Cosmic Tests for a More Explicit Equivalence Principle

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March 31, 2022

Abstract

According to this principle, the relativistic changes occurring to the bodies, after velocity changes, cannot be detected by observers moving with them because bodies and stationary radiations change in identical proportion after identical circumstances, i.e, because bodies and stationary radiations have identical relativistic laws with respect to any fixed observer. Effectively the theoretical properties of particle models made up of stationary radiations agree with special relativity, quantum mechanics and the gravitational (G) tests. They fix lineal properties for all of them: the G fields, the black holes (BHs) and the universe. The BHs, after absorbing radiation, must return to the gas state. An eventual universe expansion cannot change any relative distance because the G expansion of matter occurs in identical proportion. This fixes a new kind of universe. In it matter evolves in closed cycles, between gas and BH states and vice versa, indefinitely. Galaxies and clusters must evolve rather cyclically between luminous and black states. Most of the G potential energy of a matter cycle must be released around neutron star and black hole boundaries. Nuclear stripping reactions would transform G energy into nuclear and kinetic

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energies. This accounts for many non well explained phenomena in astrophysics. This work has been published, in more detail, in a book.

1 The New Universe Fixed by the Explicit Equivalence Principle

It is obvious that to study the universe we must use the most reliable physical principles. So far the Equivalence Principle is the best tested principle in physics and, therefore, this is the most solid base for any theory, provided that it does not depend on arbitrary assumptions. The explicit form of this principle makes possible to avoid the dependence on any arbitrary assumption because everything is fixed by properties of quantums of radiation. In this way everything in the universe is fixed by this principle that ultimately depends rather well known radiation properties. Vice versa, the good fit of the real universe with the theoretical one turns out to be a good test either for the EEP or for the radiation properties.

The underlying physical theory based on the EEP has been treated more extensively, and in more detail, in previous works published and presented in several meetings during the last 23 years [1] – [12]. This one has been briefly summarized in another contribution presented in the MG8 meeting [12]. The present work is a review of the work done to test the new astrophysical and cosmological contexts fixed by the EEP [11].

In previous works it has been proven that, if all of the intergalactic distances were increasing with the time, in the same proportion, the G potential and length of the particle model would also increase with the time, in identical proportion as that of the universe. Then it would be not possible to find a strictly invariable standard body that does not expands itself in identical proportion as in the universe. This leads to conclude that An eventual universe expansion cannot change the relative values of all of them: distances, velocities, temperatures and cosmological red shifts. This means that the physical laws are also invariable after universe expansion. This result turns out to be a self-consistency test of the EEP.

Consequently, according to the EEP, the Hubble red shift cannot depend on the time and, therefore, the age and lifetime of the universe are not limited by an eventual universe expansion.

On the other hand, according to the linear field equation fixed by the EEP,
the new angular momentum law fixes the critical escape angles of the photons and relativistic particles going away from a neutron star with $GM/r > 1/2$, called black hole (BH). Such angles are very small but not null. Thus the light emission rate of a massive BH is negligible compared with its absorption rate. So the average relativistic mass-energy of each of its nucleons must increase with the time, after the radiation absorption. Thus, sooner or later the BH must become unstable and explode. Such explosion must transform the relativistic mass-energy of its nucleons into the potential and kinetic energies of the hydrogen rich cloud generated after such expansion. The last one would be condensed at faster rates over the dead stars and planetesimals traveling around the BH. This would produce star clusters that, sooner or later, after radiation emission, must return to BH states, and so on indefinitely [2, 4, 11].

A chain of BH explosions must produce a luminous galaxy that, sooner or later, must end as a black galaxy (BG). The last one would also have global properties resembling a BH.

Similar mechanism holds for a chain of luminous galaxy formations which would produce clusters.

In general, macro-systems should evolve between rather luminous and black states, and vice versa, indefinitely. In this way the average universe entropy would remain constant.

2 Cosmic Tests for the Explicit Equivalence Principle

The new kind of universe provides crucial tests for the EEP. In particular:

**Test Ia.** - In order that the radiation lost by all of the luminous galaxies can be equal to the one absorbed by the black ones, the average number of the last ones must be of higher order of magnitude than the first ones. Thus most of the universe should be in more dense and dark states.

**Test Ib.** - The same result comes out from the higher average density of the universe derived from the constants $G$ and $H$. Then most of the universe mass must be in the state of black galaxy (BG). Observe that only the higher $G$ fields of massive BGs and their associations can account for the higher speeds observed in luminous galaxies. This would solve one of the cluster
missing mass problem in astrophysics. Notice that in the partially black galaxies, the BHs and dead star remnants, produced after star evolution, can also account for their (apparent) missing mass problems.

Test II.- All of the stages of the matter evolution cycles must be present in the sky.

The new galaxies generated after chains of BH explosions, must have the highest fractions of random angular momentum and maximum volumes of low density stars recently formed with hydrogen not contaminated with metals. They correspond with the red elliptical galaxies. By canceling random angular momentum and loosing energy, they must become denser and bluer, with an increasing number of dead stars in their borders. They must show disc regions of higher net angular momentum densities that, for this reason, don’t contract as fast as the random ones of the spherical bulges. Thus the disc and spiral galaxies correspond to intermediate stages of galaxy contraction.

The final luminous bulge of a galaxy, surrounded by dead star remnants, must be in lower G potentials. Thence it must emit light with higher G redshifts. Due to the smaller volume of the luminous region, and to its lower absolute luminosity, the relative luminosity changes caused by star’s explosions are higher. Due to the high average masses and densities of the final luminous stars, they must show more explosive events and emit higher proportions of ultraviolet light compared with a normal galaxy. Those stages correspond with the AGNs and quasars.

Then it may be concluded that most of the quasar’s red shift would be intrinsic (not cosmological) one, and that their absolute luminosities would be very small compared with ordinary galaxies. They would normally correspond to the last luminous periods of galaxy cycles.

Test III.- According to point I, most of the low temperature cosmic radiation background should come from BGs that are cooled down by BHs and the rest of the universe. It has been found that most of such photons should come from BGs located in long distance ranges of the order of magnitude of the Hubble Radius. This is consistent both with the low value of such temperature and with its high isotropy.

Test IV.- The net G energy yield per unit of mass-energy cap-

\footnote{The existence of an additional red shift occurring during the light trip through strong field gradients of star remnants cannot be ruled out}
tured by a central mass $M$ turns out to be equal to $1 - \exp[-GM/r]$. From this relation it is inferred that:

a) *The net G energy yield in a matter cycle is of a higher order of magnitude than the one of nuclear fusion.*

b) *Most of it must be released in the strongest G fields of neutron stars (NSs) and BHs, either steadily or explosively.*

Since the G binding energies per unit of mass of the neutrons in a NS are much higher than the nuclear binding energies of ordinary nuclei, then in principle *neutron stripping reactions* (NSRs) should occur after the impact of atomic nuclei on a NS (or BH). The NS would capture neutrons and reject protons or proton rich nuclei. Globally, NSRs would transform G potential energy into kinetic and nuclear potential energies, mainly in the states of relativistic protons of high magnetic rigidities. This kind of reaction would convert He and heavier atoms into renewed H, at the cost of the lower final G potential of some neutrons captured by the NS. This mechanism is consistent with the energies and composition of cosmic rays. They are obviously much richer both in protons and proton rich nuclei.

The main fields of a NS (or a BH) would drive the external plasma towards its polar regions where it would fall rather vertically. After NSRs, according to momentum conservation, the rejection angles of the relativistic particles are even smaller than the incident ones. Thus they must have higher probabilities to escape from the G field along the magnetic axis. These particle beams correspond with the *cosmic jets* observed in central regions of galaxies. Such regions are just those with the highest probabilities for the existence of both: rather naked BHs and gas clouds. Such jets, in their paths, can excite fluorescence on gas and particles.

In the rather naked BHs that are left over after some supernovas, the eventual precession of the magnetic poles can drive the jets along cones producing visible rings in their intersections with spherical shells of matter ejected from earlier explosions. These jets are obvious in the Hubble Space Telescope pictures of: SNA1987A, the Hourglass, the Egg Nebulas, and in PRC95-24 (C. Burrows, J. Hester, J. Morse and NASA). They have been available in internet, from NASA.

Test V.- From points I and IV), the most powerful stars should have a NS inside of them². Their energies should come both from nuclear fusion

²The probable mechanisms of NS formation in stars have been discussed in the reference
and neutron stripping. The last reactions must convert large fractions of the G work into nuclear potential energy that would be used up in the external shell \[7\], \[11\]. This would prevent all of them: local overheating, neutrino cooling and star collapse (urca process).

The new star model has a better defined mass-luminosity relation \[7\], \[11\], which is roughly proportional to \(M^{3.7}\). This one is consistent with that of main sequence stars. This is also consistent with the higher densities and temperatures of such stars, and with the low neutrino luminosity of the Sun and its magnetic activity.

3 Conclusions

The EEP fixes more simple and unified physical and astrophysical contexts, starting from a single quantum and ending with the universe. They are self-consistent and consistent with the observed facts. The high unity observed this theory comes from the fact that everything turns out to be fixed by common properties of radiations. This way also reduces the number of independent variables and the uncertainties due either to arbitrary assumptions or experimental errors (or limitations).

The use of a well defined reference frame, which is equivalent to generalize the language used in special relativity, prevents the current errors due to the ambiguity of the ordinary language used in current literature.

I started this work about 24 years ago from very simple but fundamental questions, trying just to understand by myself the basic phenomena in nature. Little by little the few first ideas have grown up into an extremely simple and self-consistent theory that can be used as a guide for understanding, in a unified way, a wide range of phenomena occurring in the wonderful universe in which we live \[11\].

Curiously, the truth may be much more simple than we expect. This may be just the reason for which we normally do not see it so easily.
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