Critical Tests for two Hypotheses used in Gravitation and Cosmology

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From more critical tests for gravitational (G) hypotheses it has been proved that the relative properties of nonlocal (NL) bodies at rest with respect to an observer depend on the difference of G potential between bodies and observer. The G energy comes not from the field but from a fraction of the mass-energy of the bodies. These results are in opposition with two traditional hypotheses used in Physics. In the classical tests of general relativity their errors are compensated because they have the same absolute value and opposite signs. The general theory based on such tests is consistent with quantum mechanics and with all of the traditional G tests. The new cosmological scenario, radically different from the standard one, has also been verified from astronomical observations.

INTRODUCTION

To test gravitational (G) hypotheses, a general theory not based on any of them, called “nonlocal (NL) relativity” (NLR), was introduced by R. Vera in the Einstein’s Centennial Symposium on Fundamental Physics (Bogotá, 1979) [1] and in a later paper [2]. It is based on the Einstein’s equivalence principle (EEP) according to which “radiation in stationary state between two well defined parts of a system must have the same inertial and G properties of the other parts of the same system”. Thus the properties of a particle model (PM) made up of a photon in stationary state, derived from dual properties of light, are consistent with special relativity, quantum mechanics and all of the conventional G test[1,2,3]

During a free fall, the acceleration of a PM is due to a plain refraction phenomenon in which its relative mass-energy-frequency with respect to an observer at rest is conserved, which is opposed to the Einstein’s G field energy hypothesis (GFEH). The energy released comes from a fraction of its mass-energy lost during the stop. Thus the final relative mass-energy of the PM at rest with respect to the observer depends on the difference of GP between the body and the observer, which is opposed to the classical hypothesis (CH) in that the relative rest mass of the NL body with respect to the observer is identical to the local one.

Below, these results have been verified from other critical tests that are independent on G hypotheses.

A CRITICAL TEST FROM OPTICAL PHYSICS

Assume that a standing electromagnetic wave exists between two mirrors at rest in the positions A and B of a central field. From “wave continuity”, the number (N) of waves between A and B, and the relative time interval of the trip AB of “each wave” with respect to the clock at A, called \( \Delta t_A(B) \), are strictly constants. Thus the relative frequency of the waves reflected at A and B, with respect to the clock at A, is the same:

\[
\nu_A(A) = \nu_A(B) = \frac{N_{AB}}{\Delta t_A(B)} = \text{Constant}_A \quad (1)
\]

Then the relative frequencies and energies of photons traveling freely in a G field, with respect to an observer at rest in the field, remain constants, respectively, i.e., G fields don’t exchange energy with photons which is in clear disagreement with the GFEH.

From (1) the relative “emission frequencies” of a NL atom at rest at B with respect to the observer at A, called \( \nu_A(0, B) \), are just equal to the ones measured locally in G red shift experiments (GRSE).

\[
\nu_A(0, B) = \nu_A(0, A) \quad (2)
\]

Thus the result of a GRSE can be described by:

\[
\frac{\Delta \nu_A(0, B)}{\nu_A(0, A)} = \frac{\Delta \phi_A(B)}{m_A(0, B)} = \frac{\Delta E_A(0, B)}{m_A(0, B)} \quad (3)
\]

in which \( \Delta \nu_A(0, B) = \nu_A(0, B) - \nu_A(0, A) \).

The proportional difference of the emission frequency of the NL atoms at B with respect to the observer at A is equal to the difference of GP defined by the last member in terms of the proportion of mass-energy released by the atoms, or a test body, after a free fall from B and stop at A. Such frequency differences existed before the photons were emitted, which is in opposition with the CH.

A CRITICAL TEST FROM G TIME DILATION

Here, a G time dilation experiment (GTDE) is the result of comparing well-defined time intervals of local and nonlocal clocks at rest in different GP. This is a critical test because it is independent on the frequency of any radiation traveling between the clocks, i.e., it is independent on results and hypotheses used in GRSE.
The results of GTDE are identical to those given by (3). The proportional frequency differences of clocks and atoms are the same.

On the other hand, from the EEP, the frequencies, masses and lengths of each part of a system are related to each other, locally, by universal constants:

\[ \nu_A(0, A) : \lambda_A(0, A) : m_A(0, A) := C1 : C2 : C3 \quad (4) \]

If a body changes of rest position from \( A \) to \( B = A + \Delta r \) and the observer stays at \( A \), from (3) and (4),

\[ \frac{\Delta \nu_A(0, B)}{\nu_A(0, A)} = \frac{\Delta \lambda_A(0, B)}{\lambda_A(0, A)} = \frac{\Delta m_A(0, B)}{m_A(0, A)} = \frac{\Delta E_A(B)}{m_A(0, A)} \quad (5) \]

The proportional differences of the relative properties of a NL body at rest with respect to the observer, are just equal to the differences of GP between the body and the observer. This result may be called the non-equivalence principle (NEP) for bodies at rest in different GP.

From (5) and special relativity applied to a free fall from \( B \) and a stop at \( A \) it is inferred that:

\[ m_A(0, B) = m_A(V, A) = m_A(0, A) + \Delta E_A(B) \quad (6) \]

During a free fall, the relative mass-energy of the NL body with respect to the observer at rest at \( A \) remains constant. This value is higher than the local one at rest at \( A \). Thus both the CH and the GFEH would be wrong.

**ASTRONOMICAL TESTS**

From (5), a uniform universe expansion cannot produce measurable changes with the time because the increase of GP would expand the reference standards in identical proportion, regardless on their internal structures. Thus the cosmological red-shifts don’t change during expansion, i.e. the universe age may be infinite.

From the lack of energy of the G field, the new kind linear black hole (LBH) would be a giant nucleus around which the very gradient of the relative refraction index would prevent, by critical reflection, the escape of radiation and relativistic particles. After absorbing radiation, for a long period, the relative mass-energy of its nucleons can be equal or larger than the mass of a free neutron far from the LBH. In such “excited state”, the LBH can decay into a cloud of primeval gas thus starting a new evolution cycle of matter.

Then galaxies should be evolving, rather indefinitely, in nearly closed cycles with luminous and dark periods. The LBHs formed during the luminous periods, after a long energy absorption period, would explode, in chains, generating gas for a luminous period and so on[1,2,3,4,5].

It may be verified that all of the different evolution phases of a galaxy cycle are present anywhere in the universe. They are consistent both with the different kinds of galaxies, luminous, partially luminous, and dark ones, found in the local universe and in the deep field observations. Statistically, most of them should be in their dark states, absorbing energy from the rest of the universe. The last ones should account for the dark matter in the universe and the low temperature CMB [5,6,7,8].

**CONCLUSIONS**

From NLR and tests more critical than the classical ones it is found that two current G hypotheses would be wrong. This error is not easy to detect because such hypotheses are often used altogether, like in the classical G tests. In such way their errors are canceled out.

After using a particle model consistent with the EEP, instead of G hypotheses, NLR accounts for a wider range of inertial and gravitational properties of uncharged bodies, including special relativity, quantum mechanics, the classical G tests and more critical ones. From them, the universe has no limits of age for the evolution of galaxies in nearly closed cycles, which can be verified from the observations of their different phases anywhere in the universe. Thus the dark matter and the low temperature CMB turn out to be critical verifications of NLR.