

Stars: A New Approach

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Abstract: It is proposed a new interpretation of the nuclear fusion reaction on the energy produced in stars by including the strong and weak interactions, with which we may explain the union or ligature between protons and neutrons to form atomic nuclei. The initial energy level of protons must be higher than were being estimated for fusion nuclear reactions; this energy is provided by plasma state (hydrogen ions and electrons) existent in stars remaining in the proper atomic nucleus without affecting its actual or inertial mass, because it corresponds to a virtual mass. Therefore, atomic nuclei are configured as an “abstract or inner space”, where the gauge quantum particles are provided with virtual mass; this space is distinct from the “exterior or common” one, in which particles (atoms, molecules and crystal) have real or inertial mass; electromagnetic radiation is compatible with both spaces. The emitted energy (electromagnetic) is due to the variation of “virtual” mass and to high energy photons or gamma rays formed by the union of electrons of the initial hydrogen atoms with positrons originated by the conversion of protons into neutrons, needed for the formation of nuclei. Stellar evolution involves obtaining only the so-called “white dwarf”, because they consist of ordinary matter as any planet.

Keywords: Electromagnetic, Stars.

1. INTRODUCTION

It is easy to note in the scientific world everything is based on a radical “materialism”, so it leaves no room for any other “reality” that is not supported by a tangible matter.

In search for the existence of this “reality”, we dare to get into a sea of troubles, where the latest physical theories rules like gods the modern world sets up to try to calm a reason which by its very nature is insatiable; this prompts us the oft-repeated reference to Cosmos the media is usually bombarding us mercilessly.

In this way we provide a detailed analysis of the so-called nuclear fusion reactions by which is explained the energy produced by Sun and other stars. When trying to fit it with weak interaction, it arises another interpretation of the mass (energy) put into play at the union of protons and neutrons to form atomic nuclei.

Following the course of this research we try to highlight the existence of a nature that rests on a “matter” presented from a different angle and allows giving consistency to a “virtuality” in consonance with the actual world of computer where “virtual reality” has meaning

The obsession to establish a relativistic framework of space and time, started in the second half of 19th century by E. Mach and followed by Einstein, has become “paradoxically” a new absolute, which has dominated Theoretical Physics, the “new” gravitation’s law with its mass, that supposedly governs the Universe, overlooking two facts: a) the value of G; b) the high energy involved in quantum process responsible for strong and weak interactions with the help of the electromagnetic one, whose sources are charges.

2. MATTER AND ENERGY

Classical Physics:

Let’s try to analyze the concept of matter itself the more immediate experience lies ahead; according to this, **mass** of the bodies turns out the significant quality attributed to the “material reality”, as something tangible that we can access in the simplest way with our own senses.

Since the outset the study of natural phenomena concerning physical evolution of material bodies was made through a first error: the motion of a body required the existence of an external agent or force to keep its state (velocity); it was postulated by Aristotle and accepted throughout Ancient and Middle Ages.

It was Galileo who specified the independence of bodies' movement with regards to forces under the concept of **inertia**. Newton completed the scenario considering this property also corresponds to rest state, so inertia must be associated with the most tangible of the material world, **mass**, as it is well exposed in the Dynamic's second law.

Since then, such important concepts have been handling so clearly that it seems unquestionable to identify inertial mass with that one corresponding to gravity, so

$$m_{\text{inertial}} = m_{\text{gravitational}}$$

Let's consider carefully and in a very simplified way, the method used in Classical Mechanics:

a) The objects inside a uniformly moving train, expressed their inertia by the force exerted on them when the train changes its speed; if the masses of these bodies were joined to the wagon, the effect would not be noticeable as long as the compactness of the bodies was sufficient for not occurring any alteration. So, **inertia** is related to the union (force) between the parts of composite bodies.

b) Rotations of bodies under a defined angular velocity, w , introduces different conditions to the previous situation, but it comes to a similar conclusion. Indeed, considering all points situated at the same distance from rotation's axis, they will move at a linear velocity, v , and changing its direction by cohesion force, which must be equal to centripetal force. If this is larger than that, the points are tending to be separated with a tangential velocity; it is referred to centrifugal force as the cause of this fact, which in similarity to the previous one must be linked to **inertia**. This again appears under the cohesive forces of the parts constituting the matter in bulk.

Modern Physics:

If we take out the above in the context of Modern Physics, we can detect the new error: to associate **inertia** with moving frames thanks to velocities of bodies themselves and presenting it as "inertial frames".

Thus, using the so-called Mach's principle to explain the centrifugal force, according to which the Earth is subjected by virtue of its rotation, is "amazing": to attribute it to gravitational attraction caused by distant stars and convert it in an issue of space-time geometry of the whole Universe, despite the extreme smallness of gravitational constant, G and the very large distances.

Indeed, it is hard to admit it and besides unnecessarily, as may be understood using the argument of paragraph b): the farthest layer from rotation's axis are precisely in the equatorial zones, so linear velocities are greater than those of other areas and requires greater cohesion forces with the inner layers; otherwise they tend to escape or at least to being stretched as any flexible body, which actually is our Planet.

But the surprise does not end here, under the insistence has been put in Theoretical Physics supported by Relativity, to provide electromagnetic radiation with real mass, that is, to be endowed with inertia as any stone.

Considering that light (electromagnetic radiation) is simply the transmission of energy in ordinary space, with this way of approaching the "physical reality", matter (mass) and energy are becoming the same thing, or rather, equivalent; for this purpose the famous Einstein's formula,

$$E = mc^2 \quad (1), \text{ is available, where } c \text{ is the speed of light in vacuum.}$$

The first objection appears immediately: if the mass attached to light is real, ie. inertial as any other body, how is it possible that this mass may moving at the speed of light, absolute and unreachable for a material object?.

What sort of body is transmitted with it, if its speed can not be taken by anyone?; the inclusion of the so-called photons leads to confusion, since it is admitted that they have zero mass at rest, but not moving. The truth is that they arise as "quantum particles" of electromagnetic energy by interacting with matter and the physical parameter which we must consider is the frequency, ν , according to the well known Planck's equation, $E = h\nu \quad (2)$.

On the other hand, the explanation given that the assigned velocity would be v , for being contained in the relativistic expression $E = m_0c^2/\sqrt{(1-v^2/c^2)} \quad (3)$, is unsatisfactory, since in this case the electromagnetic energy transmitted is not

affected from a dimensional point of view; in other words, the speed of light in vacuum, c , must be acting as a velocity and the mass associated should not be a real one.

In addition, the handling of the above equation by authors such as M. Born, Panofsky and Möller among others, proves nothing; indeed, it is not necessary to go into mathematical details to realize that time variation of energy leads to occurrence of a force due to the variation of velocity, v , although this is tied to the moving frame, constant for construction. So, the force must be fictitious or a “virtual” one, in consonance with the concept of “virtual work” that is sometimes used in Classical Mechanics.

The study carried out by Einstein himself in his article: “Does the inertia of a body depend upon its energy-content?” is centered on the reduction of a body’s mass when light or radiation energy emission, L , is taking place:

$K - K_0 = L[1/\sqrt{(1-v^2/c^2)} - 1] \approx Lv^2/c^2 = m_0v^2/2$ (4) where \approx indicates that the series expansion only includes the first term; then he states m_0 corresponds to mass’s variation involving the energy change, which for being included in the expression $m_0v^2/2$, consider “proved” that $m_0 = L/c^2$ is an inertial mass corresponding to electromagnetic energy, L .

Actually, it does prove nothing, since the serie expansion has only a mathematical meaning; otherwise, how is possible to associate m_0 with v , if by definition is associated with c (m_0c^2); besides, v corresponds to m according with (3).

However, the orthodox interpretation has been prevalent and therefore light “shall be” attracted to a very massive star like Sun in the same way that any body is for our Planet, that is, by the force of gravity.

General Relativity provides the mathematical formulation and it is said some experimental tests certifies it and apparently there should be no doubt. In this sense, Astrophysicists since Eddington (1919) claim to have “proven” the gravitational pull exerted on a beam of light (from a star) by the Sun during a total eclipse; but to complete the experiment six months are to be elapsed during which the relative positions of the star and Earth are different making the experimental setup unreliable or at least very difficult.

In support of the objection, M. Born states in 1962: “..an exact agreement between theory and measurement has not yet being obtained..” (“Einstein’s Theory of Relativity”)

In short, there are more than reasonable doubts that such phenomenon had the garantes demanded by any experimental science; the caution that must govern any intellectual activity suggest awarding a **mass** to radiation, but this will be **virtual** and **electromagnetic**.

(Our article: “Mass and Quantum Theory”).

This is in line with the findings given by Philosophy of Science: the meaning of “mass” is not given intuitively but are determined by laws of physics; so, the truth does not mean the correspondence with an object, but the internal consistency of the conceptual system.

Following the course of that reasoning, such **masses** should be **virtual** by nature, as they do not correspond to any real bodies.

This “virtuality” is perfectly compatible with the “reality” really important in light transmission: **energy**; besides, the frequency, ν , turns out the main characteristic for electromagnetic waves and for Quantum Theory, whose starting point is the equation (3) and in its development has no need of any tangible or inertial mass, as it is frequently stated.

Likewise, in the latest technology dominated by internet and supplemented with CCD (coupled charge design) is generally accepted the existence of a “virtual reality” full of images appearing and disappearing almost instantaneously, hardly explainable if the electromagnetic energy were provided with inertial mass.

According to the preceding arguments, energy appears to be the primary physical quantity both in the microcosm governed by Quantum Theory and electromagnetic phenomena; in both areas, **charge** turns out the essential parameter and mass becomes secondary or derived from that. This is consistente with the fact that it was introduced in Relativity to achieve the energy formula.

At this point, it is reasonable to ask: what it would be the origin of the **true mass (inertial)** of subatomic particles?; we believe it is in the so-called **strong interaction** which leads to the formation of hadrons and in particular protons and neutrons; they are particles composed of quarks (fractional charges), built by an interactive network (gluons) and the

phenomena called “confinement”, which provides the proper consistency needed for a true or real mass: **inertia** requires a structure.

By this criterion, the so-called “elementary particles” without structure, as electrons and quarks have no actual mass, but a virtual one; also it happens with photons, as it is evidenced by the well known relationship

$$\text{positrons } (e^+) + \text{electrons } (e^-) = \text{gamma rays (photons)}.$$

3. STARS

At first approaching, stars are presented as entities where is manifested a special state of matter called plasma, which is considered as a fourth state that along with the usual solid, liquid or gas are the possibilities in which Nature may be shown.

It is curious, but instructive, to note these four states correspond to the “four elements”: earth, air, water and fire, very well-known since the Ancients.

The identification of plasma with fire or energy manifestation as a mere phenomenon or dominant state in the Sun and consequently in all stars, enables them for generating new matter (atoms) and emit light.

Fusion nuclear reactions (thermonuclear):

Since the beginning, theoretical physicist coined the term **fusion** to **nuclear reactions** responsible for the enormous energy produced in the Sun.

For this purpose, the said plasma is configured as an ocean of hydrogen ions, ie. protons located in the interior of Sun which will be under high temperature (hence the name of **thermonuclear**), causing the union or fusion and implying an energy emission on account of the relativistic formula $E = \Delta mc^2$ (5), where Δm is the mass variation (diminishing) when the initial protons are converted into the final helium nuclei.

According to the usual interpretation, we must understand that some of the mass of the initial proton is lost and “evaporates” as energy to the environment, while the “fusion” or binding occurs spontaneously without any energy requirement; with other words, one can not understand the emission of this energy with the application of the concept of “ligature” used in Nuclear Physics similar to Chemistry, which suggests a force or energy responsible for the union of the component particles (protons, neutrons) of nucleus and as such it should be integrated in the same and not going outside.

This allows us in a natural way to consider the role of the so-called **weak interaction** in the mechanism of “nuclear fusion”; first, we can see the big difference between the energy₁ ~ 26 MeV according to (5) and the ~ 80-90 GeV working for weak interaction.

If we accept the special status of plasma, the initial situation of protons must corresponds to a high level of energy in accordance with the requirements of weak interaction.

But this energy level may better understood if its origin is in the “charges”; so it happens indeed, under a mechanism called gauge symmetry, consistent with Noether’s theorem, charge is established as a fundamental parameter. (our paper: “Charge in Quantum Theory”).

Thus, the existence of a prime great energy is due to proton’s charge or hydrogen’s nuclei and a enormous electric potential induced by the proximity of these charges similar to what it happens with the onset of a major storm; this is possible in the interior of Sun or any Star and making it responsible to gravity (real mass) omits at least two facts: 1) the intensity of the force is “very” below to that of weak interaction; 2) the gravity’s force on the interior of our Planet decreases with the distance from the center of it, (and inside of Sun?).

Moreover, charge and electric potential allows us to consider a much larger “virtual” mass than the “actual” mass of proton. The confusion comes from having taken indiscriminately the electron-volt (eV) units system, but according to our point of view, $eV \equiv mc^2$ (8) should only be applied when m was virtual, which by definition, is derived from charge, e , and other electromagnetic quantities: potential (V) and light velocity (c).

This simple fact is well known by Chemists who do not use eV for the actual mass of atoms, but atomic mass unit (amu) of atoms, and thanks to Avogadro’s Number may be elevated to macroscopic world in the usual units (grams).

Finally, the energy released is mainly electromagnetic, due to the variation of “virtual” mass expressed at (5) and that one coming from the initial situation or plasma, consisting of a vast sea of protons at very high potentials allowing the transformation into neutrons with the emission of positrons:

$p \rightarrow n + e^+(\beta^+) + \nu?$ (6). Some of the beta particles are joining with electrons (coming from hydrogen atoms) and producing high energy photons, ie. gamma rays (γ):

$$e^+ + e^- \rightarrow 2\gamma \quad (7)$$

The question regarding neutrinos, ν , is coming from the assumption that this particle turns out redundant, since all the involved energy is electromagnetic, perfectly understandable with our interpretation of virtual mass associated with the existence of an *inner space* and the application of the rules or laws of symmetry CPT (charge conjugation, parity and time inversion) governing the processes in elementary particles.

Accordingly, from the equation (6), we may have another one equivalent:

$p + \nu^* \rightarrow n + e^+$ (8), where the neutrino has become an antineutrino (ν^*), which will remain in the *inner space* like the gauge particles.

(our paper: “Neutrino: a particle non-existent”).

Inner Space:

What it would happen if all involved energy in the weak interaction was emitted in ordinary space?.

To avoid such a catastrophe, normal stars like Sun using the channel resource of placing that enormous energy in an abstract or **inner space**, where gauge particles, W^+ , W^- and Z may act as bosons. Thanks to this mechanism is possible the existence first of nuclei and then atoms; these provided with their “real” mass, are subjected to Classical Mechanics and Gravitations, acting on the **external or ordinary space**, compatible with electromagnetic radiation.

Stars are celestial bodies that by virtue of its enormous size and its distance from each other, physically present the characteristic and properties of “quantum” and “classical” objects at the same time thanks to the existence of the said two spaces: **inner** and **exterior**, which respectively include the two types of mass: “virtual” and “real”.

We believe this differentiation helps the understanding of physical phenomena, contrary to what it seems to be easier, ie. to use an only kind of mass (inertial), with which we have seen is difficult to fit it properly in all situations. In this sense, we can find in the common (non-public) wisdom: “If you try to solve all the problems, no one will be solved”.

Now, we may properly understand the tremendous power that had to be produced in the LHC particle accelerator at CERN in order to extract the gauge particles from its inner space to the ordinary one; these particles act as “quanta particles” similar to “photons” in electromagnetic interaction, ie. exchanging unlimited number of them as “bosons”. It would be difficult to understand such particles having “inertial” mass.

Although it turns out odd, if not funny, the explanation given by some authors to justify that “real” mass in comparison with photons (zero mass?): its existence is reduced to a very very short time; a good exercise of willingness!. Besides, it has been overlooked that in Quantum Theory for a perfectly defined energy, time is totally indeterminate.

The analogy with philosophical principles is suggestive: “Cartesian dualism of body (real mass) and mind (virtual mass)”; the superiority of the last over the first, it allows us boldly to state: “Universe is Quantum”.

Finally, allowing us a literary incursion, we venture to suggest that stars are celestial objects through which “material reality” (actual mass of atoms) occurs from the “immaterial reality” (virtual mass of quantum particles).

Origin and evolution:

Gravity explains the approach of hydrogen’s atoms, but is it possible to admit that “...clouds of hydrogens “coalesce” becoming highly compressed and heated through the gravitational interaction”? (C.G.Levine: “Lectures of Hofstra University”); we all know that any cloud of hydrogen gas would end escaping from Earth.

The surprising thing does not end here, but it is expressed in the concept of “gravitational collapse”, whereby the electromagnetic, weak and strong interactions yield under the gravitational one, albeit from a much lower intensity.

The strong, weak and electromagnetic interactions are responsible for building the material world, starting with the baryons (strong), followed by nuclei (weak) and finally atoms, molecules and crystal structure (electromagnetic); how is it possible that the gravitational interaction overlap the previous ones, even destroying atoms?.

It is due to the “curvature” of space-time has been arguing and then any student of the subject is stunned by the great mathematician deployment used, ignoring that intuition it has been emptied of content and it is difficult, if not impossible, to understand anything.

On the other hand, it is easy to question the existence of “black holes” because to the impossibility of their detection may be added that a close examination of the Schawarzschild metric shows the arbitrary use of times (our paper: “Cosmological Model: a New Approach”).

Likewise, is striking to consider “neutron stars” as spheres (of what kind of material?) rotating at high speed to explain the X-rays emission; these are simply electromagnetic radiation whose sources are the charges that as a result of the Supernova explosion will find themselves subject to high potential and channeled through the existing magnetic field and may become synchrotron radiation.

The so-called “white dwarf”, irrespective of its mass, are presented as the only acceptable outcome of Stellar Evolution, as they have ordinary matter as any planet, satellite or other celestial object.

Celestial objects called Nebulous are considered the places where Stars are beginning their lives and their name is due to appear fuzzy as huge clouds of cosmic dust; their initial condition would not be hydrogen atoms or cosmic dust but a chaotic mixture of charged particles, presumably protons and electrons with high energy, whose origin may well be due to residues explosion from Novae or Supernovae.

The most massive stars have a greater extent in the initial energy levels (higher potential), with which may be obtained elements with atomic and mass numbers higher than that of helium; therefore, it will take greater “inner space” where quantum particles (gauge) corresponding to weak interaction, can act.

This condition may lead to greater instability in the nuclei formed explaining the most striking case of Supernova, whose explosion is due to the release of this enormous energy and its projection in “exterior space” as a large amount of cosmic rays (protons, electrons, muon, etc) and other materials.

4. CONCLUSION

The failure of the so-called “nuclear fusion reactors” is in line with the proposed mechanism over the union or fusion of hydrogen nuclei to form helium.

Under the word “scientific”, modern world is full of paradigms presented as premises there is no way to challenge behaving like the old saying: “Old habits die hard”.

So it happened with the present work where our special interpretation is against the “idea” (paradigm) that prevail in Modern Physics and Astrophysics, **unification** of all phenomena explicable by a single theory that leads to the origin of the whole; for that reason it has placed special emphasis on providing real or inertial mass to electromagnetic waves.

It took many centuries to overcome Aristotle’s Physics, which curiously lacked the important concept of “inertia” that all bodies must have associated to their masses; this was introduced by Galileo and since Newton incorporated to Classical Mechanics’ laws and extended to Gravitation.

So, it is natural that at present there was a resistance to dispense with the “inertia” in some situations, but now it appears forgotten that this concept was introduced just over a century to include electromagnetic radiation without conclusive evidence in order to get that “unification” between Classical Mechanics and Electromagnetism, while Quantum Theory was out.

Anyone who may have thinking about the issue and its discussion in the scientific literature (Physics) from the beginning of s. XX can verify that the arguments used have little consistency and its adduced experimental evidence are not conclusive; among other things, the “unification” between Quantum Theory and Gravitation seems to be impossible to carry out; therefore, it does not turn out logical to consider inertial mass for all situations in which nature itself is manifested, so the assumption of virtual mass can be feasible and consistent with its involved energies.

On the other hand, both the Standard Model of Elementary Particles and Cosmological Model put on many issues and problems introducing concepts which are not easy to accept, most of them derived from the alleged “unification”.

It is curious to note that in order to solve some of these problems was introduced “Supersymmetry” (SUSY) and “String” which add much more difficulty to the understanding of Nature.

Finally, we allow a philosophical and literary digression: the distance of Stars, yet the nearest, is so great that we (humans) only may “walk around them” thanks to the **inner space** of our mind, with which we can approach the **inner space** of the star; in other words, the “material” (actual mass) connection through **exterior (ordinary) space** is impossible, but we can use the “immaterial (virtual mass) realities”: mind and inner space of Stars.

Meanwhile, we keep wondering what are those at night:

*“Twinkle, twinkle, little star
How I wonder what you are
Up above the world so high
Like a diamond in the sky”!.*

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