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The Last Basic Question Marks of Physics: Gravity and the Nuclear Bond

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Abstract

Changing perspective sometimes better helps in the understanding of physical world. Holding to basic principles, we have tried a small shift from existing theories and opened a different window on the micro and macro phenomena with the aim of finding a unifying solution. The new interpretation, with the aid of experimental data, of the pulsation of nuclei allows the unification of the strong nuclear and the weak gravitational interaction and discloses a different view of the world allowing the description of questionable physical phenomena we observe in the sky and on our Earth. We believe that this vision of the world is simple and represents a basis for future investigations.

Keywords: Physics; Nuclear; Gravity; Question Marks

Foreword

So far modern physics has made a lot of progress in the description of the world starting from Galileo original contributions to the science of motion of bodies, to Newton law of universal gravitation and to Einstein theory of relativity, not to mention the technological revolution that these and many other scientists made it possible. Nevertheless books of physics are still full of question marks that were and are always in the mind of scientist but that remained unsolved in the centuries. Questions relating the nature of gravity, of the strong nuclear interaction together with the constancy of the velocity of light postulate are still under discussion and are waiting for an answer.

In addition the books of modern physics are full of infinites and of perpetual motions, including those of the planets around the Sun and those of the molecules in the kinetic theory of gasses. In spite of this a lot of knowledge and data are available for the atoms and nuclides, on the behavior of matter and on the structure and the dynamics of the universe. The research made by us in the last fifteen years was aimed to solve these questions brainstorming available data and looking for a demonstration through the unsolved small and large anomalies of nature.

A First Advise from the Universe

One of the most important discoveries is due to two radio astronomers Arno Penzias and Robert Wilson that in 1964, using a sufficiently sensitive radio telescope, demonstrated that the space between stars and galaxies is not completely dark but a faint radiation background is present, almost isotropic, not associated with any star object and having a temperature of about 3°K.

Recent measurement report a temperature of 2.725 °K and, following Planck theory and Wien law, a perfect fitting to a blackbody spectrum having a maximum at a wavelength λ= 0,106305 cm. that is to say we have particles in the void space having energies of 1.8677×10^{-15} erg or 1.17×10^{-03} eV and equivalent mass of 2.078×10^{-36} g. This energy made scientists to think that cosmic microwave background (CMB) might be just a perceivable part of the invisible radiation named cosmic neutrino background (CNB) [1,2]. CMB has been raising a lot of discussion and theories from the date of its discovery: today CMB radiation and the cosmological red shift are together regarded as the best available evidence for the Big Bang theory; but is this the real story?

Also a cosmic neutrino background CNB, together with CMB, is supposed to be a relic of the first two seconds of the universe and it is estimated that its temperature is today roughly 2°K. Since low-energy neutrinos do not interact with matter, they are notoriously difficult to detect and the CNB might never be observed directly. For such an elusive radiation/particle having a temperature of 2.0362 °K we can estimate a wavelength **λ** of 0.14232 cm, an energy of 1.39557×10^{-15} erg or 8.71×10^{-04} ev and an equivalent masses of 1.55277×10^{-36} g. A possible interpretation is that CMB radiation is just the tip of the iceberg of the unknown dark energy and matter that nobody knows but that is thought to constitute the majority of the universe.

From The Universe to the Nuclear Atom

The necessity of maintaining energy conservation in β decay led Fermi in 1934 to suggest the existence of the neutrino ν and to propose the following reaction scheme between protons p and neutrons n in the nucleus [3,4]:

β⁻ émission $n \overset{k1}{\leftrightarrow} p + \beta^- + \nu$

β⁺ emission $p \overset{k2}{\leftrightarrow} n + \beta^+ + \nu$ (1)

Orbital electron capture $p + \beta^- \overset{k3}{\leftrightarrow} n + \nu$

and the electron-positron annihilation reaction with the production of two γ photons having energy of 0.511 Mev each, equal to the rest energy of an electron.

$$\beta^- + \beta^+ = 2\,\gamma \qquad (2)$$

A first question arises: if these reactions occur in unstable nuclides why they cannot be present in stable ones? The only difference should be that in stable nuclei the electron has not enough energy to leave the atom. This throws some light on the dynamic nature of the nuclear bond, provides some ideas for the solution to the big puzzle in nuclear physics about the relative binding energies of the lighter nuclides [3,4].

We have supposed that the protons and neutrons in the nucleus are bound together loosing part of their identity and part of their mass and that the lost mass or bond energy is 2.044 Mev, that is two annihilations reactions (2).

For example He^4 with a total mass defect/binding energy of 28.29897 shows 14 dynamic p-n interactions instead of the traditionally 6, 3 per nucleon, predicted by the simplest arrangement in the space.

In Donati G [3] we predict the number of bond and the geometry of stable and unstable nuclides in good agreement with experimental data for stable and unstable nuclides as far as to Ne.

The Neutrino Flux and its Relation with Gravity

From equation (1) we could compute the neutrino flux from all known nuclides provided the parameters $/k_1$, $/k_2$, $/k_3$ where known. The fitting with the N-Z distribution of the first β emitters 1800 nuclides gives a correlation with a surprisingly high determination index ρ^2 equal to 99.69 % and parameters $k_3/k_1=1.048253$ and $k_2/k_1=0.005943391$ [3,5].

The fitting is centred on stable nuclides while other unstable isotopes show discrepancies in neutron number with – and + sign for β^- and β^- decay. If we assume k_1 = 0.0009625, that is the experimental half-life of the neutron of 15 minutes, the values of all fundamental atomic constants can be computed as:

$k_1=0.0009625$ $k_2=4.71554 \times 10^{-06}$
$k_3=0.00105382$ (3)

The computation dN/dt =-dP/dt yields negative values for β^- emitters and positive ones for β^+ emitters, the higher values corresponding to most active emitters. If we use these constants to compute the rate of emitted neutrino, we discover that, referring to the gram of matter, the emission is almost constant over all nuclides with a mean value of 6.668E+20 neutrino per gram per second and this value does not significantly change from light to heavy nuclides.

This constant is, as a matter of facts, related to nucleons, whose weight does not change, except for mass defect, and looks like an additional universal constant. The more this value appears constant if we add that the universe is made up with a mixture of nuclides. As a consequence there is in the space an important flux of neutrino generated by matter and this flux referred to the mass of a body is almost independent of the type of the elements.

In this vision the universe has two complementary faces: one side there is coagulated matter made up of nucleons and on the other side we have the fine matter made up of neutrino evaporating from the solids.

The coagulated matter moves around in the universe under the laws of gravity and the fine one is emitted by bodies and goes to the infinite with the "velocity of light".

The logic wants that these two components should be related under momentum conservation principle applied to nucleons mass and cross section.

Therefore [3,5,6] we can define a neutrino force as the other face of the coin where the gravitational force has been written by Newton some century ago.

Gravitational force $\mathbf{Fg = G}\ M_1\ M_2 / R^2$

Where:
$\mathbf{G = 6.668 \times 10^{-08}}$ is the universal gravitational constant ($cm^3\ s^{-2}\ g^{-1}$)
M_1 and M_2 are the interacting masses (g)
$\mathbf{R^2}$ is the square of the distance between the two masses (cm^2)

Neutrino force $\mathbf{Fn = Fo\ M_1\ \mu\ c\ \sigma_n\ M_2 / (4 \times 3.14\ R^2)}$ (5)

Where:
$\mathbf{Fo = 6.668 \times 10^{+20}}$ is the neutrino flux per gram per second ($n\ g^{-1}\ s^{-1}$)
μ is the neutrino mass ($\mathbf{1.55277 \times 10^{-36}}$ g/n)
$\mathbf{c = 2.9973 \times 10^{+10}}$ is the velocity of light ($cm\ s^{-1}$)
$\sigma_n = 3.14\ r_n^2 / m_n$ is the cross section per g of nucleon having mass $\mathbf{m_n}$ and radius $\mathbf{r_n}$($cm^2\ g^{-1}$)
$\mathbf{M_2}$ can be interpreted as the number of nucleons multiplied by the nucleon mass $\mathbf{m_n}$

Imposing the equality of the two forces **Fg** and **Fn,** we can define the gravitational constant **G** in terms of only nuclear parameters and of the velocity of light:

$$\mathbf{G = Fo\ \mu\ c\ r_n^2 / (4\ m_n)} \quad (6)$$

As a consequence we can say that the week gravitational interaction is of nuclear origin, strictly bound to the strong nuclear interaction, and displays a direct action on nuclides.

The neutrino weight of μ = $\mathbf{9.35085 \times 10^{-13}}$ amu or $\mathbf{1.55277 \times 10^{-36}}$ grams or $\mathbf{8.71032 \times 10^{-4}}$ ev, is similar to that reported for CNB.

The difference is that we do not have a Cosmic Neutrino Background, as a a relic of the big bang, but a real flux from matter that continuously move the Earth, the Sun and the other stars. The neutrino is therefore at the same time the motor of the universe and the fuel that makes the whole machine move without the need of invoking a perpetual motion.

The neutrino is the cause that shapes the spherical bodies of the stars and planets and is responsible of the effects of gravity that we experiment in everyday life on our Earth The energy/mass consumed is at the expense of the solid material that decays in the long times of the life of the universe. Even the so called stable nuclides will die with time and will be transformed in the unstable ones that in turn will in short times decay to yield different stable nuclides and different elements in the periodic table(4)

The neutrino fluxes sum and subtract following their orientation as vectors and the neutrino flux shapes the space similarly to the gravitational field: there is a zero gravity and zero net neutrino flux at the first Lagrange point and an unbalanced neutrino flux arises around massive bodies immersed in an external neutrino flux originating the gravitational attractive force.

The difference with the Newton approach is that we lose discontinuities and infinites in mathematical formulae and calculations are much easier even for complex geometries. Due to the described phenomena one gram of material loses 4.24×10^{-08} g in one year and 4.24475×10^{-06} g in 100 years and this material lost is located in a sphere having a radius of 1 and 100 light years respectively. The Sun with a mass of $1.991 \times 10^{+33}$ g loses in one year $6{,}5 \times 10^{+25}$ g that is only a small fraction compared to the mass of the Sun but is about $2 \times 10^{+04}$ the quantity of mass/energy delivered with thermal radiation. The mass lost by the Sun with neutrino is the dominating phenomena of the solar system and the only one that is able to justify he increase of the revolution time o 0.515 s/y as measured by nuclear clocks. The flux of neutrino could also provide a different view of the expansion of the universe.

The Velocity of light, Relativity and Electromagnetism

We have now come to the conclusion that a space void of mass/energy does not exist and that the new particles present in the space guarantee the existence of the universe as a unique bounded entity. We have come to a physical interpretation of the gravitational field that Einstein pretended to be a physical entity and we have recognized that graviton and neutrino are the same particle.

The small number of neutrino per year captured in underground experiments either are those in the extreme left of the Plank distribution or have a temperature near that of the cosmic radiation. The most intriguing question is however the fact that bodies and even light have to move in this crowded space where they may find some influence from the neutrino flux.

This influence is near zero when bodies have normal velocity, because we know that cold neutrino are able to cross light-years of lead without interaction, but may become important at relativistic velocities. This effect might be true also for photons that move in the space with or near the velocity c.

In Donati G [7], examining the electromagnetic field, we suggested the possibility of neutrino being the true fastest particle. Good sense suggests that neutrino, differently from light, do not interact with matter. Neutrino faster than light was not proven in the Geneva - Gran Sasso experiment of (September 2011, but we have to recognize that measuring the neutrino and its velocity is not an easy job.

According to Einstein's General Relativity Theory, light will be affected in the same way matter is affected by gravity

The problem of the velocity of light has been examined in Donati G [8] and with the aid of General Relativity it has been related to neutrino density. The discussion on the constancy of the velocity of light in vacuum is still on the table but we know that, according to Einstein, absolute vacuum does not exist due to the presence of gravitational masses. To tell the truth, Einstein did not agree with many of the findings that some modern scientists attribute to him. As for the speed of light, he had some problems in the transition from special to general relativity, but finally he honestly recognized the limits of his theory. We cite his own thought taken from his first (1911) paper [9] on general relativity:

From the just proved assertion, that the speed of light in a gravity field is a function of position, it is easily deduced from Huygens principle that light rays propagating at right angles to the gravity field must experience curvature. In a subsequent paper Einstein A [10] in 1912, he concluded that: "The principle of the constancy of the speed of light can be kept only when one restricts oneself to space-time regions of constant gravitational potential."

For our everyday experience the effect of gravity is very small and we have computed: the speed of light, at 20.000 km from the surface of Earth, 15 cm/s higher than on the surface. We can, following Einstein, change the meter and the clock here and there, in order to maintain the speed of light *c* as a universal constant, but the questions, raised by the new idea of gravity, go beyond relativistic effects with the Gauss constant *G* fluctuating, *Fo* and the kilogram ageing with time together with a faster ageing of the Earth, of the Sun and of the whole Universe.

A Cascade of Question Marks

The nucleus shape and dynamics has influence on the electron orbital, that are more easily experimentally investigated due to the large size of the atom compared to the nucleus and determine the physical and chemical properties of the elements. More generally we can say that the nucleus with its electrons have influence on all the laws and phenomena of nature.

We have demonstrated [11] that in thermodynamics the *thermal agitation* that constitutes the internal energy of matter is the result of recoil of molecules in the emission of quanta of radiation. The empirical Einstein and Debye models for specific heat and internal energy have been built on the base of Planck blackbody radiation law and was one of the reasons for Planck to be accepted by the scientific community.

However, some issues remain to be solved:

Einstein was not confident with the continuous transformation of radiant energy in motion. figuring the possibility of perpetual motion, the temperature dependence near the absolute zero was questionable and different in Einstein and Debye models. The solution we proposed is that the neutrino produced by quanta degradation finally escape from adiabatic containers till in the long times the system will come to rest; near 0°K the quanta emission are in the neutrino range and, as they escape from the container, they should be removed from the Planck distribution. If we now raise our eyes from

matter, we hold in our hands, to the sky we see some question marks with the shape of ghosts hanging in the galaxy and spreading in the space.

Before Einstein scientists believed that space was permeated with an unknown substance called *ether*, supposed to be a weightless stationary substance, and used as a mean for transmission of light. Relativity eliminated *ether* but opened the way, often against Einstein opinion, to the rise of other unknown phantoms in science, if the world is expanding and the deprecated cosmological constant in Einstein equation assumes a value that fits expansion, we could go back in time to the origin of the universe, the Big Bang,

Nowadays this expansion should decelerate due to gravity but that is not the case. Some scientists imagined that Newton law was not more valid at the galaxy scale but the majority accepted the hypothesis of existence of a ***Dark Energy***, a substance with negative pressure which is spread homogeneously throughout the universe, the nature of which remains unclear.

In Donati G [6] we describe the entire story and now we know that the reason of continued acceleration is solid matter loosing mass and gravity losing its power. Another follow up of the theory of general relativity is the prediction that a sufficiently compact mass will deform space-time to form a ***black hole***. A ***black hole*** is a region of space-time from which gravity prevents anything, including light, from escaping. Einstein treated this prediction as a strange curiosity but a lot of theoretical investigations and astronomic observation are under way nowadays. Now that we know what gravity is, we are unable to explain how it works in a ***black hole*** even if we imagine it as a neutron star.

Nevertheless a **black hole** was allocated in the center of our galaxy to account for its velocity of rotation.

This however generated an additional problem: the orbital speed of stars and gas is increasing or remains almost constant far from the galactic centre: that is, stars are observed to revolve around the centre of the galaxy at increasing or the same speed over a large range of distances from the centre of the galaxy. This apparent discrepancy was accounted for by postulating a large amount of ***dark matte*r** that permeates the galaxy and extends into the galaxy's halo.

We have demonstrated [6] that this is not an anomaly and we can compute the motion of the Milky Way in agreement with available data without the use of **black holes** and ***dark matte*r.** Coming to our Earth we have the surprise that the revolution time, the calendar year is increasing each year in line with the Earth distance, "Astronomic Unit", from the Sun. This is mainly due to the loss of mass of the Sun and can be easily estimated with Newton law at constant distance [5] or more accurately computed by the variation of angular momentum due to Earth and Sun mass and distance changes [12]. We cannot perceive these phenomena, even if they have influence on our life, while everyday our Earth does not forget to make us feel its presence with both with quite and disrupting natural events, with earthquakes [13] we have the final result of the long time action of gravity in shaping the crust both as a force and as a consumer of matter.

The new view of gravity allows an alternative theory of the evolution of the Earth and on the formation of fractures in the crust, generating everyday vibration in all continents and under the oceans. We are confident with this approach because it is simple and may give geologists a different way to explain catastrophic events.

We think that this new view of the universe can be used to better understand many phenomena in areas of Science other than Physics. Scientists should not pass their time in reworking old theories, but in applying the main lesson that the genius of Einstein gave us in order to continue his investigation: *Most of the fundamental ideas of science are essentially simple and may, as a rule, be expressed in a language comprehensible to everyone. The important thing is not to stop questioning.*

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