

Inconsistencies of current gravity and cosmology with the equivalence principle and experiments: The new universe fixed by them

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Abstract. From more strictly homogeneous equations, it is proved that some basic hypotheses used in gravity and cosmology are not simultaneously consistent with the Einstein's equivalence principle (EP) and with the current gravity tests. The Gravitational (G) field does not exchange energy with the body but just momentum. The energy comes not from the field but from the test body! The same results are justified from a new approach based on a nonlocal form of the EP and general properties of radiation in stationary state. From the new liner relations it is found that a homogeneous expansion of the universe produces a G expansion of matter in just the same proportion, i.e.; it cannot change any relative value. Only in smaller regions, matter can evolve, indefinitely, in closed cycles between the states of gas and a linear kind of black hole. Statistically, the universe must look the same throughout the time. Most of it must be in the state of cool black galaxy. The main source of energy is gravitational. Most of it is transformed around neutron stars. The new astrophysical scenario is consistent with the observed facts.

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1. Introduction

The current tests for gravitational theories put on relief some radical differences between a gravitational (G) field and other kinds of fields. In G time dilation (GTD) experiments, for example, some neat differences of the time intervals of clocks located in different G potentials have been measured [1]. Such differences are independent on anything that may occur to the radiation during the small time of flight because the last time is canceled out. This rules out the possibility in that the observed phenomenon can be due to some red shift of the radiation used for communications. Then such experiments reveal, definitively, that:

- a) *The eigen-frequencies of atomic clocks located in different G potentials are different with respect to each other.*
- b) *The standard atoms of observers located in different G potentials are physically different with respect to each other.*
- c) *Strictly, the current comparisons of quantities measured by observers located in different G potentials are inhomogeneous. They have no well-defined physical meanings because the observers have standards that are not physically the same with respect to each other*
- d) *To relate quantities measured by observers at rest in different G potentials, the quantities must be previously transformed to a common unit system based on some standard located in some well-defined potential or position of the field.*

According to the point c), ordinary relations between quantities measured in different G potentials are likely to be sources of fundamental errors in physics. Thus, the original purpose of the present work was to make a more homogeneous test on some fundamental hypotheses used in current theories on gravitation and cosmology. Now this must be done after the condition of simultaneous consistency with the equivalence principle and the current G tests for G theories.

1.0.1. Conventions Here, according to the point d), the observer is at rest in some fixed position (or G potential) of a strictly static field. Due to its high importance, such position has been stated by a subscript. When such position is obvious, it is omitted.

The basic relations that can transform the quantities measured by observers in different G potentials to a single observer in a well- defined potential, may be called *non-local (NL) transformations*. To make a difference with the local quantities, the transformed ones have been named *non-local (NL) quantities*.

When the NL body is moving with respect to the observer, the quantities must also be transformed for differences of velocities, according to Lorenz transformations. Thus, in principle a NL quantity respect to some well-defined observer is a function of both, the relative velocity ($\beta = V/c$) and of the NL position of the object with respect to such observer. Here, for example, $\nu_A(\beta, B)$ may be the symbol for the NL frequency of

of the multiple equation (1). They are valid for any atom or stationary radiation that has been moved from a local rest position at A up to a NL rest position B at a NL height y_A over A , or vice versa,

$$\frac{\nu_A(0, B)}{\nu_A(0, A)} = \frac{m_A(0, B)}{m_A(0, A)} = \lambda_A(0, B)$$

Einstein tacitly ignored, without fair reasons, the possibility that the bodies can use up their own energies to accelerate themselves. In ordinary life, men and cars normally use up their own (internal) energies to accelerate in a static road. The road puts on only the momentum but not the energy. In G fields, it is not obvious which part of the system, the field or the body, puts on the energy for the G work.

Some ambiguous concepts of ordinary use may have also contributed to support the Einstein's ideas. For example, it is commonly stated that "the relativistic mass of a body increases during a free fall". However, this statement is inhomogeneous and meaningless because it is a tacit comparison of masses measured locally by different observers located in different G potentials. Such masses are referred to standards (or clocks) that are not physically the same with respect to each other.

To relate the measurements of different observers located at rest along a free fall, their values must be previously transformed to some common unit system of some observer located in some well- defined position.

Assume, in the above example, that a body at rest at B falls freely up to the observer at A . The relativistic mass measured by the observer A, at the end of the fall, is given by:

$$\frac{m_A(\beta, A)}{m_A(0, A)} = \gamma \simeq 1 + \frac{GM_A y_A}{(r_A)^2} \quad (2)$$

To compare this local relativistic mass with the "initial" mass*, the observer A can use the transformation factor given by (1). The result is:

$$m_A(0, B) = m_A(\beta, A) \quad (3)$$

Then the net energy released during the stop is:

$$\Delta E_A = \Delta m_A = m_A(\beta, A) - m_A(0, A) \simeq m_A(0, B) - m_A(0, A) \quad (4)$$

From (3) and (4), it is concluded that

- a) During a free fall, the relativistic mass of a body with respect to an observer in a well-defined potential, remains constant. (arXiv:1607.03091v1 [gr-qc])

For simplicity, assume that a "horizontal" model is originally at rest at B . According to (1), the gradient of the NL wavelengths would curve the model thus keeping the end mirrors rotated with respect to each other with an "upward" angle that is proportional to $d\lambda_A(0, r)/dr[A] \simeq GM/r^2$

During the light trips, the rotation of the vectors produced by the gradient of the NL speed of light, is just twice of the above value, and in the opposite sense. Then, after summing up the two kinds of rotations of the model vectors, the net result is downwards and proportional to $-GM/r^2$, This one accounts for the acceleration of gravity [5, 6, 7].

During the free fall, according either to wave continuity or to NL frequency conservation, the reflections and refractions cannot change the net number of waves travelling back and forth within the mirrors.

In this way, according to the NL EP, the general properties of particle models and their fields can also be outlined in terms more elemental wavelets.

Some of the general properties of the wavelets can be learned from optical physics. For example, in order that the interference and diffraction phenomena can exist,

a) The NL wavelets must propagate themselves, continuously, with the NL speed of light.

b) They must not be destroyed during previous interference with other wavelets. They can travel long distances in the universe without appreciable interaction with other wavelets.

c) For reasons similar to the ones in the Olber's paradox, the contribution of wavelets coming from infinite distances would tend to diverge unless that some wavelet red shift proportional to the distances exists. Thus, the ordinary space must be highly perturbed with wavelets coming from long distance ranges.

d) In the universe, the wavelets should be interfering constructively with respect to each other but only in the discrete regions of the quanta. According to the NL EP, most of such quanta would be in stationary states, i.e., in the state of matter. In the free space, away from matter and radiation, they must be interfering with random phases.

The G field of the model is the region far away from its stationary radiation. In order that such radiation cannot escape from it, the internal reflections must be perfect ones.

Perfect reflections can be produced by high gradients of the NL refraction index. Then it is reasonable that the coherent wavelet interference can produce higher gradients of the NL refraction index of the space than the random one. Such gradients are likely to account for the fact that photons and particles do not spread.

Then, the wavelets outside of the model must be interfering to each other with opposite or random phases. Only in such way the net wave amplitude, away from the model, can be zero. According to interference rules, the probability for the existence of energy in the G field must be zero [5, 6, 7].

4.3.1. Influence of the cosmological reds-shift on the space properties Then it may be concluded that the average properties of the space in a G field can only depend on the integrated perturbation rate produced by all of the wavelets with random phases that are actually crossing it. Similarly to the Olbers's paradox, in order that such rate can be finite, all of the wavelets must be red shifted proportionally with the distances, i.e., after a law of the form $(d\nu_A/\nu_A) \propto dx_A$. Then the wavelet red shift (WRS) correction factor must have the form $f(x_A) = \exp(-x_A/R_A)$, in which R_A is the typical distance for a correction factor of 1/e. Since light is red shifted in the same proportion as its wavelets, then, in a first approximation, the WRS can be identified with the so-called cosmological red shift (CRS). Thus R_A can be assumed to be about equal to the Hubble radius.

4.3.2. *The net perturbation rate of the space* Assume a uniform universe made up of particle models. The contribution of some particle j , to the NL perturbation rate in some arbitrary NL point i , would be proportional to the actual NL frequency and to the amplitude of the wavelets crossing such point. The first factor is proportional to the NL mass-energy of the particle j and to the corresponding WRS correction factor. The amplitude factor is proportional to the inverse of the distance, $r^{ij} = r^j - r^i$. Thus, the integrated NL perturbation rate of the space at the position i , produced by all of the particles in the universe would be proportional to:

$$\pi_A(i) = \sum_{j=1}^{\infty} m_j \omega_j / r^{ij}$$

5.1. Matter expansion during universe expansion

From above, theoretically and experimentally, it is inferred that during a free fall that the NL mass-energy of the bodies is conserved while transversal components of the model vectors are contracted with respect to the observer.

A similar fact, in the opposite sense, is expected to occur during universe expansion. To prove it, let us assume, as a hypothesis to be tested, that a strictly invariable standard exists and that all of the intergalactic distances increase in some common proportion with respect to such standard. For example, assume that after some NL time interval dt_A , the intergalactic distances between our galaxy (i) and any another galaxy (j), called r^{ij} , were expanding in the same proportion. Then this would also hold for the typical radius (R_A) defined above. This means that

$$\frac{dr^{ij}}{r^{ij}} = \frac{dR_A}{R_A} = H dt. \quad (11)$$

On the other hand, according to the no energy exchange law, the relativistic mass of such galaxy, with respect to i , is constant. Then the equation (8) can take a more simple form in terms of dimensionless variable $a = r_A/R_A$ because this ratio does not change during a homogeneous universe expansion. Then the average NL perturbation rate at i is:

$$\pi A(i)av = \frac{1}{R_A} \sum_{j=1}^{\infty} \frac{m_A^j}{a_A^{ij}} \exp(-a^{ij}) = \frac{K}{R_A}; a^{ij} = \frac{r_A^{ij}}{R_A} \quad (12)$$

For a uniform distribution of galaxies, K is constant. From (9) and (12), after a time dt , the NL gravitational expansion factor for the particles in the galaxy i is

$$\frac{d\lambda_A(i)}{\lambda_A(i)} = -\frac{d\pi_A(i)}{\pi_A(i)} = \frac{dR_A}{R_A} = \frac{dr^{ij}}{r^{ij}} = H dt \quad (13)$$

Then it may be concluded that if the universe were expanding homogeneously, it would be not possible to find a particle that does not expand expands in same proportion as any intergalactic distance. Thus, *the relative distances and velocities would not change after a homogeneous universe expansion*. The same holds, obviously, for the local physical laws. Notice that this is also a new test for the EP.

This can be understood more simply in a universe made up of particle models Thus the wavelets would be interfering constructively only in the regions in which the free and stationary radiations are temporarily located. A uniform universe expansion would stretch every wavelet in just the same proportion without changing the numbers of wavelets.

From above it is concluded that according to the EP and to the experiments, only an absolute kind of universe expansion can exist. However, such expansion would not change the relative distances with the time. The universe could be expanding forever without producing a change of any ratio between the distances. Thus, from a relative viewpoint, whatever is the nature of the CRS, the universe fixed by the EP and

experiments is, in a first approximation, *static*, i.e., it has no well-defined limits of age and lifetime.

On the other hand, relative expansions or contractions can occur within distances much smaller than R because they do not change much the value of G given in (10).

5.2. The linear black hole

From (1) or (9), the trajectory of a photon in a central G field depends on the gradients of the NL refraction index, $n_A(r) = c_A(A)/c_A(r)$. According to NL refraction and NL frequency conservation it is simple to prove[5, 7], after integration, that the photon trajectory fits the condition of constant NL angular momentum per joule given by:

$$j_A = \frac{r_A \sin \theta}{c_A(r)} = \frac{r_A \pi_A(r) \sin \theta}{c \pi_A(A)} \simeq \frac{r_A}{c} \left[1 + \frac{GM_A}{r_A} \right]^2 \sin \theta = constant \quad (14)$$

In which r_A is the NL radial position of the photon, θ is the angle between it and the photon vector. The condition *si* ie s . o TD 0 0 1 6 2 2 B q (a) T J B (d) T P 6 - 0 5 2 5 5 T d (D) P T T (d) S T c (R) T j 8 . 2

6. The evolution of the universe fixed by the equivalence principle and gravitational tests

6.1. The mayor source of energy in the universe

In a matter cycle, sooner or later the atomic nuclei must be condensed into some *neutron star state* of about nuclear density. In the

galaxy. The last one should be made up, mainly, of low temperature stars formed by condensation of the new gas over the older remnants. Thus, the new stars would be made up, of rather clean H, free of metals. Due to the randomly oriented angular momentum generated during the explosions, $\langle \mathbf{L} \rangle = 0$ and $\langle \mathbf{L} \otimes \mathbf{L} \rangle = \frac{1}{3} L^2 \mathbf{1}$.

7. Conclusions

Some fundamental hypothesis used in gravitation and cosmology are not simultaneously consistent $\dot{w}T_c(t) T_j \square 7.5-0.078 T_c(c)$

provides critical internal reflection angles that can prevent the escape of most of the radiation.

- The new kind of *linear black hole* can absorb radiation from the space until the energy per nucleon is high enough to expand the system up to the gas state. In principle *matter can evolve in rather closed cycles between the states of gas and LBH, and vice versa.*
- If the universe were expanding, the general increase G potential would produce a G expansion of matter in just the same proportion as every intergalactic distance. Such universe expansion would not change any ratio of distances. In other words, *only an absolute kind of universe expansion can exist but this one would not change the relative values of the distances, velocities, and red shifts.*
- The universe age cannot be estimated from the Hubble constant because, in one way or another, the CRS would not appreciably depend on the time.
- Statistically, the universe must look like it had no limits of time both in the past and in the future. However, in smaller regions, galaxies must be evolving in rather closed cycles between expanded (luminous) forms and compact (cool) forms and vice versa.
- Most of the universe must be in the state of BG that would be absorbing radiation from the rest of the universe. They are consistent with the low temperature CMB and with the theoretical density of the universe derived from equation (10). They are also consistent with the wide range of phenomena observed the in intergalactic regions.
- True quasars (radio source) of high red shifts are not galaxies at cosmological distance but just the last luminous regions of galaxies.
- The low temperature radiation background is not a cosmological relic. It must be the radiation coming from the rather uniform distribution of black galaxies in the universe. Such radiation should als

WRS. For example, it is reasonable that some kind of "diffraction red shift" may occur after the large number of encounters with the black bodies that should exist in the intergalactic space.

The simultaneous consistency of the new astrophysics scenario with a large number of observed facts is a good test for the NL EP and for the NL transformations derived from it. On the other hand, the use of general properties of radiation can help to understand the phenomena occurring in the universe in a more unified way.