Recent verifications of a new relativity principle and a new gravitational theory based on properties of light

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Abstract

Recent astronomical observations verify the new astrophysical scenario resulting from new conservation laws and a new relativity principle fixed by dual properties of light and by some new gravitational (G) tests. Gravitation turns out to be a refraction phenomenon in which the field does not exchange energy with photons and particles. During a free fall, and during universe expansion, the relative masses of free bodies, with respect to the observer, remain constants. During universe expansion, the average relative distances are conserved because rods must expand in same proportion. The universe entropy is conserved because the new kind of linear black hole, after absorbing radiation, must explode regenerating new primeval gas that provide new fuel for dead galaxies. Thus galaxies must be evolving, indefinitely in closed cycles with luminous and dark periods. All of their phases are to be found anywhere and in any age of the universe. They account for the recent observations.

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I. Introduction

Current gravity is based on two conventional hypotheses:

- a) *The classical hypothesis* (CH) on the equivalence of non-local (NL) standard bodies at rest in different gravitational potentials (GP).

- b) *The G field energy hypothesis* (GFEH) on presumed exchange energy between the G field and photons or bodies.

In general relativity, for example, it is assumed that during the free trajectory of a photon in a G field gradient, its relative frequency, with respect to observers at rest in the G field, changes due to some hypothetical energy exchange between the photons and the G field.

On the other hand, in the proceedings of the Einstein’s Centennial Symposium on Fundamental Physics (1979) it is proved that such relative frequency change is in clear contradiction with the most fundamental property of the electromagnetic waves which is “wave continuity”\[1,2,3\]. According to it, “both the relative frequency and the relative energy of the free photons, with respect to an observer at rest in a constant G potential, are conserved” (relative frequency conservation law for free photons with respect to observers at rest in a constant GP)\[1\].

From the new law fixed by properties of light it is inferred that the G red shift comes not from a change of the frequency of the photons but from relative differences of the frequencies of every atom and standard clocks of the observers at rest in different GP. “Such relative differences existed before the photons were emitted”.

Below, the relative differences of frequency of standard clocks in different GP have been clearly verified from the genuine experiments on G time dilation (GTD) that compare their time intervals. Thus, definitively, both, the GFEH and the CH are inexact\[1,2,3\].

\[1\]This can also be demonstrated from the fact that two waves of the same wave train take the same time interval to travel between any two points A and B of a G field. Since during the trip, the number \(n\) of waves between such waves is conserved, then the “relative” number of waves crossing the point \(B\), in the time interval of the clock of the observer at \(A\), called \(\nu_A(B)\), must be identical to number of waves going away from \(A\), called \(\nu_A(A)\)
A. The new relativity theory fixed by properties of light

From the Einstein’s equivalence principle (EEP) it is inferred that all of the well-defined parts of a body must have the same inertial and gravitational properties. If not, the differences could be detected from local measurements done either after changes of velocity or after changes of G potentials of the measurement system thus violating the EEP. Since the minimum well-defined part of a body is a photon in stationary state, then any standing wave, between well-defined parts of a system, must have the same inertial and gravitational properties of the other parts of the same system. Thus, in principle the inertial and gravitational properties of uncharged bodies can be derived theoretically, independently on the traditional hypotheses, after using a particle model made up of photons in stationary states. Then it is extremely simple to prove that such properties do correspond with special relativity (SR), quantum mechanics and with all of the current tests for G theories.\cite{1,2,3}

The general results of the new G theory can be stated either in the form of “a relative mass-energy and frequency conservation law for bodies and radiation traveling freely in a G field, with respect to observers at rest in a well defined GP, or in the form of a “non equivalence principle (NEP) for bodies at rest in different GP”. According to them,

“The relative mass-energies and frequencies of bodies or radiations traveling freely in a G field, with respect to any observer at rest in a constant GP, are conserved”. If the bodies stop in different G potentials they release different energies. From local mass-energy conservation during the stop, their final relative rest masses are different with respect to each other. Their proportional differences are just equal to their respective differences of GP”.

Below, the same principle is directly verified from the condition of consistency of the EEP with the results of the genuine G time dilation (GTD) experiments that compare time intervals of clocks located in different GP.

Further verifications of this principle come out from the agreement of the new cosmological model predicted from such principle and relatively recent astronomical observations.
II. A short cut to the new principle

A. The new formalism fixed by genuine GTD experiments

From the GTD experiments it is found that “the relative differences of frequency of clocks located in different GP depend on the differences of GP between them”

Then, to describe the real physical differences of the non-local (NL) clock at some NL position B with respect to some observer in a position A, a new formalism must be used in which the positions of the object and of the observer must be clearly stated. Here, and in previous works, the observer’s position, called A, one has been indicated by a subscript. Thus the results GTD experiments, reduced to static conditions, can be stated in the most general form:

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

The first member is called “the proportional difference of frequency of the NL clock at B with respect to the (local) clock at A”. This one turns out to be just equal to the dimensionless form of the difference of GP between the positions B and A, called \(\Delta \phi_A(B)\), which is the proportional energy released by the clock, or any other test body, after a free fall from B and a stop at A compared with the local rest mass-energy at A.

From this result it is clear that:

- The clock at B is not equivalent with respect to the clock at A, i.e., the CH is wrong.

- The current relationships between quantities measured by observers in different GPs are physically ”inhomogeneous” because their standard clocks are not physically equivalent with respect to each other. This is a source of fundamental inexactitudes in physics and its applications.
B. The non-equivalence principle for bodies in different GP

This principle can be derived straightforwardly from the condition of consistency of the EEP with the results of the genuine GTD experiments.

Assume that $\nu_A(0, A)$, $m_A(0, A)$, and $\lambda_A(0, A)$ are the generic symbols for the “local” values of any frequency, mass-energy, length or a wavelength, of any isolated part or photon in stationary state of the local system at rest at $A$, with respect to the observer at rest at $A$. From the EEP, such local values are related to each other by constants that don’t depend on the GP of the local system with respect to other bodies.

$$\nu_A(0, A): m_A(0, A): \lambda_A(0, A) = C_1 : C_2 : C_3 \quad (2)$$

Then 1 can be consistent with 2 only if:

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

The proportional differences of the relative properties of standard bodies at rest at $B$, with respect to the observer at $A$, are just equal to the difference of GP between $B$ and $A$. This is an explicit form of the NEP from which “the relative properties of a NL body, with respect to a well-defined observer, depend on the difference of GP between the NL body and the observer”.

This principle is more general than the EEP because it is also valid for the NL cases in which bodies and observers are in different GP. It corresponds with the EEP in any local case in which the difference of GP between the NL object and the observer tends to zero.

Notice that, to the contrary of the EEP, the NEP shows that some real (absolute) physical differences exist between standard bodies in different GP, i.e., that the CH is wrong. Then the current relationships between quantities measured by observers at rest in different GP are inhomogeneous because their reference standards are physically different compared to each other.

From the 2nd and the last member of 3:

$$\Delta E_A(B) = \Delta m_A(0, B) = m_A(0, B) - m_A(0, A) \quad (4)$$
The energy released during G work comes not from the G field but from the transformation of a fraction of the mass of a body into free energy.

For example, during a free fall from B to A, special relativity can be applied locally at A, just before the stop at A. If \( m_A(V, A) \) is the relativistic mass of the moving body with respect to the observer at A, then, from SR:

\[
\Delta E_A(B) = m_A(V, A) - m_A(0, A)
\]  

(5)

From 4 and 5

\[
m_A(0, B) = m_A(V, A) = \text{Constant}
\]  

(6)

During a free fall, the relativistic mass of a NL body, with respect to an observer at rest in a well-defined potential, remains constant (relative mass-energy conservation law for NL bodies with respect to inertial observers in some well-defined GP).

Either from 4 or from 5 it is clear that, to the contrary of GR, the G field does not exchange energy with the body.

C. Gravitation is a refraction phenomenon

If \( \nu_A(0, B) \) and \( \lambda_A(0, B) \) are the frequency and the wavelength of any standing wave of a system at rest at B with respect to the observer at A, then the relative speed of NL light at B with respect to the observer at A is:

\[
c_A(B) = \nu_A(0, B)\lambda_A(0, B)
\]  

(7)

Then, from 8 and 7,

\[
\frac{\Delta \nu_A(0, B)}{\nu_A(0, A)} = \frac{\Delta m_A(0, B)}{m_A(0, A)} = \frac{\Delta \lambda_A(0, B)}{\lambda_A(0, A)} = \frac{1}{2} \frac{\Delta c(B)}{c_A(A)} = \Delta \phi_A(B) = \frac{\Delta E_A(B)}{m_A(0, A)}
\]  

(8)

From 8 it is clear that the G field has a gradient of the relative refraction index of the NL space with respect to observers in a fixed GP, i.e., that **gravitation is a refraction phenomenon due to a gradient of the relative speed of light**. From wave continuity, such phenomenon does not change the frequency of radiation. Thus, **refraction occurring during the round trips of the**
model waves, accounts for the momentum changes without energy exchange with the G field.

III. The new universe age fixed by the NEP

Standard cosmology is also based on the CH. Thus it is assumed that the measurement rods would not expand after the increase of GP coming from universe expansion, which is in contradiction with the phenomenon of gravitational expansion fixed by S.

It is argued that the bodies would not expand, due to the strong interaction forces within the structure of particles. This is not true because S comes from the EEP and experiments whose results are independent on the existence of such forces.

Assume, as a “trial hypothesis”, that bodies don’t expand. If this were true, after a time interval \( t \), the proportional increase of all of the relative distances of all of the bodies of the universe, with respect to the observer, would be the same and equal to \( H \Delta t \). Then it is simple to find that the proportional increase of GP at the observer’s place would be,

\[
\Delta \phi = \frac{\Delta r}{r} = H \Delta t
\]  

(9)

Then, from S and 9, the proportional expansion of the bodies is:

\[
\frac{\Delta \lambda}{\lambda} = \frac{\Delta r}{r} = H \Delta t
\]  

(10)

Thus the trial hypothesis is wrong. It is not possible to find a reference standard, or reference frame, that does not expand in just the same proportion as any other distance of the universe. Thus, paradoxically, a global universe expansion cannot increase any “measured” distance, velocity or “cosmological red shift” because matter must expand in just the same proportion. From the relative (measurable) viewpoint, the average universe must look like it is frozen, static, for ever, i.e., its age may be infinite regardless of an universe expansion.

This conclusion matches with the relative mass-energy conservation law because, from it, the relative masses of the free bodies are conserved during universe expansion. This is obviously due to the lack of real energy exchange between the space and the bodies.
The same results come out more directly after emulating every part of the universe by particle models made up of photons in stationary states. Then, from the Huygens’s principle it is found that the photons and particles must be the result of constructive interference of wavelets that are traveling rather indefinitely in the universe. Thus a universe expansion would stretch every wavelet in just the same proportion, which would not change any local ratio or proportion anywhere in it. Notice that the lack of energy of the G field comes from the fact that the net amplitude of the wavelets with random phases is zero.

A. The new kind of black hole

The strict linearity of the new field equations eliminates the odd singularity produced by the non linear equations of GR. Thus the new kind of “linear black hole” (LBH) is necessarily different and simpler than the traditional ”black hole”. Because it is just a huge “macronucleus” that obeys ordinary nuclear laws. From due to the very low relative speed of light, most probably it is made up of nucleons of very low relative mass compared with free neutrons. Thus the phenomenon of “critical reflection” can prevent the escape of individual photons and nucleons.

Then a LBH must be an efficient absorber of particles and radiation coming from the rest of the universe. Thus, after cleaning up the external space from gas and particles, the average mass-energy per neutron of the LBH, with respect to an observer at infinite, must increase with the time until it becomes equal to the mass of a free neutron far away from it. Locally, this is equivalent to a hot gas of temperatures similar to those currently assumed to exist in the big bang model of universe.

After such critical condition, the LBH can explode adiabatically because, from the mass-energy of the neutrons traveling away from the LBH, with respect to an external observer, remains constant. Then the neutrons can escape, rather collectively, decaying into H and other neutron rich isotopes. Such a “small bang”, would generate a “new primeval gas” composition similar to that predicted for the “big bang”. The new gas, mostly hydrogen (H) rather free from metals, can be captured by other cool bodies that would become new stars. This process can generate new clusters of stars, or galaxies, with high proportions of randomly oriented angular momentum generated from the LBH explosion. Thus the new galaxies must have a nearly spherical
B. The evolution cycles of matter in the universe

From the new scenario fixed by the NEP it is inferred that, in one way or another, an appreciable fraction of the matter of the galaxies must be evolving between the states of gas and LBH, and vice versa.

Consequently a galaxies should also be evolving, indefinitely, in a rather closed cycles with luminous and dark periods. The luminous periods must end when the whole galaxy has run out of available energies, i.e., when it becomes a set of LBHs surrounded by a “dark galaxy” made up of dead stars, planets and planetesimals. The very long dark periods would end when the LBHs have absorbed energy enough to explode.

The luminous periods of a galaxy should start after a chain of LBH explosions occurring in a dark galaxy. The new gas, flowing throughout the host dark galaxy must convert its dark bodies into luminous ones. This may be called phase I.

Due to the high proportion of angular momentums of random orientations generated by the LBH explosions, the new galaxy must get a rather spherical (elliptical) shape. The dark bodies covered with the primordial gas would generate low temperature stars. The percentage primeval gas, free of metals and rich in deuterium, should be the maximum.

With the time (age), the proportion of dead stars in an elliptical galaxy should increase, starting with the more external bodies that have received less gas. The more evolved stars of preferred angular momentum, coming from the earlier dark galaxy, can capture new gas and start a new luminous period. They have denser cores that can liberate more G energy\(^2\). Then elliptical galaxies may take the forms of disk and spiral galaxies with a halo of dark bodies. This may be called phase II.

Later on, the last disc and spiral stars would also become dark ones. Then only the spherical set of stars of randomly oriented angular momentum would remain visible, inside of rings of more massive dark bodies of preferred orientations, like in “Centaurus”. This may be called phase III.

\(^2\)A mechanism of nuclear stripping reactions has been proposed, in the cited articles, that can convert G potential energy into nuclear potential energy inside of stars called “younger stars”
In one way or another, the masses of the “neutron stars” near the galaxy center should increase with the time. Due to the high net binding energy (nuclear and gravitational) of these macronucleus with the neutrons, they can strip neutron from atoms and gas thus rejecting high energy protons. Then he in fall of such gas can release G energies of higher magnitude than the nuclear one. Thus this region should become a source of high energy radiation that comes from G energy rather than nuclear energy. This may be called phase IV (Active Galactic Nuclei, AGN).

The last luminosity of a galaxy should come from a small volume near the central LBHs surrounded by the rest of the galaxy, which may be called “host dark galaxy”. The continuous fall of the remaining gas on the LBHs should produce a star like object that emits light of high red shift due both to the low GP and to Doppler Effect. Such gas would be contaminated with metals. On the other hand, the strong magnetic fields would drive the positive ions to the magnetic pole targets that, according to the mechanism of nuclear stripping proposed in the earlier papers, would produce jets of cosmic radiation that are sources of radio waves. This may be called phase V.

During the dark period of a galaxy (phase VI), the residual plasma would be captured by the more massive and dense bodies, thus producing high energy cosmic and gamma radiation. After that, there is no much G energy that can be transformed into electromagnetic radiation or other radiations. Thus, for a long period, its most massive LBHs, most probably a central binary one, can reach the critical stage for explosion. It may explode, may be in chain with its binary companion, thus starting a new galaxy cycle.

Statistically, after the rather infinite age of the universe, the different evolution phases of the galaxies and clusters should be rather uniformly distributed in the universe in proportions fixed by the periods of their corresponding phases. Due to the small capture cross section of a LBH, its dark period necessary for recovering the energy lost during the luminous period must be of higher orders of magnitude than the luminous one. Then, statistically, the number of dark galaxies must also be of higher orders of magnitude compared with the number of luminous ones, i.e., most of the galaxies of the universe should be in their cool and dark periods.

Clusters can also evolve in rather closed cycles. The higher energy released by a new luminous galaxy should accelerate (trigger) the regeneration of other nearby galaxies. Thus the regeneration of clusters can occur in chains that are consistent with the clusters of luminous galaxies and the apparent
voids, which are likely to be clusters of dark galaxies.

IV. Some recent astronomical tests for the new principle

A. Galaxies without dark matter

During galaxy evolution, the average number of dead stars and of its associated bodies should grow up with the time. Thus recently formed galaxies should have a minimum of dark matter. This fact has been recently verified by Romanowsky et al. From the study of the kinematics of the outer parts of three intermediate-luminosity elliptical galaxies, they found that “the data indicates the presence of little if any dark matter in these galaxies”. “This unexpected result conflicts with findings in other galaxy types and poses a challenge to current galaxy formation theories”.

Then this study, altogether with the dark matter observed around the other galaxies of lower luminous volumes, also verifies the rather obvious fact that the number of dark bodies increases during the luminous period of a galaxy, i.e., that sooner or later the whole galaxy would become a “dark galaxy”.

B. The new way of star formation

In the new scenario, the primordial gas comes not from a “big bang” of the universe but from a “small bangs” resulting from LBH explosions occurring in the center of dark galaxies. Most of this gas would be absorbed by dark bodies coming from normal evolution of the earlier galaxy. The density and the state of evolution of the new luminous bodies must depend on the masses, densities and the state of evolution of the earlier dark bodies. Then this new model accounts for the different kinds of stars in different evolution stages of stars, found relatively close to each other, anywhere and in anytime in the universe.

Since most of the dark bodies would be low mass planets and planetesimals, then most of the new stars are likely to be low density stars coming from gas deposited over them. Only a small number of denser bodies would come from gas captured by dead stars. The first ones would account for “globular star clusters” and the last ones would account for the bluer (hotter) stars”.
With the time, in one way or another, gas ejected from hot stars must flow towards regions of lower GP and lower temperatures, i.e., toward clusters of dead stars. The last ones would become new clusters of stars denser than the original ones. They are consistent with the so called “young star clusters” that have higher metal contamination coming from the recycled gas.

C. The new origin of the deuterium in galaxies

In the new scenario, the neutron rich elements should come from the primeval gas resulting from LBH explosion. Thus its maximum concentrations should exist the a recently formed (elliptical) galaxies. During its luminous period, D would be used up by nuclear fusion occurring mainly in the stars occurring more intensely towards the galaxy center. Thus the D would last longer in the external regions of the galaxies. This fact has been verified, in our galaxy, by Ph. Schewe and Ben Stein.¹⁰

D. Haloes and Shadows of dark bodies around galaxies

The most external shell of low mass dark bodies, that has captured a lower proportion of gas, should become dark first. However the hot gas within such bodies can be detected from the X-rays. “To keep the hot gas from expanding away, the mass of dark matter required from gravitation may be several times the mass of the stars in the galaxy“. These rather “spherical” haloes have been recently detected in the Chandra’s pictures of the galaxies <http://chandra.harvard.edu/photo/2002/0021/index.html>.

The minimum proportion of such halo should occur in the new galaxies.

E. Same kind of galaxies found anywhere in the universe

Statistically, from the NEP, all of the phases of the cyclical evolution of the galaxies should be present in the sky, anywhere and in any time, in the proportion of their corresponding periods.

This fact has been recently verified from Hubble deep field observations. Schade et al have found massive elliptical galaxies between 8 to 11 billion years ago.¹¹ There is no evidence for a decline in the space density of early-type galaxies with look-back time.
According to the conventional (hierarchical) model, elliptical galaxies would be the oldest ones and, therefore, they could not exist at near the beginning of the universe.

The same fact has been recently found to hold for quasars. Daniel Schwartz and Shanil Virani recently observed the quasar, known as SDSSp J1306, which is 12.7 billion light years away 

[http://www.journals.uchicago.edu/cgi-bin/resolve?ApJL18728].

Since the Universe is estimated to be 13.7 billion years old, we see the quasar as it was a billion years after the Big Bang. They found that “the distribution of X-rays with energy, or X-ray spectrum, is indistinguishable from that of nearby, older quasars”. “Likewise, the relative brightness at optical and X-ray wavelengths of SDSSp J1306 was similar to that of the nearby group of quasars. Optical observations suggest that the mass of the black hole is about a billion solar masses.”

Similar results have been found by D. Farrah et al on the QSO SDSS J1030 at a distance of 12.8 billion light years. “This QSO appears indistinguishable in any way from lower redshift QSOs, indicating that QSOs comparable to those seen locally existed less than 1 Gyr after the big bang”. Since the elliptical galaxies and QSOs would be the initial and the final luminous phases of galaxies, respectively, then the similar results are expected for all of the phases of the galaxies.

F. G time dilation of supernovas

From the NEP, the proportional differences of the relative frequency of the atoms and of any natural phenomenon that may occur in a NL galaxy, due either to differences of velocity or due to differences of GP, compared to those of local galaxies, should be the same.

This has been verified from the identical proportion of the GTD observed in the light curves of supernovas and of their photons.

G. Ghost galaxies

When most of the external halo of stars has dead, only a rather spherical region of luminous stars would remain around some massive LBHs. This one is consistent with the spheroid dwarf galaxies, called ”ghost galaxies”. They turn out to have proportions of dark matter as much as 99%.
H. The last luminosity of a galaxy

Such objects clearly correspond with the genuine quasi-stellar radio sources (quasars).

The relatively large fluctuations of luminosity can be possible due to the small volume of this star like object, compared with that of the dark galaxy.

Important errors would occur if the distances of quasars are estimated by assuming that their red shifts are just cosmological.

I. The black body radiation from the dark galaxies

Statistically, due to the long dark period of galaxy compared with its luminous one, the number of dark galaxies must be of higher orders of magnitude compared with the luminous ones.

Due to the large proportion of dark galaxies that are absorbing energy from the rest of the universe, and to their cosmological red shift with respect to the observers, the apparent temperature of the universe background must be close to 0 K.

Then the low temperature CMB radiation clearly verifies the high proportion of dark galaxies that should exist in the universe.

V. Conclusions

A new relativity principle comes out after eliminating two fundamental hypotheses that are in contradiction with fundamental properties of light and with crucial experiments. According to the last ones and the EEP, some fundamental relativistic changes occur to all of the bodies of a system that has changed of GP, with respect to observers that have not had the same kind of changes. The proportional changes are just equal to the changes of GP. Such relative changes cannot be detected by observers of the same system because every local ratio remains invariable (EEP). The same would occur during a universe expansion.

The new principle was originally derived from theoretical properties of a particle model that, according to the EEP, must have the same inertial and gravitational properties of uncharged matter. Here it has been directly verified from correspondence of the EEP with the general results of the genuine GTD experiments done with standard clocks. It has been indirectly verified
from the agreement of the new astrophysical scenario fixed by this principle and recent astronomical observations. The last one has fundamental differences compared with the standard model:

1. 1. A global universe expansion cannot produce measurable changes with the time. Thus the new universe age tends to infinite. Only “small bangs”, that don’t involve to all of the bodies of the universe, can produce measurable effects with the time.

2. 2. The new kind of LBHs, after absorbing radiation, can explode thus generating “new primeval gas” that can transform a dead galaxy into a luminous one and so on, i.e., it makes possible that matter can evolve in closed cycles, indefinitely.

Then the galaxies should also have been evolving, from long ago, in rather closed cycles with luminous and dark periods. Statistically, the different phases of the evolution cycles of the galaxies should be present in the universe, in the proportion given by their corresponding periods. The average relative properties of the bodies in the universe, like their mass-energies, densities and entropies would remain constants with the time.

Recent astronomical observations clearly verify this new astrophysical scenario fixed by the NEP, which is in clear opposition with the conventional one. They also verify an isentropic theory of evolution of the universe proposed in earlier articles, which was worked out in terms of the real observations rather than the mainstream of the currently accepted theories and models.\footnote{[11]}
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