The New Universe
Fixed by a Standing Wave Particle Model

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Abstract
The theoretical properties of the black holes (BHs) and of the universe were derived from a unified relativistic theory based on a generalization of local relativity for nonlocal cases in gravitational fields and a quantized standing wave particle model that accounts for relativity, quantum mechanics and the gravitational tests (See gr-qc/9509014). They fix an isentropic and conservative steady state that is independent on an eventual universe expansion because matter also expands itself in the same proportion. The new black holes BHs resulting from linear properties of the model, after capturing enough radiation, would explode. Statistically, matter would evolve, indefinitely, in rather closed cycles between gas and BH states, and vice-versa. The expected astronomical objects and cosmic radiation backgrounds that are consistent with the observed facts. This leads to non conventional models for some celestial objects.

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1 Introduction

The main purpose of this work is to find the cosmological and astrophysical context fixed by a nonlocal (NL) relativistic theory based on a single postulate on the common nature of matter and stationary forms of radiation’s. In this way the new unified contexts of all of them: physics, astrophysics and cosmology, would be fixed, ultimately, by properties of radiation’s.

According to previous works [5], [6], [7], [8], [10], [11], the simplest particle model that can account for the general properties of matter and of it’s gravitational (G) field, is a standing wave (SW) model. This one is made up of a quantum of radiation in some stationary state of a well-defined local frequency (ν) fixed by the space properties.

According to this model all the local bodies in a system, including the instruments or any standing wave, must have the same kind of relativistic changes, in the same proportions, under the same changes of velocity and G field potential. Observe that only In this way the local relative values can always remain constant, i.e., local relativity can be strictly true.

In these works it is also proven that local relativity is not well defined for relating quantities measured in different G field potentials because, according to G time dilation, the clocks and the atoms of observers in different field potentials are not strictly the same relative to each other. This means that, in general, the measurement units of observers in different field potentials are different relative to each other. Then to get strictly homogeneous relations between quantities measured in different G field potentials, each of them must be reduced to a common unit system.

These quantities, referred to a standard that has not had the same changes as the objects, are called nonlocal (NL) quantities. They correspond to a generalization of those of local relativity. They can be functions on both β = v/c and on the NL G field potentials of the object and of the standard. The last one, whose position is fixed, can be stated by a sub index. This fixes an invariable (flat) reference framework.

The model NL relativistic and quantum mechanical properties come out from the constructive interference of its wavelets. On the other hand the NL properties of its long range G field turn out to depend only on the relative perturbation rate of the space, w(r), produced by destructive interferences of random (or out of) phase wavelets. Since the net wave amplitude is null, then there is no field energy. This means that static G fields do not exchange
energy with free bodies or radiation’s. The same result comes out from other ways [3][6][11]. This contradicts rather conventional concepts used by Einstein in this theory of General Relativity [2].

On the other hand it has been found that, in order that some gradient of \( w(r) \) can exist, some kind wavelet red shift (WRS) proportional to the NL distances should also exist. This one is obviously consistent with the *Hubble red shift* (HRS) of light. If \( r_{ik} \) is the NL distance between the positions \( i \) and \( k \), and if \( R \) is the typical NL distance at which the wavelets are attenuated by the factor \( e^{-1} \), then the total relative perturbation rate of the space at a point \( i \), compared with that coming from a universe of uniform density, is:

\[
w(i) = \sum_{k} G \frac{h_{\nu}(r_{k}) \exp(r_{ik}/R)}{r_{ik}} = \sum_{j} G \frac{m(r_{j}) \exp(r_{ik}/R)}{r_{ij}}
\]

\( R \) corresponds with the Hubble radius.

For a universe of uniform density, \( w(U) = 1 \).

On the other hand the NL gradients in this field turn out to be related by:

\[
\frac{\nabla \nu_{\nu'}(0,r)}{\nu_{\nu'}(0,r)} = \frac{\nabla m_{\nu'}(0,r)}{m_{\nu'}(0,r)} = \frac{\nabla \lambda_{\nu'}(0,r)}{\lambda_{\nu'}(0,r)} = \frac{\nabla c_{\nu'}(r)}{2c_{\nu'}(r)} = \nabla \phi(r) = -\nabla w(r)
\]

The first ones correspond to the phenomena of G red shift (GRS), G work, G contraction and G refraction, respectively. \( \phi(r) \) is called *NL field potential*. The first order approximations of the above relations correspond with those of general relativity (GR).

They account for all of the ordinary G tests [7].

2 The new cosmological context

2.1 Model expansion versus universe expansion

It is currently assumed that matter does not expand itself during an eventual universe expansion. *If this were true* some standard model could be used as the base for a non expanding theoretical reference framework. In it,
\[ dr(ik)/r(ik) = Hdt. \] Then, from (1.1), (1.2), and NL mass-energy conservation,

\[
d\phi(i) = -dw(i) = -d \sum_{k=1}^{\infty} \frac{Gm(k)f(ik)}{r(ik)} = \left[ \sum_{k=1}^{\infty} \frac{Gm(k)f(ik)}{r(ik)} \right] Hdt, \tag{3}
\]

\[
d\phi(i) = w(U)Hdt = Hdt = dr(ik)/r(ik) = d\lambda(i)/\lambda(i). \tag{4}
\]

This means that every wave and particle would expand itself in the same proportion as the intergalactic distances. An eventual universe expansion would not change the relative values of all of them: the distances, the velocities, the temperatures, the WRS, the HRS, and therefore, the local physical laws\(^1\). Then the universe would have not a well-defined age and it may last indefinitely. Of course, this would invalid the current deductions normally made for the universe age, which anyway seem to be not consistent with the last measurements made with the Hubble telescope.

### 2.2 The new kind of black hole (BH)

The new exponential G relations have not a singularity at \( r = 2GM \). Then, the new kind of BH is different to that of GR\(^7\). Its nucleus would be just a neutron star (NS) with a strong external gradient of the NL refraction index that would act as a mirror for most of the internal radiation’s. Its outcoming critical reflection angle, given by \( \sin^{-1}[(2eGM/r)e^{-2GM/r}] \), would be rather negligible. Thus the escape probabilities would be not strictly null. Then the BH would absorb and store for long time most of the radiation’s traveling within the impact parameter \( 2eGM \).

### 2.3 Relativistic particle generation

In a way similar to the earth auroras, most of the positively charged nuclei would be driven by the magnetic fields towards the BH polar regions. Since the neutron binding energy in a BH is of a higher order of magnitude compared with that in atoms, then one the most probable reactions between them is nuclear stripping\(^5\), \(^7\). In it, some of the atomic neutrons would be captured by the BH while the remaining nucleus (proton or proton rich

\(^1\)This generalizes the relativity postulates for eventual universe expansions.
nucleus) would be rejected by the NS. The last one would take away the NL mass-energy difference between the original and final states of the captured neutrons. They could only escape from the magnetic fields, in axial directions, within the small escape angle given above. They would form narrow jets of relativistic particles richer in protons and with higher energies for higher \( p/n \) ratios. They are consistent with the composition and energies of cosmic ray particles [7], [4]. They are also consistent with the radio sources and jets going away from central regions of galaxies, most of them in just the expected orientations.

This process would be most important because it would convert G work into mechanical and nuclear latent energies. This would regenerate new gas of high nuclear and kinetic energies at the cost of rather burnt out materials like He or heavier elements. Such low entropy materials can in principle extend the luminous lifetimes of galaxies beyond the limits estimated from the current models.

### 2.4 The entropy switch

From the BH surface, just to the contrary of the outside regions, the external universe would look as a source of blue shifted radiation’s that would increase both the local temperature and the probabilities for filling up the local SW levels up to the highest NL frequencies. This is equivalent to a decrease of the local entropy. In this way the average NL mass and kinetic energy of the nucleons would increase with the time, with the radiation energy coming from the rest of the universe, up to some unstable state in which any decrease of the NL refraction index gradient generated by external bodies would produce frustrated reflections that can trigger the mass outflow. Thus the BH can explode producing low density gas flowing away through older stellar remnants orbiting around it. This would transform a fraction of the kinetic energy into rotational one associated with randomly oriented angular momentum’s. This is also consistent with the fronts of H rich matter diverging from very small regions in the universe.
3 The new astrophysical context

From above the universe would last, indefinitely, in a kind of conservative and isentropic steady state. In it, matter and radiation’s would evolve, indefinitely, in rather closed cycles, between the states of gas and BHs, and vice versa.

3.1 Matter cycles

Single and chain of BH explosions would produce rather spherical stellar clusters and elliptical galaxies, rather free of metals. They would regenerate randomly oriented angular momentum’s that, in the long run, would be canceled out at faster rates compared with those parallel to the galactic axis. Thus an elliptical galaxy would progressively get disc and spiral shapes of smaller volumes. Finally it would become reduced to a small central luminous volume (AGN and quasar) with massive stars and high density black bodies (black holes, neutron stars) surrounded by a halo of dead stars and planetesimals [black galaxy]. The explosive events as supernovas would produce large changes of luminosity, within relatively short periods, that are consistent with those of quasars [3].

Due to the low \( \phi(r) \) in the black galaxy center, their atoms would emit strongly red shifted light rather scattered and reflected by the external bodies. This accounts for the fact that quasar correlation’s improve under the assumption that most of the observed red shift is intrinsic [1]. The detection of metal lines would also prove the existence of highly evolved (old) matter.

The black galaxy (BG) resulting from a luminous one would be cooled down by its BHs. It would also capture and store radiation coming from the external universe, in a way similar to a huge BH. After a long period, the explosion of some central BH can trigger a chain of BH explosions that would regenerate a luminous galaxy.

Within a larger time scale, the galaxy regeneration would look like a BG explosion that can trigger the virtual explosions of the next BGs, and so on. They would produce clusters. Superclusters would also be due to similar mechanisms. Thus the fronts of galaxies in luminous stages would also account for the large scale structure of the universe.
3.2 High energy step down in stellar objects

Mechanisms of nuclear stripping similar to those occurring BHs could also occur during the matter fall over neutron stars (NSs), either steadily or in pulsed ways. They may also occur rather hidden inside some stars or gas clouds. They would transform heavy (burnt out) elements into protons of higher kinetic and nuclear latent energies that would promote convection currents. This would prevent overheating and stellar collapse after neutrino cooling.

This kind of stellar model, [9], is consistent with all of them: the low neutrino luminosity's, the higher densities and temperatures, the better defined mass-luminosity's relations and the magnetic structures of main sequence stars.

3.3 Density and isotropy of the universe

Due to the higher rates of energy emitted by the luminous galaxies compared with those absorbed by the BGs, it is inferred (after a mass-energy balance) that most of the universe should be in the state of low temperature BGs, cooled down by their own BHs. This is consistent with the high average density of the universe derived from (1.1), and assuming $H = 75 \text{km/sec per mps}$. This one is $\simeq [4\pi G R^2]^{-1}$, i.e., about $10^{-29} \text{gm/cm}^3$. This is of a higher order of magnitude than that of the luminous fractions of the universe. This is also consistent with the current mass excesses detected from dynamic methods in galaxies and clusters.

After integration of (2), the space properties are fixed, mostly, by matter existing between $R$ and $3R$. The contribution of relatively local matter is extremely small compared with that of the rather uniform universe. This is consistent with the weakness of ordinary $G$ interactions, and with the high isotropy of both the space properties and of the cosmological radiation background.

The low temperature black-body radiation coming from BGs, red shifted during its long average trip up to the observer, $(2R)$, would fix a rather uniform low temperature cosmic radiation background. Thus the universe would always look like a perfect radiation absorber\(^2\).

\(^2\)When the common mass and energy unit is the joule, $G = G_{\text{newt} c^4}$.

\(^3\)Only steady state cosmologies can account for the arrows in nature \[.]
4 Conclusions

The theoretical properties of the SW particle model fix a new kind of conservative and isentropic steady state in which matter and radiation’s evolve, indefinitely, in rather closed cycles. These cycles are fairly consistent with the luminous bodies ranging between elliptical galaxies and quasars, and also with larger scale structures of the universe.

This theory opens the way for new stellar models and non conventional interpretations of many celestial phenomena. The new universe would have not the narrow limits of time fixed by the rather conventional theories. In this way, also, astrophysics could do without the relatively large number of non testable hypotheses that can be advanced on the universe origin.

There is simultaneous consistency of the theoretical properties of the SW model with fundamental physics, and of the new cosmological context with a wide range of astronomical observations. This seems to be a fair reliability test for all of them, the SW particle model, for the relationships derived from it, and for the new cosmological and astrophysical contexts. This unified way may contribute to understand nature in terms of the most elemental properties of radiation’s (or vice versa), thus depending on the minimum number of parameters, postulates, and arbitrary assumptions normally made on relations between matter and its G field.

Due to the large amount of subjects and materials accumulated from 1976 up to day, the author intends to compilate all of this work into a single book for that may be useful to those that may like to go in this way for understanding nature from a self-consistent and unified viewpoint[12].

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