

An experimental result coming from Neutrino research gives for all particles the ratio (s_i/m_i) defined by Quantum Inertial theory in conjunction with the Micro-quanta paradigm

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Abstract

Rejecting some old misconceptions (such as the “pulling” gravitation that ravaged classical physics) the Inertial-Gravitational theory supported by the Micro-quanta paradigm incorporates both the relativistic concepts of *Mass - Momentum - Energy* and the *quantic Inertial Model* of the particle mass. The flux of micro-quanta supports primarily the physical interaction that *generates* the Inertial forces defined by Newton. Scholars believing that Inertial forces originate from the properties of the *empty space*, do not pertain to the community of physicists believing on Newton’s Inertial Law. This great ancient physicist admitted he was unable to explicit the physical nature of his Law of Inertia (“*Hypotheses non fingo*”). However, marking the difference between “*empty*” and “*absolute*” space, he remained in his conviction that some unknown physical reality *originates* (in the absolute space) the inertial forces upon accelerated masses. At present, Micro-quanta paradigm describes the quantic objects that generate through collisions the *physical* inertial forces on particles. Since the flux of micro-quanta fills all space, there is no need to refer these collisions to some external System of reference. The relative velocity between quanta and particles comes out from the momentum that micro-quanta confer to particles. By this reason the Micro-quanta paradigm defines on *pure dynamical* bases the relativistic formalism that Special relativity derived from kinematics, so creating flaws that produced the well known paradoxes. To reveal the micro-quanta it's not necessary to devise particular experiments. The technique of the accelerometers has given many evidences of the physical reality guessed by Newton to explain inertial forces exerted on masses. Since the action of micro-quanta is always manifested in *statistical* terms, classical and relativistic physics allowed to describe Inertia and Gravitation *without knowing the quantic nature* of these phenomena. The micro-quanta Paradigm shows in particular the proportionality between cross section and mass (ratio A_u) of all particles colliding with micro-quanta. To the aim of calculating the transmission across matter of micro-quanta and neutrinos (which show the same nature) the only unknown quantity is the numerical value of the ratio A_u . Recalling that micro-quanta flux fills all space, it appears also interesting to search about neutrino collisions with micro-quanta flux as possible cause of the *oscillations* phenomena that occur during neutrino travels across the (so called) astronomic “empty” space. A quantitative indication on the ratio A_u is found in this paper from an experimental measurement of the solar neutrino flux interacting with the Earth mass in the course of the Borexino research carried out at Gran Sasso National Laboratory.

1. Introduction

Quantum Inertia-Gravitation theory is derived, according to the *strict* Equivalence principle, from the Micro-quanta paradigm proposed in 2007 to describe both inertial and gravitational forces originating from the collisions on particles of the Micro-quanta isotropic flux. Derivation of Mass and Momentum of particles moving in space filled by Micro-quanta flux can be done through Compton’s collision law. This procedure shows the same formal description of *Mass - Momentum - Energy* given by Special Relativity, but their significance is greater because now the relativistic quantities are generated from *dynamical* bases, whereas S.R. was developed within an empty space through kinematical bases that are responsible for some well known troubling paradoxes. This means that

the new theory is more adherent to the physical nature of dynamical phenomena since it gives indications about the (very small) cross sections characterising particles respect to the incident micro-quanta, which show the same very low interaction with matter that characterises neutrinos. The numerical constants of Micro-quanta (energy, wavelength, flux) may be derived from the *Quantum Pushing* Gravity force originated by the shielding-effect of micro-quanta flux between two particles. This requires dropping the Newton's *pulling* gravitation and cancelling the misconception of the "*gravitational mass*" that was debated by classical physics. The *Inertial mass* becomes the only mass that can be measured. On the other hand, the recent measurements of the gravitational constant G examined by the Committee of NIST Institute (CODATA 2014) showed discrepancies among them with standard relative uncertainty equal to 4.7×10^{-5} . This value has to be compared with the uncertainty of other fundamental constants of physics. For instance : Quantum magnetic flux = 6.1×10^{-9} , Fine structure constant = 2.3×10^{-10} , Electron mass = 1.2 , Atomic mass constant = 1.2×10^{-8} , etc. Leaving to CODATA his proper evaluations, I'm convinced that the high discrepancies on the measured G are the symptom of the statistic nature of the so called "universal" gravitational constant proposed by the old *pulling* gravity. The reason may be guessed recalling that the gravitational *pushing* force (due to the mutual shielding between particles immersed in the micro-quanta flux) is pulsating due to the relative positions occupied (for very small times) by adjacent particles that are pushed each other by the incident micro-quanta. In fact, contrary to the absence of any "*macroscopic shield*" postulated by classical Gravitation, the *Pushing* gravity cannot exclude that some fraction of nucleons constituting the test mass may not participate (for a fraction of time) to the macroscopic pushing force. Besides, the uncertain nature of the mass has been enlightened during the half-century research on the Higgs problem, that recently produced the large boson observed at CERN accelerator. Such result appeared disappointing. In his article "*My life as a boson*" P. Higgs observed that it was far from the original concept suggested in his paper (1964) which described an "*invisible field strewn across space, so to give mass every object in the universe*". The parallelism between this original picture and the flux of micro-quanta (that generates the mass of particles by collective collisions on charges) appears evident (see *Inertial model* of particles, paragr.3). In addition to these scientific activities, the experimental evidence of the physical reality guessed by Newton is today given by some widely used commercial devises. Not many physicists have considered that the accelerometers are able to measure the *absolute* acceleration (no recourse to some external reference system) by calculating (Newton) the ratio between the *measured inertial force* and the test mass. Accelerometers are widely used not only in aerospace applications, but also in the field automobile incidents, mechanical analysis, smartphones, etc.

The structure of *Quantum Inertia-Gravitation* theory allows discovering new effects unknown to current physics. For instance, the mysterious "oscillations" that neutrinos undergo travelling across the so called "*empty*" cosmic space, receive new theoretical interest thinking that all space is filled by physical micro-quanta.

1.1 Theoretical and Empirical Bases of Micro-Quanta

Defining and calculating Quantum Gravitational force is possible only by defining the structure of both Inertial and Gravitational Interactions, that classical and relativistic physics showed to be tightly linked. The *strict Equivalence principle* assumed that both inertial and gravitational forces originate from the *same* physical reality. In the present paper the flux of Micro-quanta paradigm is analysed in order to verify this requirement. Some historical *misconceptions* gave rise to *unphysical* concepts, such as the "*unlimited*" gravitational collapse depending entirely on the characteristics of the old *pulling* gravitation. In nature there are many examples of gravitational collapses, among which the spectacular collapses of Supernovae, enlighting for months a whole galaxy. But this collapse isn't *unlimited* because in the places with remnants of supernovae it has been observed the presence of Neutron stars whose mass is of the order of some Sun masses. After the theoretical study about the finite volume of the gravitational collapsing bodies (Loinger, 2010), some papers showed (Michellini, Jan. 2010, Nov. 2010) that Micro-quanta paradigm, which does not shows the gravitational unlimited collapse, is able to explain some observed- phenomena, such as the mysterious cause that ended Glacial Eras. This cause is still waiting a physical explanation that did not come from the great effort developed by two international missions in Antarctica: VOSTOK (Petit et al., 1999) and EPICA (Augustin et al., 2004) which extended the drilled Ice cores up to one million years ago. Besides, some experimental observations (such as the excess infrared emissions from planets, the planetary physics, the Earth high seismicity) are still waiting a rational explanation. For instance, the strong seismic events on Earth and other planets (with the satellite Io) appear to be linked to planets which show *solid crust*. In fact these events may be attributed to the same cause found analysing the Dansgaard-Oeschger events. Firstly observed by drilling two Ice cores in Greenland (Stuiver & Grootes, 2000) these phenomena revealed large and rapid warmings on both hemispheres at *regular* interval around 1470 years. At a first time, this regularity was attributed to some astronomical events, but the analysis carried out by S.Ramstorf on the D-O events between 11,500 and 45,000 years B.P. (Ramstorf, 2003) showed that actually the standard deviation from the most

probable period was about 120 years. This result ruled out any possible astronomical influence. Taking in mind that the release of energy from micro-quanta collisions on the Earth mass amounts to a thermal power around 2.6×10^{15} watt, I put forward the hypothesis (Michellini, 2011) that the *quasi-regular* D-O rapid warming events may be triggered by a low increase of the internal temperature producing a thermal expansion of the mass able to produce an increase of the planet radius (some metres) sufficient to induce tensile stresses on the solid crust surpassing the elastic limit of the rocks. This produces fractures through which the fluid magma penetrates across the crust, giving rise to orogenesis, to large earthquakes and to the continuous volcano activities. In the D-O events the fracturing process regarded two hemispheres (Raisbeck, 2007). When the snow cap and the clouds mantle became so thick to prevent the solar energy might reach the surface, the global temperature was so low that no external phenomenon couldn't warm the planet. What gave the thermal energy that put Glacial Eras to an end? Probably it was the periodic heating of the surface produced by the magma escaping through fractures open on the stressed crust by thermal *expansion* of internal mass due to power generated by micro-quanta collisions.

During this research I was encouraged by the rising of new problems put on the table of scientific community by the Neutrino research, whose detectors require specific locations, such as old mines of coal and other natural or artificial shields against the radioactive cosmic rays. Such rough materials, disregarded by the classical physics, became the key for detecting the advanced physics of neutrinos. The widely use by theorists of the classical astronomic observations, to proof their theories, inaugurated by Einstein at beginning of XX century, was definitely set.

2. Characteristics of Micro-quanta paradigm versus Special Relativity

Since *Quanta of energy* are defined ($E = h\nu$) independently of their size, then micro-quanta interact with particles in the same way as photons (Compton's equation). The micro-quanta, filling the space, act as interaction waves of the *Inertia* of particles. The momentum of particles was defined by classical physics $\mathbf{q}_i = m_0 \mathbf{v}$ in the *empty* space. Now this quantity comes out in a proper form when the space is filled by micro-quanta with energy $E_0 = h_0 \nu_0$ which transmit power to the particles through the Doppler frequencies (ν_f, ν_b) whose definition can be derived from Micro-quanta paradigm. These values are linked to the relative velocity of the micro-quanta incident *forward* ($c+v$) or *behind* ($c-v$) the particle. The old bargain required by S.R. for summing or detracting high velocities can be now dropped since in the case of collisions between micro-quanta and particles these ones are described with proper kinematical characteristics. The mathematical proof (M.Michellini, Nov.2010) shows simply that each particle receives the momentum

$$|\mathbf{q}| = (h_0/c) (\nu_b - \nu_f) N_i = (E_0/c\nu_0) (\nu_b - \nu_f) N_i$$

where $N_i = \sigma_i \phi_0 \tau_0$ is the number of incident micro-quanta during the time τ_0 of each *collective* collision. Substituting and performing the calculation one obtains

$$\mathbf{q}_i = \sigma_i (E_0 \phi_0 \tau_0 / c^2) \mathbf{v} / (1 - v^2/c^2)^{1/2}.$$

This equation reproduces the relativistic formalism of momentum

$$\mathbf{q}_i = m_i \mathbf{v} / (1 - v^2/c^2)^{1/2}$$

with a new term that transfers the particle cross section in the rest-mass

$$m_i = \sigma_i [p_0 \tau_0 / c] \quad (2)$$

where $p_0 = E_0 \phi_0 / c$ is the energy density of micro-quanta in space. The term in brackets is constant for all particles because it depends on micro-quanta constants, so that the ratio

$$A_0 = \sigma_i / m_i = c / p_0 \tau_0 \quad (2a)$$

represents a fundamental result that gives the cross section encountered by micro-quanta incident on a particle with mass m_i . In other words the present approach, based on *dynamical* quantities, shows that the particle mass *originates* from interaction of micro-quanta on the charges. This fulfils in principle the mechanism originally suggested by P. Higgs in 1964. On the contrary, Special Relativity obtained the "relativistic" formalism assuming an *empty space* and using *kinematical* equations that produced *erroneous* predictions, such as the well known paradoxes, the "transverse" mass and the Fitzgerald's contraction. Micro-quanta do collective collisions on the cross section σ_i of particles during the time τ_0 . Since the *average density* of micro-quanta in space equals $n_0 = \phi_0 / c$, the average distance between two micro-quanta is $x_0 = (1/n_0)^{1/3}$. We assume that the duration of collision $\tau_0 = x_0/c$ equals the time necessary to cover the average distance x_0 between two adjacent micro-quanta travelling on the same beam, so hitting the particle at any average interval τ_0 . Now we use (to continue

the present reasoning) the numerical values given in par.5 after the calculations of the micro-quanta constants performed by implementing the preceding paragraphs. So, using the value $x_0 = 4.526 \times 10^{-32}$ resulting from eq(5a) we obtain the duration of the *collective* collision

$$\tau_0 = 1,508 \times 10^{-40} \text{ sec.} \quad (2)$$

To verify this result we recall that the energy ΔE released by each quantum colliding on the particle is fixed by the *Compton's equation*. Let's recall that each incident micro-quantum release also to the particle a momentum that is statistically balanced by the action of its diametrically opposite momentum, preserving the total momentum of any free particle. In the case of micro-quanta ΔE satisfies the ratio

$$\Delta E = E_0 (E_0 / m_i c^2)$$

which, adopting the value $E_0 = 1.289 \times 10^{-32}$ resulting from eq(5b), gives us the ratio $(E_0 / m_i c^2)$ for any particle. For instance, nucleons (that constitute 99,95% of the neutral masses) take the value

$$E_0 / m_n c^2 = 8.5933 \times 10^{-23}. \quad (2a)$$

The total energy $N_i \Delta E$ released by a *collective* collision with generic duration τ , corresponds to

$$N_i = \sigma_i \phi_0 \tau$$

which is the number of colliding micro-quanta in the Compton's equation

$$N_i \Delta E = E_0 (E_0 / m_i c^2) (\sigma_i \phi_0 \tau). \quad (2b)$$

The energy ΔE released by each micro-quantum is a small fraction of the energy E_0 . We observe that in the preceding equation both sides result equal to E_0 when the number $N_i = (\sigma_i \phi_0 \tau)$ equals

$$(\sigma_i \phi_0 \tau) = (m_i c^2 / E_0). \quad (2c)$$

This gives a correlation between the number of micro-quanta of a collective collision (duration τ) and the mass-energy $m_i c^2$ of any particle. To this aim we rearrange eq(2c) in the form

$$\sigma_i / m_i = A_0 = (c^2 / E_0 \phi_0 \tau) = (c / p_0 \tau) \quad (2d)$$

which confirms eq(1a) implying that $\tau = \tau_0$ as expected. Some trouble arises from the relative increase of mass of particles at any collective collision $Y = \Delta m_i / m_i = \Delta E / m_i c^2 = (E_0 / m_i c^2)^2$. In the case of nucleons the velocity of increment is

$$\Delta Y / \tau_0 = (E_0 / m_i c^2)^2 / \tau_0$$

which is troubling. However we don't forget that the Inertial Model of particle have to give answers to the still hidden process of rapid collapses shown by instable particles., which may grow or disappear.

Let's now show what happens to the duration of collision τ derived from eq(2d)

$$\tau = (c^2 / A_0 \phi_0 E_0) \quad (2e)$$

when we assume the value $A_0 \approx 1.43 \times 10^{-14}$ coming from an experimental result of the Neutrino research described in parag. 4. Substituting the numerical values of ϕ_0 and E_0 found in parag. 5 in conjunction with the assumed value of A_0 , we calculated $\tau = 1.506 \times 10^{-40}$ sec. Comparison with $\tau_0 = 1.508 \times 10^{-40}$ sec given by eq(2) shows a little difference that may depend on the assumed A_0 . Considering that τ_0 has been calculated through a radically different procedure (based on the average distance x_0 between two adjacent micro-quanta travelling on the same beam) τ_0 might be in principle *very different* from τ . This did not happen, supporting our theory.. Another point to be enlightened is the existence of a value of A_0 derived directly from theoretical way.

3. The Inertial Model of particles

The fundamental time interval τ_0 scans the rhythm of collisions of micro-quanta upon matter in the universe. Notice that their average distance x_0 is much smaller than the "size" of elementary particles. For instance the "radius" of a nucleon r_n is about 10^{-20} . The energy of the particle is given multiplying the energy E_0 by the number N_i of micro-quanta in a collective collision $N_i E_0 = \sigma_i \phi_0 E_0 \tau_0 = \sigma_i p_0 x_0$. Recalling the electromagnetic energy $m_i c^2$ of particles, the balance of these quantities gives

$$m_i c^2 = N_i E_0 = \sigma_i p_0 x_0. \quad (3)$$

which expresses the Inertial Model of stable particles. Resuming, this model presents shell-particles with cross

section σ_i and thickness x_0 much less than radius. In fact eq(3) can be interpreted as the product of the particle volume ($\sigma_i x_0$) of thin shells multiplied by the energy density $p_0 = \phi_0 E_0 / c$ of micro-quanta in space. In other words, the colliding micro-quanta are scattered by the *repulsive* forces between the uniformly charged micro-particles that constitute the charge and the mass confined within a sphere whose surface represents the cross section of particles. In other words, the flux of recoiling micro-quanta act the confinement of the repulsive micro-charges constituting the elementary charge. In practice the repulsive electric force is balanced by the newtonian force of inertia $F_{in} = -m^*(\Delta v / \Delta t)$ due to each scattered micro-quantum (mass $m^* = E_0 / c^2$) that undergoes the re-direction ($\Delta v / \Delta t$) of the velocity c . The statistical distribution of the collisions generates the "compression" p_0 upon the micro-charges Δe that repel each other. Taking in mind the reasoning given in parag.6 (substantially affirming that $\Delta t = \tau_0$) we may affirm that the Inertial model of particles is based on Newton's concept that mass of particles is generated by the momentum re-direction of an isotropic flux of incident micro-quanta. Rearranging eq(3) gives us the ratio

$$A_0 = \sigma_i / m_i = c^2 / p_0 x_0 = c^3 / \phi_0 E_0 x_0 \quad (3a)$$

which confirms eq(1a) stating the *uniformity* of this ratio : a fundamental result of the Micro-quanta paradigm. This fact is not present in Special Relativity because it assumed the concept of "empty" space, widely accepted at beginning of XX century, that ignored other physical realities possibly present in space.

4. An experimental result coming from Neutrino research

Let's analyse the structure of eq(3a): we don't know all micro-quanta constants, so we have to find the value of A_0 from the experience. To this aim we recall that between single Micro-quantum and Neutrino (Michellini, 2012) there is a relationship: both show a particular attitude of ignoring matter. The Micro-quanta flux is also involved in generating the mass of particles, as shown by the Inertial model. Low energy solar neutrinos show a little interaction with particles, differently from high energies neutrinos around 30-50 GeV. Then I made the hypothesis that Neutrinos are *directional waves* constituted of very high number of Micro-quanta packaged without forming elementary charges in their interior. So they differ from the high energy γ -rays containing a rotating pair electron-positron.

In January 2012 at LNGS laboratories, the Borexino Experiment measured a very low *day-night* asymmetry in neutrino flux, that is a low interaction with matter of solar neutrinos observed at midnight, i.e. after travelling across the diameter of the Earth mass. (Borexino collaboration, 2012). The scattered neutrinos resulted a fraction around 0.001 of the total flux, showing a neutrino mean free path of the order $l \approx 10^3(2R) = 1.27 \times 10^{10}$. This result may be introduced in the formula of Micro-quanta paradigm

$$l = 1 / (A_0 \delta_m) \quad (4)$$

where δ_m is the average density of the tested mass. This equation is valid when the cross section of the exploring Quanta is negligible compared to the cross section σ_n of nucleons (as it happens for solar neutrinos). Solving for the unknown A_0 one obtains $A_0 = (\sigma_n / m_n) \approx 1.43 \times 10^{-14}$ for particles constituting the Earth mass, in practice nucleons. This ratio obtained by solar ^7Be neutrino measurements may be assumed also for micro-quanta.

Substituting in eq(3a) it appears that a second equation is necessary to obtain the distance x_0 and the micro-quanta energy E_0 . This requires to write the equation of Quantum Pushing of gravitation.

5. Origin of the Gravitational Pushing force

Micro-quanta show very small energy E_0 and wavelength λ_0 of the order of the Planck's length $l_p = 4.05 \times 10^{-35}$, so they pertain to the class of physical objects introduced by micro-quanta and characterised by the second Planck's constant $h_0 = E_0 \lambda_0 / c$. The energy E_0 can be calculated assuming the *experimental* Gravitational force numerically equal to Newton's gravity $G m_n^2 / r^2$ adopting the *measured* G . This force is the Quantum Pushing gravity expressed in terms of Micro-quanta collisions on nucleons representing 99.95% of the masses

$$F_{gr} = (2E_0 / c) (\phi_0 \Delta \sigma) (\Delta \sigma / 2\pi r^2) = p_0 \Delta \sigma^2 / \pi r^2 = G m_n^2 / r^2 \quad (5)$$

where $(2E_0 / c)$ is the momentum released by each *recoiling* micro-quantum. The mutual shielding between particles reduces the quantum flux incident on the *shaded side* of each particle. For theoretical reasons the *central* tubular beam (cross section equal to $\Delta \sigma$), placed along the line joining the centres of two particles, shows *zero* quanta (*missing beam*). The beam $(\phi_0 \Delta \sigma)(\Delta \sigma / 2\pi r^2)$ is the real beam diametrically *opposite* to the *missing beam*, so the gravitational Pushing force drives any pair of facing particles. For the sake of simplicity, the total flux reduction on the *shaded* face may be concentrated on a central beam with a small area $\Delta \sigma$. So we have to calculate $\Delta \sigma$ in order to respect the *equivalence* with the actual shielding effect on the shaded side. Recalling eq(2a), the value

$\Delta\sigma = \sigma_t / N_t = x_o^2$ appears to depend on the characteristics of the flux, as expected.

Let's substitute $\Delta\sigma = x_o^2$ in eq(5) obtaining $(E_o \phi_o / c) x_o^4 = E_o x_o = \pi G m_n^2$, from which one obtains the equation

$$x_o E_o = 5.837 \times 10^{-64} \text{ (Joule metre)}. \quad (5a)$$

Rearranging eq(3a) and substituting eq(5a), one gets

$$A_o = c^2 x_o^2 / E_o = c^2 x_o^3 / 5.837 \times 10^{-64}$$

which, adopting the experimental $A_o \approx 1.43 \times 10^{-14}$ and solving respect to x_o , gives

$$x_o = (1.43 \times 10^{-14} \times 5.837 \times 10^{-64} / c^2)^{1/3} \approx 4.526 \times 10^{-32} \text{ (metres.)} \quad (5b)$$

Notice that from this result we may correctly derive the flux

$$\phi_o = c / x_o^3 \approx 3.2347 \times 10^{102} \text{ (quanta / m}^2 \text{ sec.)}$$

At the same time from eq (5a) we obtain

$$E_o \approx 5.837 \times 10^{-64} / x_o \approx 1.289 \times 10^{-32} \text{ Joule}. \quad (5c)$$

These equations made firstly possible to express (Michellini, 2012) the gravitational constant G in terms of the constants of micro-quanta and nucleons constituting 99.95% of the ordinary mass

$$G = (E_o / \pi m_n^2) (c / \phi_o)^{1/3} \quad (5d)$$

showing that G vary slowly throughout the universe since the flux ϕ_o may undergo sensible increments in presence of concentrated large masses (dense stars, galactic nuclei, etc).

6. Analysis of Newton's Dynamical Law of Inertia

An unexpected support to the Micro-quanta paradigm came from the analysis of the Newton's Law of inertia which, after more than three centuries, works still well. Contrary to the classical pulling gravity whose "universal" constant G assumes the role of a statistical parameter. Newton's equation of dynamics $F_{in} = -m_i \Delta v / \Delta t$ assumes that the force *braking* the motion of some mass (accelerated by known forces) or *accelerating* the motion of another mass (braked by known forces) is *proportional* to the mass *acceleration*. To which reference system has the acceleration be considered? Newton showed courage in stating that inertial forces are only apparently generated by the "void" interplanetary space. Did he use the somewhat obscure locution "*absolute space*" to indicate some physical reality? Questioned on this point, he replayed correctly "*Hypotheses non fingo*". Does the accuracy of the incremental ratio $(\Delta v / \Delta t)$ requires more and more tight time intervals, as require mathematicians? We think not, because physical phenomena refer to objects having *always finite size*. In this case the time interval might be found through some experimental apparatus.

We believe that the "*absolute*" space hides a *physical* reality (Michellini M. 2016) that compels *free* bodies to travel in *strait line* (Principle of Inertia). In this case the physical reality can be a homogeneous flux of micro-quanta which *collide on particles*, but *do not practically collide* between them. The mean free path of micro-quanta in cosmic space due to their own cross section is enormous and equals the Hubble's radius $L_o = 1.3 \times 10^{26}$. The Hubble's redshift is due to Compton's collisions of micro-quanta upon photons, so reducing their energy along their travel. This redshift happens *without any cosmic removal* of far galaxies (Michellini M. 2016).

Let's now consider a particle with velocity v under action of an accelerating force. The particle collides with beams of micro-quanta (having velocity c and the same direction), which hit *forward* and *behind* the cross section σ_t at any collision time statistically equal to $\tau_o = x_o / c$. So the accelerated particle shows, in the time τ_o , an increase of velocity Δv whose direction may be *different* from the velocity v , for instance in central motions where the Inertial force becomes the centrifugal force. The change of particle velocity Δv during the time τ_o gives the collision rates: *forwards* $R_f = \sigma_t (\phi_o / 2) (c + \Delta v) / c$ and *behind* $R_b = \sigma_t (\phi_o / 2) (c - \Delta v) / c$. The inertial force exerted by micro-quanta delivering on the average the momentum (E_o / c) , is

$$F = (E_o / c) (R_b - R_f) = -\sigma_t (\phi_o E_o / c) (\Delta v / c) = -\sigma_t p_o (\Delta v / c). \quad (6)$$

Recalling the fundamental eq(1a) one has $\sigma_t = A_o m_i = (c / p_o \tau_o) m_i$ which, by substitution in eq(6), gives finally the Newton's Law of the inertial forces

$$F_{in} = -m_i \Delta v / \tau_o \quad (6a)$$

referred to the fundamental time interval $\tau_0 = x_0/c = 1.508 \times 10^{-40}$ sec. This shows that the *physical* origin of Newton's inertial force, acting upon an accelerating particle, depends on receiving *more* collisions on *forward* side than on *behind* side. Since the momentum released by each incident micro-quantum is the same on each side, the force unbalance depends on the different number of collision upon the two sides. This is confirmed by the Principle of Inertia stating that the *uniform strait motion* of a free particle continues indefinitely. In the language of micro-quanta this means that the flux upon particles at *uniform motion* is absolutely isotropic, that is the collision rate upon *forward* side equals that upon *behind* side. Concluding, Newton's inertial force depends on the *collision anisotropy* originated by the change Δv of particle velocity.

Speaking of acceleration respect to some *external* inertial system of reference (as stated by classical physics) is misleading because what matters is the *local generation* of the inertial force upon particles in accelerated motion directly "observed" by the micro-quanta.

Let's consider the new technology of Accelerometers, whose detector is contained within a strong black box, which transmits the accelerations due to accidents by through the ratio between the *measured* inertial force and the test mass. Many types of detectors are used in terrestrial and spatial vehicles for recording shocks happened at any place of universe. No recourse to an inertial frame of reference is needed. Newton guessed the quantum character of the Law of inertia notwithstanding that Quantum concept were ignored at his time. On the contrary Newton failed in defining the Law of *pulling* gravitation because nature is capricious and hides the *Quantum pushing* gravity under the classical *pulling* gravity. Of course Newton didn't have at his disposal the concept of Quantum, which was attained after more than two centuries, when Planck defined the quantum of light and Einstein gave the quantum explanation of the photovoltaic effect. It is worth noticing that the first introduction in 1748 of the *pushing* gravity concept (based on very small ultra-mundane corpuscles, due to George Louis Lesage) failed for the absence of Quantum concept.

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