a significant amount of energy of about 13.8815089 MeV.

^{3}He-^{4}He Reaction

The ^{3}He-^{4}He reaction (9) is estimated to take place in the sun in an important proportion of 15.08%.

$$\begin{cases} {}^3_2He + {}^4_2He \to {}^7_4Be + \gamma \\ \gamma[MeV] = {}^3_2He + {}^4He - {}^7_4Be = \\ 2809.413282\text{+}3728.401028\text{-}6536.22718 \\ =1.587130036 \end{cases} \tag{9}$$

The reaction releases only a small amount of energy 1.587130036 [MeV].

^{7}Be

The reaction known as beryllium 7 (10) occurs between beryllium 7 and an electron and leads to Lithium 7 and an electronic neutrino:

$$\begin{cases} {}^7_4Be + e^- \to {}^7_3Li + \nu_e + \gamma \\ \gamma[MeV] = {}^7Be + e^- - {}^7Li = \\ 6536.22718\text{+}0.51099895 \\ \text{-}6535.365828\text{=}1.372351478 \end{cases} \tag{10}$$

The reaction releases only a small amount of energy 1.372351478 [MeV]. Beryllium is a chemical element denoted by the symbol Be and has the atomic number 4. It is a bivalent element produced by stellar nucleosynthesis and is a relatively rare element in the Universe. It is found in nature only in combination with other elements, being present in the composition of minerals. The most popular gemstones that contain beryllium are beryl (aquamarine, emerald) and chrysoberyl. As a pure element, it is a gray, light, and brittle alkaline earth metal. When added as an element in alloys of aluminum, copper, iron, and nickel, beryllium improves some of its physical properties. Tools made of copper-beryllium alloy are durable and do not create sparks in contact with steel surfaces. In structural applications, the most common combination of flexural rigidity, thermal stability, thermal conductivity, and low density (1.85 times lower than water) make beryllium a highly sought-after material in aviation components, torpedoes, space shuttles, and satellites. Due to its low density and atomic mass, beryllium is relatively transparent in contact with X-rays and other forms of ionizing radiation; therefore, it is the most common material as a shield for X-ray equipment and components of physical particle experiments. Its high conductivity, as well as that of beryllium oxide, has led to its use in thermal management.

At the nuclear level, this amount of energy is considerable, so the reaction could be used on an industrial scale to produce energy and Lithium 7 if we had larger amounts of beryllium. But we will probably talk about this interesting reaction in another future paper.

ppII

Between Lithium 7 and a proton occurs the reaction known as ppII (11), an important reaction that donates ^{4}He twice and energy:

$$\begin{cases} {}_{3}^{7}Li+{}_{1}^{1}p\rightarrow{}_{2}^{4}He+{}_{2}^{4}He+\gamma \\ \gamma[MeV]={}_{4}^{7}Li+{}_{1}^{1}p-2\cdot{}_{2}^{4}He= \\ 6535.365828+938.2720132\text{ -} \\ 2\cdot 3728.401028=16.83578411 \end{cases} \tag{11}$$

The energy obtained by the ppII reaction is very high and because of this, we will return in one future work on it.

Discussion

Alpha decay: This process is caused when the nucleus emits an alpha particle, i.e., a nucleus of helium, consisting of two protons and two neutrons. The emission result is a new element with a smaller atomic number.

Beta-decay (and electron capture): These processes are regulated by a weak force and result from the transformation of a neutron into a proton or a proton into a neutron. The neutron-proton transition is accompanied by the emission of an electron and an antineutrino, while a proton-neutron transition (except for electron capture) causes the emission of a positron and a neutrino. Electron or positron emissions are called beta particles. Beta-decay increases or decreases the atomic number of the nucleus by one. Electron capture is much more common than positron emission because it requires less energy. In this type of degradation, the nucleus absorbs an electron rather than emitting a positron. In this process, however, a neutrino is emitted and a proton is transformed into a neutron (Durand *et al*., 2000).

Gamma decay: This process results from a change in the energy level of the nucleus to a lower energy state, which results in the emission of electromagnetic radiation. The excited state of a nucleus that produces gamma emission usually occurs after the emission of an alpha or beta particle. Thus, gamma degradation usually follows alpha or beta decay.

Other rarer types of radioactive decay are the ejection of neutrons or protons or groups of nucleons from the nucleus or more beta particles. An analog gamma emission that allows excited nuclei to lose energy differently is the internal conversion-a process that produces high-speed electrons other than beta radiation, followed by the production of high-energy photons in which there is no energy, gamma radiation. Several large nuclei can explode into two or more electrically charged fragments of various masses, plus a few neutrons, in a degradation called spontaneous nuclear fission.

Each radioactive isotope has a period that characterizes the decomposition-the half-life-which is determined by the time required for half of a sample to disintegrate. This is an exponential decrease process that decreases the ratio of the remaining isotopes by 50% every half time. Therefore, after twice the half-life, 25% of the present isotope will remain so.

All particles considered today to be elementary have a quantum (intrinsic) mechanical property called spin. This is analogous to the kinetic moment of an object rotating around the center of mass, although, strictly speaking, these particles are considered to be point-shaped and can no longer be rotated. Spin is measured in units of reduced Planck constant (ħ), electrons, protons, and neutrons, all with spin ½ ħ, or 'spin -½'. In an atom, electrons moving around the nucleus have an orbital kinetic moment in addition to the spin, while the nucleus itself has a kinetic moment due to the nuclear spin.

The magnetic field produced by an atom-its magnetic moment-is determined by these different forms of the kinetic moment, just as an electrically charged object usually produces a magnetic field. However, the most important contribution comes from the spin of electrons. Due to the nature of the electrons to respect Pauli's exclusion principle, according to which two electrons cannot be found in the same quantum state, the bound electrons are pairs, each member of the pair rotating upwards and the other in slow rotation. Thus, these rotations cancel each other out, completely reducing the momentum of the magnetic dipole to zero in some atoms with an even number of electrons.

In ferromagnetic elements such as iron, cobalt, and nickel, an odd number of electrons leads to the existence of an unpaired electron and the presence of a clear magnetic moment. The orbits of neighboring atoms overlap and reach a lower energy state when the spins of the unpaired electrons are aligned with each other, a spontaneous process known as the exchange interaction. When the magnetic moments of the atoms of the ferromagnetic materials are aligned, the material can produce a measurable field on a macroscopic scale. Paramagnetic materials have atoms with magnetic moments intertwined in random directions when no magnetic field is present, which aligns in the presence of a field.

The nucleus of an atom will not rotate when it has both an even number of neutrons and protons, but in other cases with odd numbers, the nucleus can rotate. Rotary cores are normally aligned in random directions due to thermal equilibrium. However, for certain elements (such as xenon-129) it is possible to polarize a significant proportion of nuclear spin states so that they are aligned in the same direction-a condition called hyperpolarization. It has important applications in magnetic resonance imaging.

The potential energy of an electron in an atom is negative, its position dependence reaching a minimum (maximum absolute value) inside the nucleus and disappearing when the distance from the nucleus tends to infinity, approximately inversely proportional to the distance. In the quantum-mechanical model, a bound electron can occupy only a set of states centered on the nucleus and each state corresponds to a certain energy level; see the time-independent Schrödinger equation for a theoretical explanation. An energy level can be measured by the amount of energy required to release the electron from the atom and is usually given in units of electron Volts (eV). The lowest energy level of a bound electron is called the ground state, or steady state, while a transition of an electron to higher-level results in an excited state. The energy of the electrons increases when n increases because the (average) distance from the nucleus increases. The energy dependence of ℓ is caused not by the electrostatic potential of the nucleus, but by the interaction between electrons.

All the reactions presented in the "Results" section, as well as many others, will be analyzed separately in future works of the author, in order to determine the acceleration energies of the entrainment particles, necessary to trigger the respective reactions, either fusion or fission, or in the future and in other possible nuclear reactions, such as those of total annihilation.

Conclusion

The courageous hypotheses made by the author of the paper, if they are practically confirmed, will open the way for new achievements in elementary particle physics, with the possibility of obtaining sustainable, cheap, friendly energy, directly from the heart of the matter.

Quarks are produced permanently from light, by a continuous mechanism still unknown to us, and immediately after production two or three are caught forming light base matter (electrons, positrons, electronic neutrinos, electronic antineutrinos) and if they are filled with other matter (heavy particles) it forms the basic heavy matter (protons, antiprotons, neutrons, antineutrons). Light particles are made up of first-generation quarks (2 plus 2 antiquarks, a total of 4), there are just four basic light particles of visible matter presented now in Table from the Fig. 2, while heavy particles belonging to visible matter are formed similar to light particles (from the same quarks) but at they also are added some heavy mass particles that give the density, mass, and consistency of heavy particles, thus distinguishing them from light ones.

The heavy particle that is added to a light one to fill it is the same in all basic situations. Thus, by filling an antielectron (positron) with a heavy particle, a proton is born. When an electron is filled with a heavy particle, an antiproton is born. When an electronic antineutrino fills with a heavy particle, a neutron is formed and when an electronic neutrino fills with a heavy particle an antineutron is born.

The diagram in Fig. 2 can also explain the balance between matter and antimatter. Electrons are more stable and filling them with heavy particles to result in antiprotons can be difficult and rarer. Antielectrons are more unstable but they easily fill with heavy particles permanently forming the protons that are the basis of visible matter. An electron neutrino is more stable and can rarely fill with a heavy particle to form an unstable antineutron. Instead, an electronic antineutrino is the most unstable, having a permanent tendency to capture a heavy particle and swell to form a neutron, which explains the abundance of neutrons along with protons.

For example, the energy obtained by annihilating matter with antimatter, being clean, sustainable, and huge, if controlled will be able to donate to humanity virtually unlimited amounts of energy.

The most plausible hypothesis about the masses of the light particles (small at one electron and insignificant at one electronic neutrino), is the one in which the connections between two quarks I(d)-I(d) or I(d)-II(u) made with low energy are considered and the connection between two quarks II(u)-II(u) is obtained with a higher energy equivalent to the mass of the electron (positron).

It is known that atoms of the same element all have the same number of protons, called the atomic number. For the same element, however, the number of neutrons can vary, determining the isotopes of that element. The total number of protons and neutrons is what determines the nuclide and the number of neutrons relative to that of the protons will practically determine the stability of the nucleus and therefore of that isotope, which leads to the situation in which certain isotopes are suitable for radioactive decay. This is exactly what can be speculated when we choose a certain nuclear reaction.

Obtaining neutrons from protons or antiprotons directly from neutrons can be used to manufacture antimatter that will be annihilated immediately after its manufacture with the matter to obtain massive, industrial energy. Instead of using huge amounts of energy in the manufacture of antimatter as is currently the case when antimatter is obtained by colliding super accelerated particles at huge energies, we will be able to make antiprotons from neutrons with the help of accelerated electrons. A massive energy supplement will result from these processes anyway.

All the reactions presented in the "Results" section, as well as many others, will be analyzed separately in future works of the author, in order to determine the acceleration energies of the entrainment particles, necessary to trigger the respective reactions, either fusion or fission, or in the future and in other possible nuclear reactions, such as those of total annihilation.

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Ethics

This article is original and contains unpublished material. The author declares that are no ethical issues and no conflict of interest that may arise after the publication of this manuscript.

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