[To Home](#) [To Book Index](#) [To previous subject](#)

CONCLUSIONS AND DISCUSSIONS

Tabla de contenidosS

11.1 The General form of the Equivalence Principle (GEP)

The gravity experiments prove that

“Observers located at rest in different G potentials, have clocks, atoms, and unit systems, that are physically different with respect to each other, respectively”.

For example, their atomic clocks run at different speeds with respect to each other. This is a well-proved fact that must be definitively accepted.

According to the Equivalence Principle:

“***An ordinary observer cannot detect any of the changes THAT HAVE OCCURRED TO ALL OF THE BODIES in his system, due to changes of velocity or gravity potentials of his system”***

These two facts can be compatible to each other only if:

“ALL OF THE PARTS OF THE SYSTEM, including ANY KIND OF RADIATION IN STATIONARY STATE, HAVE changeD in the same way and in the same proportion *AFTER IDENTICAL CIRCUMSTANCES*”.

General form of the Equivalence Principle (GEP)

This means, necessarily, that:

Uncharged particles and radiation’s in stationary states have the same general physical properties.

Explicit Equivalence Principle (EEP)

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Then in principle,

The general properties of the bodies and of their fields can be found from general properties of radiations in stationary states

This seems to be the simplest, and the most reliable way to start all over with a new kind of physics, and astrophysics based on ***a more general and well-tested principle.*** In this way, it is possible to get rid, from the very beginning, of some explicit and implicit hypotheses that are normally made in current literature.

Above it has been proved that, “effectively”, the EEP can be used to derive, theoretically, the relativistic changes occurring in matter after changes of velocity and field potentials.

11.2 Nonlocal Relativity

On the other hand according to the Einstein's Equivalence Principle, the forms of the local physical laws do not change after a change of G potential of the measuring system. This has normally made believe either in that matter is invariable after changes of G field potentials, or that the eventual changes occurring to it are not important.

Thus most people do no realize that the current (local) physical language becomes ambiguous, non well defined, for relating quantities measured by observers that are in quite different field potentials. This has been the origin of serious errors in physics, cosmology and astrophysics. Such errors have remained rather undetected throughout the current literature for nearly a century.

Then to describe the G phenomena, "*a single and well-defined reference (Lorenz) frame, in a fixed potential, must be used*". This is obvious because observers located in different G potentials have clocks and standards that are not strictly the same with respect to each other, respectively. This is equivalent to put a more strict condition of *homogeneity* for each single relationship.

In brief terms, in order that any Nonlocal relationship in G fields can have some well derived physical meaning, it is most important that:

All of the quantities in a single relation must be referred some well defined reference frame that has not changed in the same way as the objects

(Only in this way all kinds of changes can be described)

Notice that observers moving with the objects cannot detect such changes from strictly local measurements.

Only in this way the mathematical relationships can be strictly homogeneous and have a well-defined physical meaning.

To relate quantities measured by observers in different G potentials, they *must* be previously transformed to some common unit system. These *transformed quantities* are called here "*Nonlocal quantities*".

The corresponding transformation factors have been found

a) From experiments, according to the most exact gravity experiments used for testing gravity theories and

b) Theoretically, according to the GEP.

A reasonable name for the present approach is "NL relativity". This is because "*this is plain generalization of special relativity*" for the more general nonlocal case in G fields.

11.3 General physical laws derived from general properties of light

Here, the general properties of the bodies and their gravity fields have been derived both experimentally and theoretically. Using the simplest particle model based on the GEP and general properties of radiations has done this. Such model is made up of a single quantum of radiation in stationary state. Thus, the main conservation laws can be derived from dual properties of light, mainly from "***wave continuity*"**.

From optical experiments done with single photons, it is inferred that single photons must be the result of interference of more elemental kinds of "*wavelets*". *Then an electromagnetic wave is the result of interference of a large number of wavelets*. Consequently, Then, the wave continuity of an electromagnetic wave turns out to be a consequence of the "wavelet continuity" of each of its photons.

To define the NL properties of a photon it was necessary to define its quantum's NL frequency vector and its NL quantum vector proportional to it. Then a correspondence has been established between the NL frequency vector of a single quantum, and the rate at which its coherent wavelets are virtually crossing some plane at rest with respect to such observer. Each cycle corresponds to just one wavelength of the coherent wavelets.

According to wave-continuity, the quantum's waves (or quantum's cycles) cannot disappear leaving nothing else. If this were not so, the mass-energy conservation law would be violated. Such "*quantum's cycles*" turn out to be basic elements that are conserved during any interaction in nature.

On the other hand, according to the results of a universal set of experiments that are summarized in the GEP "*particles can be emulated by particle models made up of quantum's of radiation in stationary states*". Thus, from the nature of the particle model and from basic optical phenomena it is found that the wave properties of photons and particles can be described in terms of even more elemental kinds of wavelets associated to each quantum. Such wavelets are somewhat better defined compared with the wavelets normally used in optics. For this reason, they may be called "quantum's wavelets".

Consequently, matter and radiation should be the result of interference of a large number of wavelets. Then "*the ultimate realities of nature of the things are not the particles, nor radiation, but some more elemental kinds of "wavelets*"[1].

Effectively, the constructive interference of wavelets accounts for all of them, the dual properties of the radiation and for the dual properties of matter.

The non-constructive interference of wavelets also account both for the NL properties of the space in G fields and for the NL properties of the bodies located in it, i.e., for NL gravity.

The conservation laws for local and nonlocal cases in physics turn out to be a direct consequence of properties of light. For example the Nonlocal conservation laws for mass-energy and momentum, and for angular momentum, turn out to be direct consequences of quantum wavelet continuity. Such laws can only be well defined for a "single" observer in some fixed state of velocity and G potential. This makes sure that everything is referred to a more strictly invariable unit system.

In the end, the wavelets turn out to fix the general properties of all of them: a) free quantum's of radiation, b) isolated particles, c) their G fields, d) the black holes, e) the universe.

For example, any well-defined NL frequency or NL wavelength of an atom at rest in a G field gradient turn out to vary with the square root of the NL speed of light of the space in which is located. An interesting point is that the product of the NL eigen-frequencies of the standing waves of particles and the NL perturbation rates of the space has also constant values. This means that *the particle wavelets are is in a sort of equilibrium with those of the space*.

11.4 Physical Tests

11.4.1 Conservation laws

Such NL laws turn out to correspond with the conservation laws of fundamental physics. However, some fundamental disagreements come out with the Einstein's theory of general relativity, in the strong field range. "The Einstein's hypothesis on the G field energy is not compatible with the EP and the gravity tests".

11.4.2 Special Relativity

The relativistic properties of the model derived from properties of light are in strict agreement with special relativity. In this way, the particle model makes possible to understand the reasons for the relativistic phenomena.

11.4.3 Quantum Mechanics

- The properties of particle models turn out to be direct consequence of interference phenomena of the radiation confined in stationary states.
- The dual properties of particles turn out come from the dual properties of the radiations confined in them.
- The quantum mechanical properties of the model are in strict agreement with quantum mechanics.

11.4.4 Gravity

Gravity and the universe cannot be studied separately. This is because all of the bodies would be in a kind of equilibrium with respect to each other, i.e., with the universe.

According to the nature of the model fixed by the EEP, a high density of wavelets should cross the universe. The last ones fix the relative positions of particles and radiation's. In it, photons and particles must be at the sites of coherent interference of wavelets. Relatively far from such sites, the wavelets cannot build up net wave amplitude, i.e.; there is no energy at all. Thus, "*the G field between particles has no energy*".

In any particular point of the space, its gravitational properties turn out to be fixed by the destructive interference of all of the wavelets with random phases crossing it. Such wavelets would fix the “NL perturbation rate of the space” with respect to some fixed observer.

Thus, the NL properties of the space, and of the bodies located in it, turn out to be fixed by the NL perturbation rate of the space. The last one is produced by all of the wavelets with random phases that are virtually crossing it. This parameter fixes the NL refraction index of the space and the NL eigen-frequencies of the particles located in it.

Some of the main points demonstrated above are:

1. The G field around the model turns out to be due to a gradient of the NL perturbation rate of the space.
2. The NL refraction index of the space, with respect to a fixed observer, depends, exclusively, on its NL perturbation rate.
3. The NL eigen-frequencies of matter systems are conversely related to the NL perturbation rate of the space, i.e., “*matter is in equilibrium with the space*”
4. The trajectories or orbits of photons and of particles in static fields are independent on the NL masses of the objects. The NL masse-energies remain constant with respect to an observer in a fixed potential
5. G fields do not exchange energy with the bodies.
6. The energy released after G work comes from the bodies, not from the field.
7. According to the EP and the experiments, the NL field equation is “linear”. This is a fundamental difference the nonlinear Field Equation of the Einstein’s theory on general relativity.
8. The results of the present theory are in simultaneous agreement with the current tests for gravitational theories.

[On the other hand, the presumed exchange of energy between the G field and the bodies is not “simultaneously” consistent the EP and the gravity tests.]

11.4.5 Other gravitational tests

Some other tests can be added to the current ones:

1. *The negative results for instrumental detection of gravity waves*.

From above it may be anticipated that gravity waves cannot be detected, either because they would not exist or because all of the parts of the instruments would change in the same proportion.

According to the Explicit Equivalence Principle, any eventual change of the space properties brought up by some gravity wave would produce identical changes on the pseudo-stationary waves of the measuring instruments and on those confined in every particle of it. Thus, the ratio between them is bounded to remain unchanged. Then, the same as in the MM experiments at the end of the last century; *the expected gravity waves measurements should give negative results.*

2. *The simultaneous correspondence of the NL theory with fundamental physics, mainly: relativity, quantum mechanics, gravity and particle physics.*

3. The simultaneous correspondence of the new cosmic context with a wide range of astronomical phenomena.

The last point comes from a large list of correspondences with observed facts. The most discriminative ones correspond to the current problems that the astrophysicist normally has. Such problems come out when they try to adjust current theories or models to the observed facts. The main ones seem to be.

a) *The missing mass problems in current astrophysics*. Here, such mass must correspond with the large number dark bodies resulting from long periods of evolution of galaxies. Such long periods would be not compatible with the current estimations of the universe age.

b) *The quasar-cosmic jet test given in Section 7.3* show that the true (noisy) quasars correspond to the near end stages of the luminous periods of galaxies. The quasars of high red shifts are not distant objects but the rather small luminous regions of nearly black galaxies that are relatively close to us.

c) *The iron lines the X-ray spectrum coming from the intergalactic space*. The existence of iron lines proves that most of the dark mater in the intergalactic space is made up of black galaxies of ordinary matter that is rather exhausted from light elements.

d) [The strong "*gamma bursts*" should also come from the last falls of matter into massive neutron stars of black galaxies that are relatively close to our galaxy]

e) *The cosmic jets given in Section 7.3* prove that high-energy radiation can get away from black holes i.e., that there are no singularities in the universe.

f) The composition and energies of cosmic rays are consistent with nuclear stripping occurring in black holes and neutron stars. This would prove that they get away from the massive neutron stars and black holes.

g) The angular momentum of globular clusters. Globular clusters have a high proportion of angular momentums with random orientations. They could not be formed from a slow process because in the meanwhile the angular momentums would be cancelled out. Then a much faster process should generate such clusters. This would not hold if the randomly oriented angular momentums were suddenly generated during the explosion of a BH.

h) The low temperature cosmic radiation background. The existence of this radiation proves that most of the universe is made up of cool black galaxies, absorbing energy from the rest of the universe. They should be storing it for future regeneration of matter in the dispersed state.

i) The wavelet red shift necessary for the existence of gravity is consistent with the Hubble red shift. Thus, the average density of matter of the universe, derived from the Hubble constant, is of the same order of magnitude than the one currently estimated from dynamic methods.

11.5The main advantages of the Nonlocal Relativity

Several improvements have been introduced by the NL theory. The main ones seem to be:

1. *To simplify and unify the theoretical description of the phenomena in different branches of physics. This has been verified here, mainly, in relativity, quantum mechanics, gravity, and aster-particle physics*.

2. *To get an outstanding reduction in the number of independent physical principles, postulates and laws.*

3. *To test current hypotheses and implicit assumptions normally made in physics, astrophysics and cosmology.*

4. *To understand a wide variety of phenomena between the micro and macro cosmos, in terms of the most elemental properties of light and of the least number of independent hypotheses and postulates*

5. *To find a new unified cosmic context whose global context is inexorably fixed by the Explicit Equivalence Principle. This has been done by verifying the existence of all of the evolution stages occurring in a full cycle of matter-radiation.*

6. *To find a new stellar process that can unify a large number of phenomena occurring in the universe.*

7. *To get a unified approach in which the arbitrary assumptions are strongly reduced. This comes out from the introduction of a particle model whose physical properties can be obtained from plain properties of light. This is a more secure way for not depending on non-well proved hypotheses.*

8. *The simultaneous consistency of this theory both with fundamental physics and with a wide range of astronomical phenomena. This seems to be a fair reliability test for the particle model and for the relations obtained from it.*

11.6 The role of the Linear Black Holes in the evolution of the Universe

It is obvious that the conventional black hole would not allow a cyclic evolution of matter in the universe. On the other hand the new kind of “linear black hole”, on the contrary, makes possible that matter can evolve into closed evolution cycles.

The linear black holes turn out to be the counterparts of the luminous bodies of the universe. They would absorb and store the energy radiated by the other bodies in the universe. . They would concentrate a large number of low-energy quantum’s, into several of them in higher energy levels. In this way, the average NL mass-energy per nucleon in a black hole would increase with the time.

For an idealized observer in a black hole surface, the external universe would look like a source of "blue shifted" radiation's falling into its surface. The increase of the local radiation densities would increase the probabilities for the radiation's to fill higher energy levels in the neutron star core, i.e., for becoming part of standing waves of higher NL frequencies. This process would increase the average number of particles or nucleons in higher energy states. This means *a decrease of the NL entropy*. Such upgraded NL energy will be released later, after black hole explosion, as neutrons or protons of high kinetic and nuclear latent energies.

The net energy stored in a black hole would become more *available* after the black hole explosion. The decrease of *z(r)* produced by the escape of particles should open the critical reflection angles thus increasing the escape probabilities for other nucleons. After the escape, the high-energy quanta confined in the new primeval atoms, is a low entropy material with high mechanical and nuclear latent energy per unit of mass. These clouds of regenerated matter, rather free of metals, would produce rather spherical clusters of low-density stars made up with fresh H coming from a sudden expansion from an extremely dense state.

In the average, these "*small bangs*" would be continuously re-injecting the universe with low entropy matter. This would balance the current entropy increase occurring outside of the black holes. In the last regions, the high frequency quanta are normally transformed into a large number of low energy ones. Vice versa, the black holes would condense them into its single nucleons. Thus, the average entropy of the universe would remain constant. In other words, the linear black holes would prevent the so called the "*entropy catastrophe*".

[Notice that lack of energy in a G field is fundamental for the evolution of the universe, for three main reasons:

I. Due to the linear form of the field relationships, the new kind of BH can finally explode so that matter can start a new cycle.

II. During the "sleeping period" of black galaxies, they would not radiate gravity waves and, therefore, they would be stable for the long recovering periods.

III. If this were not so, galaxies would collapse after emitting gravitational waves. In such case it would by hard to account for the black galaxies and for the missing mass of the universe.]

11.7 Some Differences with Conventional Theories

The Explicit Equivalence Principle brings out some fundamental differences with conventional gravity and cosmology, mainly*:*

1. *It is not necessary to make arbitrary assumptions on the form of the G field equation because this one is fixed by the Equivalence Principle. (The one of the theory of the Einstein general relativity is not based in such principle)*

2. *Gravity and electric fields turn out to be fundamentally different to each other in every respect. (Einstein assumed that they would have some common properties.)*

3. *The space in G fields, to the contrary of that of E fields, does not have energy (Einstein assumed that G fields themselves do have some energy density.).* The G field itself is not a secondary source of G field.

4. *G fields, to the contrary of E fields, do not exchange energy with other bodies. (Einstein assumed that G fields do exchange energy with the bodies.)*

5. *This theory has not singularity. General Relativity has the Schwartzchild singularity at r = 2GM.*

6. *The new properties of black holes and of the universe are "fixed" by linear properties of the wavelets. They have fundamentally differences with those predicted from general relativity.*

7. *The linear black holes can let escape of particles and radiation's, within finite time intervals, but with very small probability. The conventional black holes cannot let particles to escape from them at all. The theoretical traveling times would become infinite.*

9. *The new black holes, after capturing energy from the space, can explode. (The conventional black hole can never explode)*

10. *During a universe expansion, particles are bounded to expand themselves in just the same proportion. Thus, the Explicit Equivalence Principle also holds for the case of universe expansion. In current cosmology, it is implicitly assumed that particles do not expand in the same proportion*

during universe expansion.

11. *The Hubble red shift cannot change with the time, even if universe were expanding. This is because matter must expand itself in just the same proportion as anything else. This invalidates the current estimations on the universe age, based on the "tacit assumption" in that the particles do not expand in the same proportion.*

12. *The universe age and its lifetime are indefinite. There is no way for determining its true age. Such cosmological uncertainty turns out to be a direct consequence of the Explicit Equivalence Principle.*

13. The last point should bring out a strong relief in the uncomfortable position of the astrophysicists who are normally compelled to fit their theories and models within the very short age of the universe predicted by conventional theories.

14. The simultaneous agreement of the non-exchange law with the EP and with "all of the gravity tests", including the self-consistency test given in the appendix B. [On the other hand, the hypothesis on the G field energy does not fit with this simultaneity test with respect to a well defined observer]

15. The GEP would hold anywhere in the universe, even the universe were expanding. This is the only way according to which the local physical laws can not change after changes of G potential of the measuring system. This would not occur if particles do not expand in the same proportion as the universe.

11.8 The New Cosmological Outline

According to the Explicit Equivalence Principle, both the black holes and the universe should have properties different to the conventional ones.

From the new G field equations it is concluded that the actual universe must be, necessarily, in a kind of dynamic equilibrium in which the ratio between the distances, do not change after an absolute kind of universe expansion. Such equilibrium is ultimately fixed by a cosmological red shift that. The last red shift can be emulated by a rather “absolute” kind of universe expansion. Any change from this relative stationary state would produce a reaction in the opposite sense.

Globally*: The universe* turns out to be like *a deep sea of wavelets* that would be continuously interfering to each other. They would do it constructively at the sites where the quanta are. Most of the last ones would be confined in the forms of stationary states in particles[2].

The new universe has no well-defined age or lifetime, even if the universe were expanding itself, indefinitely.

“*A uniform universe expansion would not produce relative changes with the time*”. This is because any particle and any stationary radiation are bounded to expand itself, due to “*gravitational expansion”*, in just the same proportion.

Then:

It is not possible to estimate the universe age from the cosmological red shifts.

This is because, according to the GEP, such red shifts must be constant, i.e., independent on the time.

11.8.1 The new kind of stationary state of the universe

In the new cosmic context, matter must be evolving between gas and linear black hole states. Other black bodies or black holes of the universe must absorb the energy liberated during matter contraction, eventually. The last ones, in the end, after recovering enough radiation from the space, must explode. They would regenerate new gases that would start new matter cycles. *In the average, the typical parameters of the universe, including the Hubble red shift, would remain constant throughout the time*.

[Notice that the “small bangs” occurring during the explosions of the “black galaxies” would be somewhat similar to the “big bang” currently assumed for the universe.]

Single and chains of black hole explosions ("*small bangs*") would produce the gas necessary for regeneration of the luminous inhomogeneities like: *star clusters*, *galaxies*, *clusters of them*, and so on. However, most of the matter in the universe should be in the black states absorbing energy from the rest of the universe. In this way, statistically, the universe should look about the same throughout the time, rather indefinitely. Thus, the GEP would also resuscitate the old "cosmological principle"

The main disagreement with the current "big-bang" model comes from the fact that the last one does not take into account the real gravitational expansion of matter. The last one occurs in just the same proportion so that the relative distances don't change. Thus, only an absolute kind of universe expansion may exist, but this one would not produce relative changes with the time.

In the present theory, the conservation laws of physics would not be violated, locally and non-locally, anywhere in the universe. After considering the processes occurring inside and outside the linear black holes, The global entropy of the universe would also be conserved. Thus, according to the GEP, the new stationary state of the universe is somewhat consistent with the *steady state model* proposed by F. Hoyle[27]. It is more fundamentally different with that of H. Bondi and T. Gold[28].

11.8.2 The new model of formation of star clusters and planetary systems

It has been found that no real primeval gas, coming form some early explosion of the universe, can actually exist.

1. Most of the new celestial bodies would normally be formed by condensation of gas coming from relatively recent ejection from older bodies. The G fields of older stellar remnants or planetesimals would concentrate them. This process would occur within relatively short period. For example,
2. A "*new*" *globular cluster* can be formed by condensation of "new gas" ejected from explosion of a linear black hole and condensed around older remnants.
3. New satellites can be formed from rings of planetesimals condensed around older planets.
4. New planets can be formed gases condensed around older satellites.
5. New stars can be formed from gas concentrated around older planets or dead stars.

11.8.3 The new model of evolution of galaxies

[According to the new context,

Galaxies must be evolving, rather indefinitely, in closed cycles between luminous and black states and vice versa.

The new luminous galaxies would come from a chain of black hole explosions occurring in black galaxies. Such expansion would transform most of the internal energy, accumulated during cosmological ranges of time, into gravitational potentials, nuclear potential energies and rotational energies. The last ones should produce a rather spherical galaxy that would be consistent with an "*elliptical galaxy*".]

During the evolution of an elliptical galaxy, the cancellation of *randomly oriented* angular momentums must occur at higher rates compared with those in *the same orientation*. This must produce a faster contraction of the "*spherical bulge*" of stars, that has "randomly oriented angular momentum's". The equatorial regions, that have most of the "***net***" angular momentum of the galaxy, should contract at slower rates. Such galaxies should progressively take the form of *disk galaxies*, with some spirals. Finally, only small central bulges would remain luminous. [Notice that such luminous bulge may be oddly classified in the same group of "elliptical galaxies"]. In the end, last luminous bulge of a galaxy should have a high density of massive stars. They would produce ejections of high-energy particles and a high proportion of radio waves compared with the last luminosity the central bulge. Due to the low G potentials, light would be emitted with a high red shift. The properties of such objects correspond with the true (noisy) "*quasars*". They should be the true "quasi stellar radio sources".

Statistically, the energy-recovering period of black galaxy must be of higher order of magnitude compared with its luminous one. Then it may be concluded that, in the average, "*most of universe should be made up of black galaxies that are absorbing energy from the rest of the universe*".

Thus, the role of black galaxies in the evolution of the universe is as important as the role of the luminous ones.

11.8.4 The new kind energy source in the universe.

The gravitational energy released over cores of nuclear density (neutron stars) immersed in a gas cloud can be of a higher order of magnitude compared with that of nuclear fusion of H. Since the final state of matter, in a matter cycle, would have densities equal or higher than this one, then:

"*Most of the energy released in a matter cycle must come from gravitational work that is released around bodies of nuclear density*".

On the other hand, the most efficient mechanism for transforming G energy into nuclear energy would be "neutron stripping reactions".

[In principle, depending on each particular condition, this kind of reaction may generate from electron pairs and proton rich particles of high kinetic energies. This is done at the cost of the lower final potential of the neutrons captured by the NS.]

Most of the times this kind nuclear-gravitational reaction would generate free protons, or proton rich nuclei, of high kinetic and nuclear latent energies.

Neutron stripping reactions would account for a large list of phenomena, like cosmic jets, cosmic rays, X-ray bursts, supernovas, pulsars, and the well-defined properties of main sequence stars and their low neutrino luminosity. The proton rich materials rejected after neutron stripping can extend the luminous lifetimes of galaxies considerably over the conventional estimations.

Neutron stripping reactions turns out to be the missing link for explaining a variety of celestial phenomena occurring in the universe. Most of them would be rather hidden be inside of some rather powerful stars.

Globally, the contribution of the gravitational potential energy, to the energies released in a galaxy cycle, would be of a higher order of magnitude compared with that of the original nuclear potential energy. This would extend the luminous lifetime of ordinary galaxies.

11.8.5 The new kind of stellar model

In the new context, most of the energy released in matter cycle should occur around neutron stars and black holes. Then some of the most dense and powerful stars should have a NS in their centers. This would account for the higher densities and luminosities of main sequence stars. This is consistent with the peculiar properties of these stars, including "*the low neutrino luminosity of the Sun*".

11.8.6 The low temperature cosmic radiation background

According to global mass-energy conservation of the universe, the average fraction of mass in luminous states must be very small compared with the fraction in the state of black galaxies. *Then the low temperature background of the universe* must be fixed mostly by the average temperature of the blackbody radiation coming form the black galaxies and by the cosmological red shift produced during the trips between them and the observer. This means an *apparent NL temperature of the universe must of an order of magnitude smaller than the apparent temperature of a nearly local black galaxy*. Thus, it is reasonable that the black galaxies around our galaxy may have apparent temperatures of about "one order of magnitude higher" than 2.7 ºK.

Since most of the radiation background would come form distances of the order of magnitude of a Hubble radius, such measurements involve an extremely large number of black galaxies. Statistically, this should account for the high isotropy observed in such measurements[3]. The main anisotropy's would come from inhomogeneities that would exist within the Hubble radius.

11.9 The "time arrows" in nature

The new evolution model of the universe seems to be the only one that can in principle solve the dilemmas on *the arrows in nature*. It has been recognized[26], according to the Wheeler-Feynmann theory, that *only steady state theories can account for the natural arrows in nature*.

Due both to the Hubble red shift and to the high proportion of the cool black galaxies, *the rest of the universe would always be a nearly perfect radiation absorber*. This would account for the fact that the atoms are normally in the their lowest energy levels.

The opposite holds for an idealized observer in the surface of a linear black hole. For him, due to the high blue shift of radiation coming from the rest of the universe, the last one should look like a permanent source of high-energy quanta. They would be filling the higher local energy levels, i.e., decreasing the entropy. Thus, the entropy changes occurring in such sites would counterbalance the average entropy changes observed outside of the linear black holes.

11.10 The Role of the Wavelets in the Universe

11.10.1 Wavelets with random and coherent phases

The use of the more elemental wavelets helps to understand in a more simple way, and somewhat deeper, the physical phenomena. They lead to visualize the universe as a set of continuous wavelets traveling in all orientations. They would be interfering constructively only in the small regions where the actual quanta are. The last ones may be travelling either free or confined as stationary radiations in particles.

This new insight on the nature of matter should look more familiar for those working in *crystallography and holography*[4]. This is because they are used to reconstitute an image after summing waves or wavelets that become coherent, with the right phases, just at some well-defined positions where the elemental particles should be located.

The present theory leads to *a more detailed universe model* in which “the particles should be at constructive interference peaks of a dense wavelet sea extending throughout the universe”.

According to this new viewpoint, the long range G field turns out to be due to a gradient of the NL perturbation rate produced by the random phase wavelets. Such gradient turns out to be equivalent to a gradient of the NL refraction index of the space. *Thus, the trajectories of single photons and bodies in a G field* depend on the gradient of the NL refraction indexes of the space. Such gradients would produce the deviation of light travelling close to the sun.

A reason for which the G field does not exchange energy with the bodies can be understood from general properties of refraction phenomena. This is because refraction doesn’t change the energies (colors) of the photons. Since the gravitational acceleration comes from gradients of the NL refraction index of the space, then gravity work cannot involve a real energy exchange between the space and the particles. This is why gravity interactions are very weak compared with the short range ones.

Then the use of wavelets can also put on relief other differences between G fields and short-range fields. Because the first ones would come from gradients of “non coherent” wavelets that are not associated with energy, while the second ones come from gradients of coherent wavelets that are associated with some energy density.

In general, any radiation can remain confined in any particular system if in its boundary there is some critical reflection angle coming from a gradient of the NL refraction index. This fact could also be applied to the boundaries of the particle model and for a linear black hole.

11.10.2 Coherent wavelets “in phase”

To account for the optical properties of a single photon, according to the Huygen´s principle, this one should be made up of large number of wavelets of the same frequency and phases. Such wavelets must be always interfering with respect to each other, rather constructively, the same as they were traveling within a perfect optical fiber[5].

Then it is reasonable that " *Two coherent wavelets would decrease the NL speed of light of the space much more effectively than two wavelets out of phase*"

Then, this hypothesis is likely to account for:

a) ***The photon non-spread***. According to the Huygen´s principle, the temporal decrease of the NL speed in the space between them would prevent the spread. In this way, the coherent wavelets of *a single photon would propagate themselves as they were in a perfect "optical fiber*" of higher NL refraction index compared with the empty space.

b) ***The reflections in a particle model***. The high gradients of the NL refraction index around the model would prevent the escape of the photons. For example, this mechanism can in principle prevent the photon escape from a particle model of *torus shape*. If the model has *n* wavelengths, from E5.51, the photon would have an angular momentum equal to *nh/2*. Such momentum corresponds with that of *boson* particles.

c) ***The short range interactions***. The reflection zone around the model should correspond to a strong gradient of the wavelet amplitudes that are "in phase" with respect to each other. This means a gradient of some "energy" density of the space. Then the field gradients in this zone would be of higher orders of magnitude than the gravitational ones. This would explain the reason for which the short-range interactions are of higher orders of magnitude compared with the gravitational ones.

Notice that one half to the particle model of one wavelength would have a permanent phase difference of p with respect to the other half. This means that they have electric fields in opposite sense, i.e., with a permanent difference of "*electric charge*". *Thus, it is interesting that the differences between positive and negative charges would be mainly due some permanent differences of phase between them.*

11.10.3 The wavelets and some fundamental dilemmas in physics

According to the nature of the model radiation, the universe should be made up of a high density of wavelets traveling in all orientations. They would be interfering to each other constructively only in the sites of the quanta that exists in either free or in stationary states. Thus, *the most elemental parts in nature would be not the particles, nor the photons*. *The wavelets are even more elemental than single photons*. According to this, "the current paradoxes of physics are meaningless. This is because they are the products of two *erroneous assumptions* a) that the photons and the particles are the most elemental parts of the systems, and that the ordinary systems are strictly "isolated".

Assume, for example, an interference experiment done with “a single photon” passing through two slits. In such case, we would be making an erroneous idealization of the experiment. Because we are assuming that the system is made of well-defined and rather isolated parts. However, the truth would be that all of such objects are just the loci of coherent interferences of *a universal system of wavelets that existed long before the measurements are made up.* Then, strictly, the coherent wavelets that would be making up the photon that goes away from the slits may be not the same ones that were coming with the original photon.

Notice that the interference would not occur in the level of photons but it the level of wavelets. Then the wavelet-system also includes those of the instruments and, strictly, the entire universe. Thus, according to the more elemental wavelet viewpoint, the old dilemma on which one of the slits a single photon is passing through, makes not sense. This puts on relief that the *Einstein-Podowsky-Rosen (EPR) paradox* comes from the erroneous belief in that particles and photons are isolated realities[6]. Such assumption is of course a good approximation for regions far away from local inhomogeneities.

11.10.4 Some probable components of the Hubble wavelet red shift

The above cosmological model is independent on any speculation about the origin of the Hubble red shift. I have avoided the use of the term “cosmological red shift” so as to net get involved in some arbitrary hypothesis. Thus the present theory does not rules out the possibility of an absolute kind of universe expansion may exist. However, it does rules out the possibility that such red shifts can change with the time.

On the other hand, some other kinds of red shifts proportional to the distances may possibly exist. Any red shift proportional to the number of close encounters with particles and other bodies could also be a component of the observed red shift. They may be due to any interaction of photons with the bodies that are relatively close to its trajectory. These kinds of “interactive red shift” would be consistent with:

a) The higher red shifts observed in light passing through denser cumulus

b) The higher red shifts observed in light coming from the backward regions of galaxies that are inclined relatively to us, compared with the ones coming from the side closer to us. The first photons must pass through spaces with higher number of gradients of z(r).

c) The anisotropy in the distribution of the red shifts of distant galaxies of well defined type and magnitude, in different directions of the sky (Rubin effect). Such anisotropy is not related to the movement of the Sun, according to the cosmological background radiation.

d) With the differences of the Hubble red shift found in different directions. Such differences are not consistent with a uniform expansion of the universe.

11.10.5 The observed red shifts

If we measure light coming from the center of a compact black galaxy, far away from us, such light would have several kinds of red shift components.

a) “Gravitational red shift” of light emitted in a low G potential.

b) “Interactive red shift” of light travelling throughout the halo of black remnants of the old galaxy.

c) “Interactive” red shift and “true cosmological red shift” occurring during the long trip from the galaxy up to the observer.

Such variable red shift components should account for the high dispersion of the experimental values of the Hubble constant.

In the cases of “the last luminous regions of old galaxies”, the main red shift components should come from the points a) and b). They would correspond to the *quasars of high* “*gravitational red shifts*”. Due to their low absolute luminosities, we could observe only the objects that are relatively close to our galaxy.

On the other hand, according to the cosmological hypothesis, such quasars would be huge galaxies of high absolute luminosity located at cosmological distances. Thus the lack of consistency of their theoretical properties, with current physical laws, puts on relief that such hypothesis is wrong.

11.10.6 The cosmological uncertainty principle

In the new cosmological context, "*it is not possible to find the age of the universe from local and nonlocal measurements*”. *Because, according to the General Equivalence Principle,* the expansion of the universe must expand every piece of matter in just the same proportion. Thus, the relative distances do no change, indefinitely with the time. Then the nonlocal cosmological red shifts should also remain constant with the time. This means that the universe may have a nearly infinite age and it may remain for rather infinite time without a net change of the average relative distances.

Notice that this kind of *cosmological uncertainty principle* is imposed by the common nature of matter and radiation in stationary states. These conclusion rules out the narrow limits of the universe age fixed by current cosmological models[7].

According to the stationary models of matter and of the universe,

"*Astrophysics can do without the relatively large number of non testable hypotheses, or speculations, that can be advanced on the origin of the universe"*.

According to it, statistically "all of the different stages of the evolution cycles of matter should be present in the sky". Each of them should be present in some well-defined proportion that would not change with the time. This seems to be consistent, with the astronomical observations.

On the other hand, according to the Explicit Equivalence Principle, the universe would have a nearly infinite age. *Then we cannot find, form actual experiments, the information on how our universe was created*". This is equivalent to some *uncertainty principle for the creation of the universe* that cannot be surpassed. This is consistent with the fact that the theories on the origin of our universe are based on a large number of speculations that cannot possibly be verified.

11.11 The Dilemma of the Origin of the Universe

The above universe model is based on experimental facts that may be not exact enough. Then it cannot be concluded that the universe has an infinite age or an infinite lifetime. It is better to conclude in that "*the universe should be many orders of magnitude older than currently estimated*". "*No real cosmological relics could be observed*". Notice that this conclusion is independent on the way in which the universe was formed.

On the other hand, the large number of hypotheses on the origin of the universe can only be based on speculations that cannot possibly be verified.

For example, it may be speculated that long time ago the universe was created from a *"hot big bang"*. If such hypothesis were true, sooner or later such radiation should be trapped into stationary states thus forming atoms, stars, galaxies and so on. After such stage the GEP can be applied. According to it the observed cosmological red shifts should have not changed up to nowadays, regardless on how many galactic cycles have occurred and regardless of an absolute expansion of the universe. The same holds for the cosmological red shifts. Then the red shifted temperatures, in the average, should have remained unchanged with the time, indefinitely. Thus, statistically, we should have a cosmic radiation background coming from galaxies in their last evolution cycles, regardless on how many cycles have occurred before.

Such temperatures would have nothing to do with the origin of the universe, i.e.; "*such radiation would be not a cosmic relic*".

On the other hand, it may also be speculated that in the very beginning of our universe, only random-phase wavelets (nothing!) could have existed. Of course, this is a very strong hypothesis. Then we would be forced to speculate about some mechanism of formation of photons and matter coming from nothing else. Of course, this one would violate the mass-energy conservation laws.

It is reasonable that nobody will ever find a truly scientific answer for the real origin of the universe. Of course, we may speculate about it after using many ad-hock hypotheses, in a rather scientific-looking way. However, we could never be able to verify such hypotheses. Consequently, we had better to leave such old problems in the hands of God.

To the top of this page To next subject

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[1] Curiously, the wavelets have been currently used in ordinary literature to explain optical phenomena, according to the Huygen´s principle. However, since the wavelets cannot be detected, most people are reluctant to accept that they are real ones. I think in that it is time to start by thinking that they are true realities, maybe the most elemental ones in nature.

[2] This interpretation is also consistent with a model proposed by T. B. Andrews (private communication).

[3] Such background it's normally assumed to be due to some residual radiation coming from the initial "big-bang" of the universe, that is, a "cosmological relic"). This is just one of the ad-hock assumptions normally made in cosmology.

[4] This is my case because my first research work in physics was on determination of crystal structures by means of X-ray diffraction.

[5] In an optical fibre the photons cannot escape from it because the critical reflection angle is higher that the photon's incident angles. Such critical angle depends on the ratio between the refraction index of the glass and that of the dielectric around the fibre.

[6] In a similar way, there is an erroneous tendency of the man to considering himself as a rather isolated part of the rest of the universe. It may helpful to think in that this is not so. We all would be parts of other ones, rather connected to each other after the rather mysterious kinds of wavelets that in principle cannot be detected, individually.

[7] This one may be welcomed by the astrophysicists because, for long time, they have hard times in

order to fit the observed facts within the relatively small universe age predicted by current theories.