Application of Wavelets to the Unified Description of Physical Phenomena in the Universe

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Introduction

According to the Equivalence Principle and to gravity experiments, in order that local physical laws can be invariable after changes of velocity and G Potentials, all of its parts, including any stationary radiation, must change in same proportions after the same circumstances. Thus ***ordinary matter and stationary radiations must obey same general physical laws***. Only in this way every local ratio can remain constant. Thus ***more exact physical laws for matter and its gravity field can be obtained from properties of stationary radiation***, after using a particle model made up of radiation in stationary state. Thus, the same as in holography and crystallography, the properties of matter and its fields can be described in terms of optical wavelets. So far the predictions obtained from use of wavelets correspond with fundamental physics. On the other hand they put into relief ***basic errors in gravitation that have been tested with experiments.*** Similar kind of errors are detected in cosmology.

The new universe fixed by the wavelets turns out to be more consistent with both, fundamental physics and with the observed facts.

1. SOURCE OF ERRORS IN ACTUAL PHYSICS

From *G time dilation experiments*,

1. "The clocks in different G potentials run with different frequencies".
2. *Standards in different G potentials are not the same relative to each other.*
3. *Quantities measured in different G potential cannot be compared to each other because the standards are not the same with respect to each other.*
4. *Most of the non-local relations in current gravity are inhomogeneous, i.e.; they have no well-defined physical meaning.*
5. To relate quantities measured in different G potentials they must be transformed to some common reference standard in some well-defined potential (invariable or flat reference frame). *Only in this way such relations can be strictly homogenous.*

Here, the transformed quantities, for NL objects, are called "nonlocal" (NL) quantities. The observer position is stated after a subindex.

2. UNIFIED PHYSICS BASED ON LIGHT'S PROPERTIES

From above it is concluded that, we can get general properties of matter by using a "light-box" particle model made up of a single quantum of radiation in stationary state. Its mass local rest mass ($V = 0$), with respect to an observer in a position A, is:

$$m = hn \qquad (1)$$

It has the same general properties as any uncharged particle in the universe.
Effectively it accounts, in a very simple way, for special relativity, quantum mechanics and the most exact gravity experiments (Refs. 1, 2, 3, 4, 5, 6, and 7.).

3. PHYSICS BASED ON PROPERTIES OF WAVELETS

From above, to describe the properties of matter we can also use the "wavelets" used in optics. Even when we still don't know many properties of the wavelets, the few ones that we know are most useful for many applications in physics. This way puts on relief that the most elemental realities in nature are not the isolated quanta or radiation but some more elemental kinds of "wavelets"-
The main wavelet properties inferred from experiments are:
1. Wavelet-continuity. A wavelet-train travels, continuously, with the speed of light fixed by the space properties. The wavelet cannot suddenly disappear.. Such property turns out to be most important to account both for optical phenomena and for conservation laws in physics (Refs. 1, 2, 3, 4, 5, 6, and 7.).
2. The wavelets themselves are not destroyed during destructive interference. Then they must travel rather indefinitely in the space, but their frequencies are redshifted in a way proportional to the wavelet trips.
3. Photons and particles must be located in regions in which the wavelets have coherent (constructive) interferences .
4. The interferences between wavelets do not change, appreciably (?), their frequencies. (momentum exchange without energy exchange).

4. APPLICATION TO THE GRAVITY FIELD ENERGY DILEMMA.

From above, the space should be crossed by a high density of wavelets with random phases, coming back and forth between the bodies in the universe.
According to the optical laws derived from photon statistics, the probability for the existence of energy in some place the gravity (G) field depends only on the net wavelet amplitude in such place. Far away from the particle model, the wavelets interfere to each other with random phases. Thus the net wavelet amplitude is null. This also means that ***the probability for the existence of energy in a G field is null***[1].
Of course this conclusion may look odd because it is in contradiction with the G field energy tacitly postulated by *Einstein* in his theory on general relativity. Let us verify whether or not such postulate is consistent with the experiments and with the EP.

5. GRAVITY FROM WAVELETS

6. EXPERIMENTAL AND THEORETICAL INCONSISTENCY OF GENERAL RELATIVITY

According to wavelet continuity, ***the frequency of light travelling throughout G fields is conserved*** with respect to a well-defined observer, i.e., ***light does not exchange energy with G fields***. Thus ***the particle model cannot***

[1] On the hand the particle model has reflection regions in which the wavelet amplitude decreases rather exponentially. Since the net wavelet amplitude is not null, then such region has some energy density. This is consistent with the field energy of short-range fields. The amplitude of the reflected wavelets grows up at the cost of the decrease of the net amplitude wavelets escaping from the model. The existence of such region has been proved in the experiments on frustrated reflections.

exchange energy with the static G field because it is made up of radiations that do not exchange energy with G fields. This can be verified with the experiments, as follows.

Assume that a standard atomic clock is at rest at a position B, at a height H over an observer at A. From G time dilation experiments, the frequency of the clock at B with respect to the observer at A is higher with respect to his local clock:

$$\frac{n_A(0,B)}{n_A(0,A)} = 1 + \Delta f \quad ; \qquad Äö = \frac{gH}{c^2} \qquad (2)$$

(The subscript *A* states the observer's position. The values in the parenthesis state the velocity and the position of the model with respect to the observer at *A*).

From the EP, all of the frequencies, the mass-energies and the wavelengths have changed same proportions after the same changes of *Df*. Thus, from (1) and (2),

$$\frac{n_A(0,B)}{n_A(0,A)} = \frac{l_A(0,B)}{l_A(0,A)} = \frac{m_A(0,B)}{m_A(0,A)} = 1 + \Delta f \qquad (3)$$

If the clock B falls freely, the mass observed at A, before the stop, is given by:

$$\frac{m_A(V,A)}{m_A(0,A)} = 1 + \Delta f = g \qquad (4)$$

After comparing equations (3) and (4),

$m_A(V,A) = m_A(0,B)$ (NL mass-energy conservation in a free fall) (5)

"In a free fall, the body's mass, relative to a well-defined observer, is constant"

"There is not a true exchange of energy between the field and the body"

"The energy released comes from the test body, not from the field.

'*The tacit postulate on the G field energy, used by Einstein in his gravity theory, is not consistent with the main principle of the same theory*'.

Thus the changes of frequencies detected by observers located in different G potentials turns out to be not due to real changes occurring to the photons but to the different frequencies of their local clocks.

7. A GRAVITY THEORY FROM WAVELETS

The G field equation for relating the space and matter properties, according to Eq-(3) can be derived after using *the relative perturbation rate of the space* at some point *i*, called *z(i)*. Such parameter is equal to the sum the utions of all of the wavelets crossing such position. Each one must be proportional to its actual frequency weighted according to its corresponding amplitude and corrected after the cosmological wavelet red shift.

If R is the typical distance after which the wavelets are red-shifted by the factor *1/e*, then the perturbation rate of the space turns out to be proportional to

$$z(i) = \sum_{j=1}^{\infty} \frac{m_{r*}(r^j)}{r^{ij}} \exp\frac{-r^{ij}}{R} = R\left[\sum_{j=1}^{\infty} \frac{m_{r*}(r^j)}{x^{ij}} \exp\left(-x^{ij}\right)\right]. \qquad (6)$$

In which $x^{ij} = r^{ij}/R$. From comparing (6) and (7),

$$df(i) = -\frac{dz(i)}{z(i)}; \qquad \mathrm{G} = \frac{1}{z(i)} \cong Constant. \qquad (7)$$

This relation, and Eq. (3), account for the most exact tests for G field theories.

8. APPLICATION THE COSMIC DILEMMA

From above it may be concluded that the universe is like a network of wavelets in which photons and particles are at the loci of coherent interference of wavelets.

During an homogeneous expansion of the universe, according to doppler effect, all of the wavelets would be stretched in just the same proportion, anywhere, both in the space and in the particle models. Thus, in general, *it would be not possible to find a body that does not expands in the same proportion as everything else.* Then a uniform universe expansion cannot change the relative distances, velocities or cosmological redshifts. Thus the universe should have no limits of time, in the past or in the future.

This conclusion can also be proved from a gravitational viewpoint, after calculating the gravitational expansion due to universe expansion.

For a uniform universe expansion, after a time *dt*, from (7) and (8),

$$df(i) = \frac{dl(i)}{l(i)} = \frac{dR}{R} = \frac{dr^{ik}}{r^{ik}} = Hdt\ . \qquad (8)$$

The increase of G potential, due to a lower perturbation rate of the space, produces *a G expansion of any stationary radiation or particle in just the same proportion*. Thus universe expansion does not change the distance and velocity ratios.

9. THE NEW UNIVERSE FIXED BY THE WAVELETS.

1. According to wavelet continuity and to the EP, the universe must be in a kind of “conservative and stationary state” in which mass-energy and entropy are conserved.
2. The wave continuity also fix new kind of “linear black hole” (LBH), without singularity (Refs 2,3,4,5,6) in which the critical escape angle for photons decrease rather exponentially with with its mass. Thus a massive LBH would capture radiation from the space and it would store it until the average mass-energy of its nucleons is equal to that of a free proton. In such case a LBH can “decay” into a primeval gas that would normally condense as a rather spherical cluster of low-density (red) stars with maximum densities of randomly oriented angular momentums (globular clusters, elliptical galaxies).

Thus, from points 1) and), matter should be evolving, rather statistically, in rather closed cycles between states of gas and LBH states and viceversa.
All of the evolution stages should be present in the sky, visible or not, in a direct proportion to their relative periods or lifetimes.
Chains of LBH explosions should produce voluminous *elliptical galaxies*. After cancellation of random angular momentum, they must pass through the stages of disc galaxies, spiral galaxies, active galactic nuclei (AGNs) and quasars. Later on they must end as compact black galaxies cooled down by LBHs. After a long period, they would recover the energy lost during their luminous periods. After a chain of LBH explosions, they would turn into luminous galaxies and so on.
Since the energy-recovering period for a black galaxy is the largest one, compared with its luminous period, then most of the universe must be in the state of black galaxy with apparent temperatures close to *0 K°*. This accounts for the low temperature background of the universe, currently misinterpreted as a cosmic relic.
The kind of noisy quasars, would correspond to the last luminous regions in the center of nearly black galaxies. Their high G red shifts are commonly misinterpreted as a high cosmological red shift. Since their presumed distances are highly distorted such misinterpretation leads to apparent violations of fundamental physical principles.

The new universe fixed by the EP and wavelet properties is more self-consistent and consistent with fundamental physics and with the observed facts (Refs. 6,7,8,9,10,11)

10. CONCLUSIONS.

According to the EP and to the experiments, matter and radiation in stationary states have similar nature and obey the same general physical laws. The same as in optical physics, the general properties of matter and of the universe can also be studied after using the current wavelets normally used in optics. They make possible

1. To unify several branches of physics in terms physical wavelets.
2. To get more reliable conservation laws in the case of G fields.
3. To get a reliable cosmic context consistent with all of them, the EP, the gravity experiments, and with astronomical observations.
4. To get rid of misleading statements, both in gravity and cosmology. They turn out to be not consistent with the EP and with the experiments.
5. To relate the gradient of a G field with the gradient of the perturbation rate of the space produced by the wavelets with random phases. Such rate fixes the values of the refraction index of the space which in turn fixes the eigen-values of the frequencies and of the wavelengths of the stationary radiations. The last values, in turn, are linearly related to the masses and the lengths of the bodies.

The gradients of the NL refraction index of the space are produced by a gradient of the density of *wavelets with random phases*. Normally, they are very small. This accounts for the weakness of ordinary G fields.
On the other hand this fact puts on relief that the changes produced by *wavelets with common phases* should be of a higher order of magnitude compared with those of wavelets with random phases. This seems to be an interesting possibility because it could account for the high stability of photons, whose wavelets have common phases, and for the high stability of the stationary radiations in particles. In this way the quanta in stationary states are likely to generate their own perfect dielectric mirrors, due to the high gradients of refraction index generated by their coherent wavelets.
A short-range interaction between two particle models can also be emulated by stationary radiation between them. Such radiation may also come from *frustrated reflections*. Notice that the higher order of magnitude of the changes

of the relative refraction index of the space produced by coherent wavelets is also consistent with the higher order of magnitude of the short-range fields.

This work, that started about 25 years ago, is just a first step in a new direction in physics and cosmology. This one seems to be a first step for a new kind of physics based on properties of light and its wavelets, i.e., for a new approach to the physics and cosmology for the new millenium.

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