Physical Phenomena and Theoretical Problems Explained by the Micro-Quanta Paradigm

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Abstract

The physical research deals mostly with intriguing problems which appear beyond the current physics. But sometimes they are not well established on theoretical and observational basis. There is however several already observed phenomena that are really beyond the current physics and wait for a rational explanation depending on new physical paradigms. For instance, the source of energy heating the galactic cold clouds and QSO, the excess infrared emission from planets, the planetary geophysical evolution and the cosmological evolution in nearly static universe. From the pure theoretical side there are good theories, as Special relativity that kept a "mysterious" character due to the persistent lack of interpretation within some physical paradigm. Considering the micro-quanta collisions with particles through the relativistic Doppler effect, some theoretical problems find solution, as the origin of particle mass, the origin of inertial forces, etc. New physical concepts arise from this paradigm, for instance the *pushing* gravitation that shows the basis for the unification of fundamental forces. Some old concepts hidden in our mind, as the Newton's "gravitational mass", hindered the gravitational research in the last century. For instance the incorporation of the Newton's constant G in General relativity theory guided the theoretical research towards some blind alleys, as the unlimited gravitational collapse (black holes), the Big bang model, the dark energy, etc.

Keywords: Theory of Mass, Pushing gravitation, Gravitational power on celestial masses, Planetary physical evolution, Inter-particle strong force

1. Introduction

Sometimes the interest towards intriguing problems, whose comprehension appears beyond the current physics (as the "dark energy" arising from the Big bang features), appeals the theoretical researchers. However some of these concepts are not well established on theoretical basis and the related observations do not appear unambiguous. The theoretical weakness of some concepts will be discussed in the following Sections.

For instance the "black hole" and the "Big bang" misconceptions appear to depend on the archetype concept of *gravitational mass* which, according to Newton's ideas, originates the *pulling* gravitational force.

On the other hand, we know that some *already observed* phenomena (for instance the energy heating the galactic gas clouds or QSO, the excess infrared emission from planets, the planetary physics, the high energy cosmic rays, etc) are still waiting a rational explanation. This "cabinet" of forgotten science is a good place to find unexplained phenomena requiring more complete descriptions of the phenomena.

New physical paradigms have to explain phenomena whose comprehension is beyond the current physics. Preferred theories describe the observed phenomena through plain mathematical laws to the aim of giving both rational comprehension and clear predictions.

To give an example, we briefly analyse the phenomenon of the heat generation within the cold galactic gas clouds. According to the classical gravitation, energy is generated by the Newton's force heating and contracting the cloud mass through collisions which reduce the inter-particles distance. The astronomers observed that the cold Bok's globules attain, within about half million years, hot spot temperatures up to the threshold of the Hydrogen nuclear fusion originating new stars.

Which source of energy gets hot the cold gas clouds? Classical physics has no rational answer since the Newton's force *creates* kinetic energy *without* receiving energy, in contrasts with the First Principle. Of course Newton's law didn't respect the Principle because it was elaborated a century later. But today we are obliged to respect the energy conservation Principle.

In Sec.6 it is examined the origin of the gravitational power heating any celestial mass. This applies also to the planets, giving rise to the *observed* excess infrared radiation and to long term fluctuations of the external temperature which have been clearly observed during the last million years on the Earth (ice core data).

It is clear that some physical process has been missed in Classical physics.

The relativistic paradigm explains that *new* particles arise from collisions at very high kinetic energy, in accord with the relativistic mass-energy equivalence. However Special relativity did not specify the structure of particles, nor the process which disrupts them and generates new particles.

Besides, the General Relativity theory, as well as Newton's gravitation theory, contains the gravitational constant, so the model of universe *expanding under* gravitation (relativistic cosmological models) appears questionable.

From the present state of physics, one may point out *at least* the following Physical phenomena and Theoretical problems which did not have an explanation within the conceptual frame of Relativistic Mechanics + G.R. Gravitation.

The unexplained *Physical phenomena* we examined are:

-   The misconception of the classical gravitational energy

-   The excess infrared emission from giant solar planets

-   Earth's high seismic level and crust ruptures with magma escaping

-   Earth's infrared emission and the temperature cycles of Glacial Eras.

From the *theoretical* side, there are several problems that did not found a plain explanation within current physics. For instance the origin of particle mass, the origin of the inertial forces and gravitational force, the origin of the gravitational power, the *common* origin of the fundamental forces, etc. Among the theoretical troubles rising from the current physics, the following ones have been explained through the Micro-quanta paradigm :

-   The physical origin of mass

-   The collision process generating the Inertial forces.

-   The quantum gravitational *pushing* force

-   The theoretical unlimited gravitational collapse.

-   Origin of the gravitational power within any celestial mass

-   The strong force between particles.

In the following the unexplained phenomena and theoretical problems are analysed and compared with the experimental results or the theoretical explanations given by the micro-quanta paradigm.

2. The physical origin of mass

Each particle is characterised by the rest-mass, which depends on the electromagnetic energy holding the particle. All particles are hold by charges, whose sum can be sometimes zero. However it is not clear the reason *why* the rest-mass, tightly linked to the inertial and gravitational phenomena, is equivalent to the particle electromagnetic energy.

Current physics elaborated a complex theory - the *Standard Model* of elementary particles - to explain the phenomena of High Energy physics through specific theories and a long list of adjustable constants (L.Smolin, 2006). The *Standard Model*, created through decades of experimental and theoretical work by hundreds of people, accounts for the mass of particles and for the fundamental forces (excepting gravity), constituting a useful tool to understand the nature. The reason why the theory of the gravitational interaction is lacking in the *Standard Model* may depend on the archetype of the Newton's *pulling* force, whereas other fundamental forces are transmitted by waves *colliding* with particles. This characteristic of classical gravitation introduces non-natural phenomena such as the *unlimited* gravitational collapse reducing large stars up to a material point (Sec.5).

To explain the mass of stable and short-lived particles formed in High Energy collisions requires the assumption of the Higgs boson, a heavy particle (more than 120 times the proton mass) which, roughly speaking, has the property of creating the mass of particles. Up to now, the very High energy LHC experiments did not verify this assumption.

These rough hints about the historical development of the *particle physics* help us to point out that the scientific community failed to establish *in the past* a plain theory of mass. In my opinion, the favourable contest was that following the advent of Special Relativity, which opened the way to the solution showing the equivalence between energy and rest-mass. However the happy event did not take place.

In its *Reply* to the criticism of a book (L.Schilpp, 1949) contributed by many physicists in honour of his 67th birthday, Albert Einstein expressed some profound considerations and remarks. The most crucial point was the balance of physics within the preceding one hundred years:

"[The classical physics] has nevertheless been abandoned since Maxwell and Hertz have shown that the idea of forces at a distance has to be relinquished and that one cannot manage without the idea of continuous fields. The opinion that continuous fields are to be viewed as the only acceptable basic concepts, which must also be assumed to underlie the theory of material particles, soon won out. Now this conception became, so to speak, "classical". But a proper, and in principle complete, theory has not grown out of it. Maxwell's theory of the electric field remained a torso, because it was unable to set up laws for the behaviour of the electric density, without which there can, of course, be no such things as an electro-magnetic field. Analogously the General theory of relativity furnished then a field theory of gravitation, but no theory of field-creating masses."

These few rows cannot be ignored by anyone investigates about the problems of contemporary physics. Einstein denounced with clarity the inadequacies. Firstly he recalled that the concept of field is central. The physicists need such *physical continuum* as a flux of small waves carrying the interactions between masses and charges. The first example was the Maxwell's electromagnetic field, but his theory remained unfinished because the flux of waves that determines the field at any point was not found.

Einstein did not save critiques even to his General Relativity theory, which described the gravitational field but did not explain how the mass creates the *physical continuum* generating the field.

This last observation shows with no doubt that he was thinking the gravitation interaction within the old Newton's scheme, i.e. the "gravitational" masses exchange forces between them in the *void* space. This archetype of the mass "creating" *pulling* forces put many obstacles to the research in general. For instance, Einstein was induced to adopt a sophisticated mathematical formalism defining the metrics of *void* space which meets the field characteristics. However, his intellectual honesty compelled him to admit that G.R. contains no theory of field-creating masses.

Taking as a guide these Einstein's recommendations, we try to show that a correct choice about the *physical continuum* enables us to explain the origin of the mass, the relativistic inertial forces and the Gravitational force between particles.

Finally let's recall that Einstein assumed in G.R. theory the additional hypothesis, not logically required, that gravitational actions have the same velocity of the electromagnetic waves. This assumption − empirically *not* verified and not accepted by all physicists − has gradually gained consensus between them.

In our paradigm the micro-quanta carry the gravitational interaction with the same velocity of the light constituted by photons that are directional packets of micro-quanta.

Resuming, there is a good basis to assume that a flux of micro-quanta filling the space constitutes the "*continuum"* recommended by Einstein.

2.1 The physical reality underlying Special relativity

The Special Relativity theory, published in 1905, was elaborated by Albert Einstein through logical-mathematical reasonings about two established paradigms: classical Mechanics and Maxwell's electromagnetism. To be compatible, Classical mechanics must be substituted by Relativistic mechanics when the particle velocity is comparable to the light speed. The analysis of the invariance of Maxwell's equations under transformations of co-ordinate systems, gave Special Relativity an "abstract" character linked to some strange predictions (e.g. different body contractions depending on the different velocities in different inertial frames, etc.) that the same Einstein defined as a consequence of "our manner" to see the things. The criticism about these abstract predictions gave rise to some well known paradoxes (for instance the twins paradox) and to claims of logical absurdity (H.Dingle, 1972). No other theory so much attracted the interest of philosophers, so meaning that some concepts can hardly be expressed within unambiguous terms.

As a matter of fact, after a century of experimental results, there is no doubt that Special Relativity theory interprets correctly some natural laws depending on some physical phenomena still unknown to the current physics. The "mysterious" character of S.R. comes likely from this fact.

Our aim is to show that the relativistic mass and momentum of moving particles depend on the interaction with the *micro-quanta* flux filling the space, whose collisions with particle cross sections generate their masses.

Since this physical *"continuum"* is undulatory, the relativistic Doppler effect describes the collisions between particles and quanta. Doppler effect is the door that connects the world of particles and the world of waves.

Let's consider a free particle moving through the flux of micro-quanta.

The particle velocity is defined through Doppler as the *effective velocity* which changes the frequencies of the micro-quanta incident along the direction of motion. Namely, the frequency of quanta colliding in front is $\nu_f = \nu_o (1+ v/c)^{1/2}/(1-v/c)^{1/2}$, whereas $\nu_b = \nu_o (1- v/c)^{1/2} / (1+v/c)^{1/2}$ is the frequency of quanta colliding behind. So, the effective velocity v can be expressed, operationally, through the ratio $(\nu_f /\nu_o) = (\nu_o/\nu_b)$ between the frequency in front and the natural frequency ν_o of micro-quanta

$$v /c = [(\nu_f / \nu_o)^2 - 1] / [(\nu_f / \nu_o)^2 + 1] .$$

For instance, a particle is *at rest* (**v** = 0) respect to the *incident isotropic flux* when the frequencies in front and behind *equal* ν_o.

Being the Doppler frequencies an intrinsic characteristic of the particle motion, the velocity **v** appears to be the effective or *absolute* velocity (i.e. not-depending on the reference systems) of the particle. Of course the frequency ν_f (or ν_b) might be hardly observed. But we may observe the energy and momentum of the particle (eq.3) which gives its velocity on *physical* grounds.

This explains the accuracy of the solar system dynamics when referred to the "inertial" frame linked to large masses of the universe, because they are globally *at rest* respect to the local flux of micro-quanta.

The undulatory characteristics of the electromagnetic waves, as well as other waves, are defined by proportionality between energy and frequency. For usual electromagnetic waves the proportionality is given by the Planck's constant. For the very small energy $E_o = h_o\nu_o = h_o c/\lambda_o$ of micro-quanta the proportionality constant is much smaller than the Planck's one. As later shown, we assume that the quantum wavelength λ_o equals the Planck's length $l_P = (Gh/c^3)^{1/2} \cong 4\times10^{-35}$ which depends both on gravitational and inertial phenomena. This choice is congruent with other parameters of micro-quanta shown in Table 1.

Very important is the concept of *simultaneous* collisions of micro-quanta upon the particle cross section σ_i. The time a quantum wavelength λ_o requires to bounce is of the order of $\tau_o = 2\lambda_o/c$, so the simultaneous collisions in front of the particle are $N_f = \sigma_i \phi_f \tau_f$, whereas behind are $N_b = \sigma_i \phi_b \tau_b$, where ϕ_b and ϕ_f are the perturbed fluxes behind and in front of the particle. To give an idea, the simultaneous collisions of micro-quanta upon a nucleon are of the order of 10^{50}, a fact which justifies the collision process as a *stationary* event. This originates the stable particles, as well as the short-lived particles.

Whatever the numerical value of h_o, the momentum of a free particle moving within the quantum flux is given by the momentum received from backward collisions minus the momentum of forward collisions

$$| \mathbf{q} | = N_b E_b / c - N_f E_f / c = (h_o /c) \sigma_i (\nu_b \phi_b \tau_b - \nu_f \phi_f \tau_f) \tag{1}$$

which, recalling that $\nu_j \tau_j = 1$, becomes

$$| \mathbf{q} | = (E_o / c\nu_o) \sigma_i (\phi_b - \phi_f). \tag{1a}$$

Free particles moving within the isotropic flux ϕ_o maintain indefinitely their motion (principle of Inertia) since the micro-quanta do not create obstacles to stationary straight motions. The conservation of the unperturbed energy density $\ni_o = \phi_o E_o/c$ of micro-quanta requires that, during the collisions, the energy density in front and behind the particle, remains unchanged, although the related frequencies change with Doppler

$$\ni_o /2 = \phi_o E_o /2c = \nu_b \phi_b h_o /c = \nu_f \phi_f h_o /c. \tag{2}$$

Substituting in this equation the Doppler frequencies ν_f and ν_b, the resulting perturbed fluxes can be substituted in eq.(1a) obtaining the momentum of a free particle moving within the flux of micro-quanta

$$\mathbf{q} = [\sigma_i \phi_o \tau_o E_o / c^2] \mathbf{v} / (1- v^2 / c^2)^{1/2}. \tag{3}$$

This expression coincides with the relativistic momentum when the product in brackets defines the *inertial rest-mass* of particles originated by collisions with the micro-quanta flux

$$m_{oi} = (\sigma_i \phi_o \tau_o) E_o / c^2. \tag{4}$$

It defines also the proportionality between *cross-section* and *mass* of particles $\sigma_i = m_{oi} A_o$ where A_o is a constant not depending on particles characteristics

$$A_o = c^2 / \phi_o \tau_o \, E_o. \tag{4a}$$

Let's remark that eq.(4) shows specifically that the rest-mass of a particle

$$m_{oi} \, c^2 = (\sigma_i \, \phi_o \tau_o) \, E_o = N_i \, E_o \tag{4b}$$

is equivalent to the energy of $N_i = (\sigma_i \, \phi_o \tau_o)$ quanta hitting simultaneously the particle. Notice that N_i is the inverse of the Compton ratio $K_{oi} = E_o / m_{oi} \, c^2$ between the quantum energy and the particle mass- energy.

This equation describes the *inertial* model of particles as *persistent aggregates* of micro-quanta. It shows *specifically* why there is equivalence between rest-mass and energy, as obtained in principle by Special relativity.

As we know, particles may disrupt under high energy collisions. This explain, for instance, that a particle of high energy $E_{tot} = N_i \, E_o /(1 - v^2/c^2)^{1/2}$ may disappear through a violent collision, releasing N_i micro-quanta which rearrange into different particles (with conservation of charge) whose sum of energies equals E_{tot} and the sum of momenta equals the momentum of the original particle.

3. The physical process generating the inertial forces

First of all, we have to define the inertial force on a particle when its effective velocity **v** is varying during the simultaneous collisions of micro-quanta. Following the scheme of eq.(1) defining the particle momentum, the inertial force depends on the collision rates in front ($\sigma \phi_f$) and behind ($\sigma \phi_b$) which depend on Doppler

$$| \boldsymbol{F}_{in} | = \sigma (\phi_b \, E_b /c - \phi_f \, E_f /c) = \sigma (E_o \tau_o /c) \, (v_b \, \phi_b - v_f \, \phi_f). \tag{5}$$

When we apply this equation to a *freely* moving particle, the conservation of energy density in front and behind (see eq.2) shows immediately that the inertial force is zero.

Of course when a particle feels an *external* force, the conservation of the energy density in front and behind is no longer verified and eq.(5) gives the *correct* inertial force. Putting in eq.(5) the rest-mass of eq.(4) one obtains

$$|\boldsymbol{F}_{in}| = m_o \, c \, [v_b \, (\phi_b /\phi_o) - v_f \, (\phi_f /\phi_o)] \tag{6}$$

where the flux ratios ϕ_b/ϕ_o and ϕ_f/ϕ_o depend from the particle motion.

It may be useful to make recourse to the relativistic law of dynamics which defines the inertial force through the time derivative of the momentum

$$\boldsymbol{F}_{in} = - \, d\boldsymbol{q} / dt = - \, d \, [m_o \boldsymbol{v} / (1 - v^2 / c^2)^{1/2}] \, / dt \tag{7}$$

where the velocity **v** is referred to an *inertial* frame to be individualised. In this way one obtains the Inertial forces of Relativistic mechanics.

This definition is quite different, conceptually, from the physical process of quantum collisions described by eq.(5), as derived from micro-quanta paradigm.

However the numerical difference between the two quantities is very little.

For instance it has been shown that the process of collisions originating the inertial forces leads to a centrifugal force (M.Michelini, 2007)

$$\boldsymbol{F}_{cf} = - \, [m_o / (1 - v^2 / c^2)^{1/2}] \, \Delta \boldsymbol{v} / \tau_o \tag{8}$$

where it appears the velocity incremental ratio ($\Delta \boldsymbol{v}/\tau_o$) respect to the finite duration $\tau_o \approx 10^{-43}$ of the simultaneous collisions.

From the standpoint of the numerical accuracy the centrifugal force defined by Relativistic Mechanics

$$\boldsymbol{F}_{cf} = - \, [m_o / (1 - v^2 / c^2)^{1/2}] \, d\boldsymbol{v} / dt \tag{9}$$

may be assumed accurate to any practical purpose, since the assumption $\Delta \boldsymbol{v} / \tau_o \cong d\boldsymbol{v} / dt$ is justified when the time increment is very little.

The process of collisions originates *inertial forces* which depend on the change of velocity $\Delta \boldsymbol{v}$ occurring in the time τ_o. An accelerated particle creates a *compression* of the energy density in front and a *depression* behind, so the inertial force experienced by an accelerating particle is a real reaction related to the *radiation pressure* of the micro-quanta flux. All references to inertial systems of co-ordinates vanish.

3.1 The new fundamental inertial forces

The Inertial forces experienced by particles moving within the quantum flux give us an additional physical insight. In the relativistic paradigm, inertial forces depend on the particle velocity respect to an "inertial" frame,

for instance signalled by fixed stars. Since the far (fixed) stars do not surely interact with the particle, the inertial forces arise *locally* from the *void* space. But it is impossible to generate forces in absence of fields.

To make sense, the experimental inertial forces require that the micro-quanta flux filling the space contains sufficient local energy to generate very high inertial forces on colliding particles.

Eq.(2) shows that the energy density in space $\ni_o = \phi_o E_o / c \approx 2.4 \times 10^{61}$ J/m^3 equals twice the high quantum radiation pressure p_o (Sec.4). This quantity depends on the very high micro-quanta density (ϕ_o/c). These quanta however do not interfere each other due to the extremely low mutual cross section, corresponding to quantum mean free path of the order of 10^{22} metres.

Nevertheless a question arises. Since the nucleon cross section (Table 1) is $\sigma \approx 7.85 \times 10^{-38}$, the nucleon energy density may be estimated naively as $(m_o c^2 / \sigma^{3/2}) \approx 10^{46}$ J/m^3, which is about 10^{15} times lower than the energy density of the *physical space*. This astonishing result may simply mean that the elementary particles, with charge placed at centre, are internally void and their mass is limited to the thin surface layer (thickness λ_o), according to the *inertial model* of particles expressed by eq.(4b) which, after rearranging, shows

$$m_{oi} c^2 = 4 \sigma_i p_o \lambda_o. \qquad (10)$$

The known *fundamental* forces between particles are *position forces,* that originate through interaction between matter and quantum waves and can be measured with sufficient accuracy. On the contrary, the difficulties of the accurate measuring of *inertial* forces made them a sort of "*ghost forces*".

Today the high centrifugal force on protons and electrons circulating within known high magnetic fields reveal a centrifugal force of $10^{-8} \div 10^{-7}$ N, which is about the same calculated for the electron moving in the Hydrogen atom. Moreover we calculated for the Deuterium's nucleons (M.Michelini, 2008) a centrifugal force, which counteracts the nucleonic force, rising up to 10^5 N. According to many physicists, the inertial forces attain in High energy collisions values that are able to disrupt the particles.

These evidences require that the local space *must contain* a high energy density.

Within the present paradigm, Inertial forces become *fundamental* (i.e. *physical*) *forces* because depend on the physical interaction between the motion of *single particles* and the micro-quanta flux. Probably the collision process originating these forces represents the *best physical evidence* of the micro-quanta. These small quanta passed up to now unobserved, leaving to growth the *erroneous* belief that inertial forces arise uniquely from *space* and *time*, without intervention of physical waves.

4. The origin of the quantum gravitational pushing force

Up to some decades ago G.R. theory was still considered *the* theory of the gravitational interaction.

However at present its drawbacks have been recognised through the deficiency of cosmological models and the questionable existence of the black holes.

Some decades after the celebrated advent of G.R. theory, Einstein recalled that to explain the interactions between mass/particles we need the concept of field sustained by some *physical continuum* filling the space. This statement was dramatically in contrast with G.R. theory, which assumed that the gravitational force arises from the metrics of space-time *deprived of any physical continuum.*

Einstein was probably conscious that the mathematical structure of G.R. was not able to describe by means of *physical waves* the gravitational *interaction* between masses.

As previously recalled (L.Schilpp, 1949) he declared his opinion: "*[...], the General theory of relativity furnished then a field theory of gravitation, but no theory of field-creating masses.*"

This means that in the Einstein's late opinion the *masses* do not create gravitational field. But this does not deny that some kind of waves sustain the gravitational force.

Introducing the *pushing* gravitational force, the theoretical problem vanishes.

Let's now assume a flux of micro-quanta filling the space and scattered by collisions upon particles.

It is known that two particles immersed in a homogeneous flux of quanta show a *self-shielding effect* which gives rise to a force *pushing* each other. Putting this force numerically equal to the Newton's force, we obtain a constrain. Of course, in this case the concept of "gravitational mass" does no longer exist.

According to the Einstein's view, the "strong" formulation of the Equivalence Principle means that *both* inertial and gravitational forces originate from the *same* physical phenomenon. Let's transfer entirely this principle in the micro-quanta paradigm.

A plain derivation of the gravitational force has been shown (M.Michelini, 2007) considering a neutral body made, for the sake of simplicity, of nucleons (which constitute the 99,95% of a neutral mass) with cross section σ_n. Obviously the mass of the electrons can be taken into account, but with no sensible increment of the calculation accuracy, considering that the measurements of the gravitational constant G are affected by discrepancies sometimes greater than 0,05% (M.Michelini, 2009).

Any quantum bouncing on a particle along the radial direction r leaves a momentum $|\ q\ | = 2E_o/c$ which is balanced on the opposite side by a quantum bouncing along the direction ($-r$). Considering the enormous number of simultaneous isotropic collisions, the particle does not feel any resultant force.

In general from eq.(4b) the total number of quanta colliding simultaneously on the particle i results $N_i = m_i c^2/E_o$ and is of the order of 10^{50}. Because the Compton ratio $K_i = E_o/m_ic^2 = 1/N_i$ is very small, the micro-quanta undergo a Compton scattering following the *optical law* on the particle surface (M.Michelini, 2008).

Let's now consider a pair of nucleons. As a consequence of the optical reflection, no quantum flying along the joining line can hit both the "forbidden" small cross sections

$$\Delta\sigma = K_n^{1/2}\sigma_n \qquad (10a)$$

placed in the centre of σ_n of the two nucleons, where K_n has to be taken from empirical basis.

Defining $\gamma(r) = (\Delta\sigma/2\pi r^2)$ the solid angle by which a forbidden $\Delta\sigma$ is seen from the other, we obtain the *missing quantum beam* $\psi(r) = \Delta\sigma\phi_o\gamma(r) = \phi_oK_n\sigma_n(\sigma_n/2\pi r^2)$.

The *not balanced* collisions related to the missing beam, produce on both particles the pushing force

$$f(r) = \psi(r)(2E_o/c) = (2E_o/c)\phi_oK_n\sigma_n(\sigma_n/2\pi r^2). \qquad (11)$$

Substituting through eq.(4a) the nucleon cross section $\sigma_n = A_om_n$, one finally gets the expression

$$f(r) = [E_o\phi_oK_nA_o^2/\pi c]\ m_n^2/r^2 \qquad (11a)$$

which becomes just the Newton's law of gravitation between two nucleons when the term in the brackets equals the gravitational constant

$$[E_o\phi_oK_nA_o^2/\pi c] = G. \qquad (12)$$

The quantity G is the product of quantum constants, one of which, namely ϕ_o, probably varies across the universe as a consequence of the self-shielding of large masses.

Thus G is no longer an universal constant and the locution "universal gravitation" in no longer correct.

A guess of the radiation pressure on the particles $p_o = E_o\phi_o/2c \approx 1.2\times10^{61}$ N/m^2 was found comparing the electric and the nucleonic force (see Sec.6) between two adjacent protons within a nucleus (M.Michelini, 2008). Recalling eq.(4a)

$$A_o = c^2/\phi_o E_o\tau_o = c^2/4\lambda_o p_o \qquad (13)$$

and assuming the quantum wavelength λ_o equal to the Planck's length (i.e. $\lambda_o \approx l_P = 4\times10^{-35}$) one gets

$A_o \approx 4.7\times10^{-11}$. Substituting A_o and p_o in eq.(12) one gets the constant $K_n \approx 3.94\times10^{-51}$, so the number of simultaneous collisions upon a nucleon is $N_n \approx 2.54\times10^{50.}$ Subsequently one calculates the quantum energy E_o, the flux ϕ_o and the nucleon cross section σ_n. The principal micro-quanta characteristics are reported in Table 1. We have to remember that the particle cross sections may vary in the collisions as a consequence of the kinetic energy. The reported nucleon cross section is equivalent to the rest-mass.

< Table 1 >

Since the Planck's length is defined through dimensional analysis, it may be inaccurate of a little factor (such as 2, π, etc.). Assuming $\lambda_o \approx l_P$ and $p_o \approx 1.2\times10^{61}$ N/m^2, eq.(13) may give a ratio A_o somewhat different from the guess $\approx 4.7\times10^{-11}$.

Let's now to express some general considerations about the numerical structure of the pushing gravity. Between a pair of nucleons the rate of the quantum missing beam

$$\psi(r) = \phi_oK_o\sigma(\sigma/2\pi r^2) \approx 3.7\times10^{42}(\sigma/2\pi r^2) \quad \text{quanta/sec} \qquad (14)$$

is correlated to the distance between the particles. For instance between two nucleons placed at a distance of 10 cm (laboratory apparatus), the strength of the *missing* beam equals about 4×10^6 quanta/sec. This explains why the *intermittent* quantum pushing gravity may be confused with the *continuous* Newton's force.

However, things are not so simple when the gravitational force between two nucleons is calculated placing the former on the Earth, the latter on the Sun. In this case we see the statistical nature of quantum gravity, because the missing beam equals 1 quantum at any 17.2×10^9 years. Only the great number of Earth's and Sun's nucleons is able to restore the balance of their gravitational force. Obviously the pushing gravity considers times larger than the so-called age of the universe (14×10^9 years). This leads cosmology to a model of universe similar (but not equal) to the stationary Hoyle's model. A brief discussion is reported in Sec. 5.

4.1 Remarks about the detection of gravitational waves

This section ends recalling that the problem of detecting the gravitational waves does not vanish in the *pushing* gravity theory. The experimental search of the gravitational G.R. waves was promoted by J. Weber in 1968 using heavy solid detectors. Measurements are presently made with large and accurate facilities based on the new generation (laser interferometers) of gravitational wave antennae which, considering the inherent noisy character of the process, have not led scientists to the expected results after decades of detection of far astrophysical events.

I agree with the opinion recently expressed by D. Rabounski which believes that "in some way" the gravitational waves will be found, since the physical interaction exists (D.Rabounski, 2008).

Let's focus the attention on the fact that, in the present work, the *pushing* gravitational force is just due to the interaction between particles and waves with known characteristics (the micro-quanta) which explain some gravitational phenomena placed beyond the current physics. Considering the very small energy of micro-quanta, it is questionable if single waves might be ever observed. In this sense Loinger appears correct when claims that in General Relativity are not foreseen GW's (A.Loinger, 2007).

However if one thinks of gravitational waves as oscillations of the *space energy density* $\ni_o = \phi_o E_o /c$ defined by eq.(2), it seems conceptually possible to devise some experiment aimed to the detection of these oscillations.

A possible idea may be to observe single charged particles easily managed in laboratory (cyclotron, etc) to the aim of detecting some deviations from the ordinary trajectory of particles due to fluctuations of *local* energy-density $\ni_o$ influencing the centrifugal force which balances the magnetic force.

Another proposal may be, in principle, to detect possible effects on the *pushing* gravitational force of masses made of atoms/nuclei oscillating in phase. This might induce on the pushing gravitational force a small Doppler effect related to the thermal velocity. Further development is required.

5. The theoretical unlimited gravitational collapse

As we know, two particles immersed in a flux of quanta feel a *pushing* force, contrary to the Newton's force which is *pulling* them. This simple reverse produces a great change in the physical phenomena of the Universe.

Consider for instance the gravitational collapse which takes place on stars of large mass *M* where the classical gravitational pressure

$$p_{gr} \approx G\, M^{2/3}\, \delta^{4/3} \tag{15}$$

becomes higher than the ideal gas pressure $p \approx (k/m)\delta T$ that balances gravity.

The astronomers observed very luminous *supernovae* due to the collapse (and consequent explosion of the external layers) of stars with $M \geq 4 \div 8$ Sun masses, which leave in their place a few neutron stars of little radius and high density. This has been observed in several star collapses.

The Central Bureau for Astronomical Telegrams has published data about the discovery of new Supernovae (CBAT, 2010). In the period 2001-2010 about 85-90 Novae within the Milky Way have been signalled by the astronomers. Perhaps only a fraction of these stellar explosions did really originate neutron stars. Nevertheless assuming an average of 2-3 neutron stars per year, this means that dark mass in the Milky Way (that is about 6-9 times the luminous mass) may be due to neutron stars with about the Sun mass. Assumed the Milky Way constituted by 10^{11} solar masses, one obtains that the dark mass has been originated within 3×10^{11} years.

Although 20 times greater than the standard age of the universe, this time does not create troubles in the nearly static universe.

The astrophysicists studied several models of star collapse, according to Classical mechanics or General relativity theory. In these models the star mass continues to shrink up to *vanishing*, although its gravity remains unchanged in the outer space (black hole).

These calculations gave rise to troubles, because the law of physics (such as the gas pressure) are not known at very high densities when about all matter is constituted of neutrons.

From the astronomical point of view, black holes have not been found up to now, but they are difficult to individualise through the motion of nearby orbiting stars.

This fact put a general question to the physicists (Bloomer & Dunning-Davies, 2005) examining the accountability of exotic stars versus conventional wisdom. The black holes do not show credibility. Someone made new G.R. calculations and found that star collapses may stop leaving a very dense body, in analogy with the neutron stars observations.

From the theoretical viewpoint there is evidence that black holes are tightly linked to collapse models using the *pulling* gravitational force (i.e. Newton's and G.R. theory) that reaches infinite values when the star radius tends to zero.

In the *pushing* gravity the *unlimited* collapse does not take place because the gravitational pressure cannot attain the maximum pressure in nature, i.e. the radiation pressure of micro-quanta upon particles $p_o \approx 1.2 \times 10^{61}$. The pushing gravitational pressure within dense stars does not likely exceed a very small fraction of p_o.

5.1 Dark energy and cosmological redshift

The astronomers observed many decades ago that the peripheral stars in Milky Way show a velocity corresponding to a gravitational force consistently higher than that of the observed galactic mass.

Vera Rubin suggested the hypothesis of the *dark mass*, i.e. the presence in the galaxy of many obscure bodies which do not emit appreciable light or infrared radiation, but are gravitational bodies. This assumption is under check by counting the supernovae that are observed in the Milky Way (CBAT, 2010).

The dark mass hypothesis has no relation with the "*dark energy*" hypothesis which arose recently to the aim of explaining a change in the relativistic Big bang model introduced by new redshift measurements through supernovae Ia. These results suggest an *increase in the expansion rate* of the universe, in contrast with the braking force due to the universal gravitation related to the quantity *G* assumed unifom and constant in G.R. theory.

From the standpoint of the micro-quanta paradigm, which sustains a nearly stationary universe similar to that described through the observations of the astronomer Halton Arp, the *dark energy* appears a *misconception* arising from the deficiencies of the Big bang model.

In our nearly stationary universe the pushing gravitation between distant galaxies tends exponentially to zero because the weak self-interaction of micro-quanta (mean free path of the order of 10^{22} meters) restores the quantum flux *isotropy* far from the galaxies. Zero missing beam equals zero gravitation between two particles. Gravitational motions are confined within the giant clusters of galaxies.

Obviously the question of the cosmological redshift, that was assumed as proof of the universe expansion, must find an explanation. The original Hubble's law says, strictly speaking, that "the observed redshift is proportional to the distance of galaxies". This fact can be explained in terms of the photon "thermodynamics" related to the high number of the constituting micro-quanta. The scientific community advanced many decades ago the hypothesis of the "tired" light. Now the lowering of the photon frequency may depend on the small interaction between photons and the surrounding micro-quanta flux.

This picture completes the cycle of the great quantity of radiation emitted from hot matter and diffused in the universe. The radiation energy cannot vanish, it simply degrades and comes back to the micro-quanta flux, from which the atoms draw, in turn, the energy they emit as photons.

6. The origin of the gravitational power within celestial masses

This argument has been briefly presented in the Introduction talking about the misconception of the classical gravitational energy derived from the Newton's force.

From the present definition of the *pushing* gravitation, the mystery of the energy source heating the Bok's globules up to the star ignition, has found solution (M.Michelini, 2010).

Let's recall eq.(11) which describes the force pushing a pair of nucleons, whose self-shielding determines a missing beam $\psi(r)$ between them. The quantum rate of the beam given by eq.(14)

$$\psi(r) \approx 3.7 \times 10^{42} \left(\sigma/2\pi r^2\right) \text{ quanta/sec}$$

is correlated to the distance between the particles. For instance between two H atoms placed on the diameter of a cold Bok's globule (8°K external temperature) at a distance larger than 10^{14} metres, the beam rate equals about 4×10^{-24} quanta/sec, that is about 1 quantum at any 10^{16} years. The pushing quantum gravity changes the temporal age of the universe, because the gravitational force between peripheral particles of a Bok's globule requires a

time interval considerably greater than the current age of the expanding universe (1.4×10^{10} years). The time scale of the universe is strongly enlarged and it appears to be static-evolving, similarly to the galaxies observed by the astronomer Halton Arp that light up in many places of the universe whenever the gravitational power heats them.

Where this gravitational power is coming from?

The unbalanced collisions (*missing beam*) transfer little quantities of momentum and energy to the particles. To find the power $p_i(r)$ transferred to a pair of particles let's consider the pushing gravitational force eq.(11) multiplied by the velocity c of the beam of bouncing micro-quanta,

$$p_i(r) = c\,(2E_o\,/c)\,\phi_o K_o \sigma_n\,(\sigma_n\,/2\pi r^2) = (2E_o/\tau_o)(\sigma_n\,/2\pi r^2) \tag{16}$$

where it has been substituted $\phi_o K_n \sigma_n = 1/\tau_o$.

This equation shows that the simultaneous collisions give up in the time τ_o the energy

$$\Delta E = p_i(r)\tau_o = 2E_o\,(\sigma_n\,/2\pi\,r^2) \tag{17}$$

upon each particle. The fact that particles receive energy from waves is well known in the collisions of the electromagnetic waves (Compton's scattering).

6.1 The gravitational power on the galactic Bok's globules

Let's consider a galactic gas cloud at low temperature. The gravitational power upon this body of radius R is defined (M.Michelini, 2010)

$$P_{gr} = \int_0^R p_i(r)\,4\pi\,r^2[\delta\,(r)/m_N]dr \tag{18}$$

For the sake of simplicity we adopt in eq.(16) the newtonian notation (equivalent as long as G remains constant)

$$p_i(r) = G\,m_N^2 c\,/x_i^2 \tag{18b}$$

which shows the power *feeding* the gravitational force between two nuclei of mass m_N placed at an average distance x_i

To calculate the effective distance between atoms of an emitting gas, one may make recourse to the Wien's law $\lambda = 2.89\times10^{-3}/T$ which gives the most probable frequency of the infrared radiation emitted by the nuclei of two grazing atoms $\nu = c\,/\lambda = 1.038\times10^{11}T$.

Putting $x(t)$ the distance between the two atoms, for a very small time their charged nuclei oscillate with amplitude $x(t) \cong x_o\,/\cos(\omega t)$, so it can be assumed that the infrared emission happens when the distance is x_o and the instantaneous angular velocity is

$$\omega = \text{v}\,/x_o = (2kT\,/m_N)^{1/2}\,/\,x_o = 2\pi\nu = 6.52\times10^{11}T. \tag{19}$$

From this equation one gets $x_o^2 = 6.49\times10^{-47}/\,T\,m_N$ which, substituting $x_i \approx x_o$ in eq.(18b), gives the average energy loss of a just emitting pair placed at a distance r along the gas cloud radius

$$p_i(r) = 1.54\times10^{46}\,G\,c\,m_N^3(r)\,T(r). \tag{20}$$

Substituting in eq.(18) and integrating to a gas globule made of equal molecules, one has

$$P_{gr} = 1.54\times10^{46}\,Gcm_N^2 \int_0^R 4\pi\,r^2\delta(r)\,T(r)\,dr\,. \tag{21}$$

Considering that the molecule within the Bok's globule is Hydrogen and recognising that the equation contains the definition of the average temperature of the body, one gets

$$P_{gr} \approx 3.42\times10^{-9}\,M\,T_{av}. \tag{21b}$$

This quantity corresponds (M.Michelini, 2010) to the gravitational power heating and contracting the Bok's globules, whose emitted infrared radiation is a fraction of P_{gr} received from micro-quanta. The remaining fraction of P_{gr} produces the mass heating and contraction. This logical process shows the misconception of Classical physics which assumes that the Newton's contraction generates the heating power. Actually both contraction and heating are manifestations of the same gravitational power.

Obviously, micro-quanta give up the gravitational power to *any* celestial mass. This may be the case of QSO and other bodies, such as the white and brown dwarfs, neutron stars and planets.

6.2 The gravitational power on the planets

Calculating the gravitational power on the giant solar planets is necessary to compare with the observed infrared emission which, deducted of the Sun contribution, resulted much higher than the emission corresponding to the planet cooling in sidereal space. About four billion years ago the planet surface temperature was around one thousands degrees. According to this scheme, the present surface temperature of the giant planets would be near the absolute zero. In contrast with the observations of the infrared excess emission.

The high planetary densities originates the repulsion forces of the Lennard-Jones potential between atoms which prevent further contraction of the planet.

In the present paradigm the gravitational power produces only an internal temperature increase which comes to the surface and diffuses as IR radiation. The related gravitational power has been defined (M.Michelini, 2010)

$$P_{gr} = 2.95 \times 10^{-9} G c \int_0^R 4\pi r^2 \left\{ \delta^2(r) / [T(r)A(r)]^{1/2} \right\} dr \ . \tag{22}$$

The astronomers measured an infrared radiation coming from the interior of giant planets which differs from the predicted P_{gr} power of about 6% (Saturn) and 20% (Jupiter). But the Neptune's measured emission is only 1/5 of the predicted, depending on the fact that the internal structure of these planets (density, temperature) is poorly known.

The same calculation carried out for the Earth, the unique planet whose internal structure is known to some extent, shows a predicted value around $P_{gr} \approx 2.6 \times 10^{15}$ watt. The comparison with the corresponding measured IR emission resulted problematic due to the difficulty to find a reliable average value in literature.

We have at disposal the classical computation (C.Stein, 1995) of the heat flowing by conduction through the solid crust, which amounts to about 4.4×10^{13} watt. This little heat flow can be hardly considered responsible of the seismic activity observed on the crust. The giant solar planets are likely without seismic activity depending on the *fluid* peripheral mass.

In the case of planets and satellites with solid crust, a strong seismic activity takes place when the planet heat flow largely exceeds the power transmitted by heat conduction.

High seismic activity is just the characteristic of the Earth.

The classical heat flow computation considers also the heat flow from all volcano, but *does not take into account* any heat transfer by magma escaping through the *seismic fractures* on the thin solid crust of seafloor (about 6 km thickness, against 40-80 km of continents).

Trying to give an estimation of this quantity, we have to consider that the U.S. Geological Service data show a daily average of about 8 earthquakes with Richter magnitude greater than 4, whereas minor earthquakes may reach some hundreds per day. Note

To give an idea of the total heat released to the ocean seafloor by a great earthquake, let's make recourse to the estimated heat of about 10^{22} Joule released by the earthquake 9.2 Richter that fractured the Sumatra-Andaman fault, producing the Indian Ocean great tsunami of December 26, 2004.

Only one event released the total heat flowing during 7 years, according to the classical computation.

There is another indication. In the last year many You Tube files appeared on the web showing extraordinary images of magma escaping from seafloor, sometimes occasionally filmed by deep cameras. The classical picture, that neglects the continuous fractures, appears today untenable.

Taking this in mind, our research has been directed towards the possibility to find a relation between the gravitational power and the fluctuations of temperature found in Antarctica through the ice core data, which have not yet obtained a clear explanation.

The high gravitational power predicted by eq.(22) requires some cyclic mechanism able to transfer this power from the viscous interior up to the solid surface. In Antarctica it determines the $\approx$100.000 years temperature cycles (J.R.Petit et al.,1999) made of a long series of "rise and fall" corresponding respectively to the seismic phase (crust heating with magma escaping from the seafloor) and to the cooling phase (crust contraction without

magma flow). Presently Earth is in the interglacial heating phase, so it can be expected that through the wide seafloor area (71% of planet surface) may flow about all gravitational power $P_{\text{gr.}}$

7. The strong force between particles

There are several reasons to believe that the fundamental forces of nature (electromagnetic, gravitational and strong forces) arise from the interaction between particles and waves travelling with the velocity of light.

The wide consensus to this idea justifies the locution "unification of forces" to indicate theories aimed to this target. It is then opportune to verify if the micro-quanta paradigm supports this unification. Let's apply in general the optical reflection law of the micro-quanta colliding upon particles. We see in Sec.4 the small " forbidden" cross-section $\Delta\sigma = K_o^{1/2}\sigma$ placed along the line joining two particles, so generating a pushing force between the particles.

The very little constant $K_o \approx 3.94\times10^{-51}$, obtained imposing the value of G on the pushing gravity force, shows that gravitation is really the weakest force in nature.

Now we have to ask ourselves if some other forbidden $\Delta\sigma$ between two particles exists which may give rise to a new pushing force between them. Let's consider Fig.1 showing the optical reflection of micro-quanta upon spherical particles. From this figure it has been obtained (M.Michelini, 2008)

$$\Delta\sigma(r) = (\sigma/2)\,(\sigma/2\pi r^2) \tag{23}$$

showing that the forbidden cross-section depends on the distance between particles. So the beam of quanta that cannot play "ping pong" between the two particles (*missing beam*) results

$$\psi_N(r) = \Delta\sigma(r)\,\phi_o\,\gamma(r) \tag{23a}$$

where $\gamma(r) = \Delta\sigma(r)/2\pi r^2$ is the solid angle under which any forbidden $\Delta\sigma(r)$ sees the other. Then one gets the force due to the *not balanced* bouncing quanta

$$\Phi(r) = \psi_N(r)\,(2E_o/c) = (2E_o\phi_o/c)\,(\sigma/4)\,(\sigma/2\pi r^2)^3. \tag{24}$$

Substituting the radiation pressure $p_o = E_o\phi_o/2c$ and considering two different particles, one obtains the canonical non-commutative form

$$\Phi_{ij}(r) = \quad \sigma_i \quad p_o(\sigma_j/2\pi r^2)^3 \tag{25}$$

of the force acting on the particle *i* due to the particle *j*. Because of the simple scheme adopted for calculation, the accuracy of the nucleonic force is good within distances not exceeding the nuclear radius. When particle *i* is *electron* and particle *j* is *nucleon,* the force $\Phi_{en}(r)$ acts strongly on the electron. Vice-versa the force $\Phi_{ne}(r)$ on the nucleon is normally negligible. When both particles are nucleons, the force becomes the *nucleonic force*

$$\Phi_N(r) = \sigma_n p_o(\sigma_n/2\pi r^2)^3 \tag{26}$$

that holds together neutrons and protons in the nuclei. Since the nucleonic force within nucleus exceeds the electric repulsion between protons, one can assume $\Phi_N(r_x) > e^2/4\pi\varepsilon_o\,r_x^2$, where r_x is the mean distance between adjacent nucleons. A rough calculation shows that a good value (M.Michelini, 2008) of the radiation pressure is $p_o \approx 1.2\times10^{61}$. An application of this strong force has been given (M.Michelini, 2008) for the dynamics of the Deuterium nucleus where the strong force between proton and neutron is balanced by the centrifugal force. The calculation shows a distance between the nucleons equal to $1.6\times10^{-16.}$

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Table 1. The principal characteristics of micro-quanta paradigm

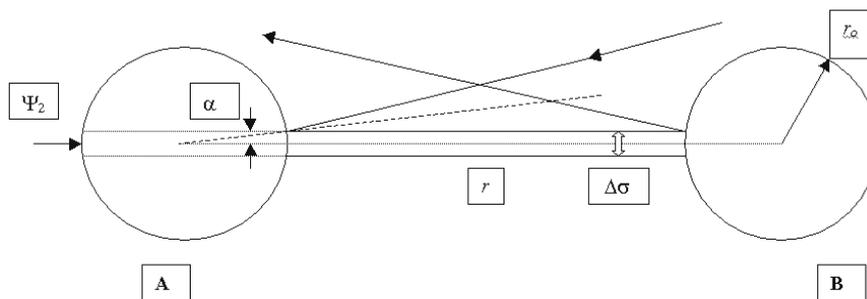|		
- λ_o	$\approx 4\times10^{-35}$	micro-quantum wavelength
- $A_o \approx 4.7\times10^{-11}$		universal ratio (cross section / mass)
- $E_o \approx 5.9\times10^{-61}$		micro-quantum energy
- $\phi_o \approx 1.22\times10^{130}$		micro-quanta flux
- $p_o \approx 1.2x10^{61}$		quantum radiation pressure on the particles
- $\sigma_n \approx 7.85\times10^{-38}$		inertial nucleon cross section.

Figure 1. Optical reflection of micro-quanta on particles