The Black and Luminous Galaxies

Predicted from the Equivalence Principle and the Gravitational Tests

Rafael A. Vera.
Departamento. de Física. Facultad de Ciencias Físicas y Matemáticas. Universidad de Concepción. Chile.

Abstract: The evolution of galaxies derived directly from the experimental facts is radically different from the conventional. because the last ones reveals that matter is not strictly invariable after a change of G potential. The G field has no energy. The new kind of "linear black hole" (LBH), after absorbing radiation, must explode regenerating new star clusters or galaxies. A universe expansion cannot change the relative distances because matter is also expanded in identical proportion. The universe has no limits of age and lifetime. Statistically, "galaxies must be evolving, indefinitely, in rather closed cycles between elliptical galaxies and "black galaxies", and vice-versa. Most of the universe must in the state of black galaxies at temperatures close to 0 °K. The true elliptical galaxies and globular clusters must come from recent LBH explosions. Most of the energy released in a galaxy cycle must come from gravitational energy transformed into other kinds of energies around neutron stars. All of the evolution stages are present in the sky.

1 INTRODUCTION

1.1 The classical error in gravitation, cosmology and astrophysics

The ordinary physical language is based on **the classical hypothesis on the absolute invariability of matter after a change of G potential** with respect to an observer that has not changed of potential. Such hypothesis is in contradiction with the true "**G time dilation**" (GTD) experiments" made up with "atomic clocks". From them[A]:

1. *The standard clocks located in different G potentials run with <u>different</u> frequencies with respect to each other* (Vessot 1980)(Vera 2000).
2. ***T*he current relations between frequencies measured by observers located in different G potentials are inhomogeneous and meaningless** *because they are referred to clocks that have with different eigen-frequencies with respect to each other*. **The same holds for relations between masses and lengths** *because are related to each other by constants that don't change after change of G potential.*

Such kind of error becomes important in the strong and untested field range. To get rid of it is essential to start all over from *a better-defined formalism* that can describe the real changes occurring to the bodies after changes of G potential with respect to the observer. To be free of any eventual error of the current theories, one must start from **raw experimental facts** that have not been already interpreted according to them.

[A] A *true* GTD experiment measures only "differences of the arrival times" of electromagnetic signals coming from some nonlocal clock located at rest in a G potential different from the observer's one. Then "*the time of fly of the signals is cancelled out*". *No photon frequency is measured*. Then it is most important to know that the results of these experiments have nothing to do with what may happen to the photons during the trips. Then, to the contrary of photon's G redshift experiments, the <u>position in which GTD occurs is well defined</u>.

1.2 The General Equivalence Principle (GEP)

From the equivalence principle (EP), the local ratios within parameters of an instrument are constant values that do not change after a "common" G potential change (Misner 73). Such *constant ratios* must be consistent with the *variable values* observed by a "nonlocal observer" that has not changed of G potential. This can happen only if:

I. *"All of the parameters of any well-defined part of the instrument change linearly, in just the same way and in the same proportion, with respect to such observer, after any common change of velocity or G potential with respect to the observer that have not had such changes". Only in this way every local ratio can remain constant, i.e., the local physical laws can remain constant* (General EP or GEP) (Vera 2000)

II. *All of the well-defined parts of the instrument obey the same physical laws* (GEP II).

1.3 The New Formalism Fixed by the Experimental Facts

From *the GEP* it is concluded:

A. *To detect or to describe all of the changes occurring to the bodies, due to changes of velocity and G potential, the observer must not change of velocity and of G potential* (strictly invariable observers). This is already done in special relativity.

B. To relate quantities measured by observers in different potentials, they must be previously corrected for the physical differences that exist between their standards:
   - The *Lorenz Transformations* correct them for differences of *velocity*.
   - The new kind of ***Gravitational Transformations***[i] corrects them for differences of G potential.

   The corrected quantities are called *nonlocal* (NL) (relativistic) ones (Appendix A).
   Then the new formalism fixed by the GEP is *a plain generalization of special relativity for nonlocal cases in G field.* (It may be called NL relativity)

C. From the GEP II, *particle models made up of photons in stationary states can emulate matter. The model's consistency with special relativity, quantum mechanics and gravitational experiments, has been previously verified* (Vera 1981a, 1981b, 1997).

1.4 Inconsistency of general relativity with the experiments

From the G transformations it is concluded that the G field energy density postulated by Einstein is in contradiction with the EP and the GTD experiments[ii] (See Appendix A). *It is the body, not the field, the one that puts on the energy for the G work.* This has also been proved from several different ways (Vera 1981a, 1981b, 1997, 2000).

1.5 Inconsistency of cosmology with the experimental facts

Cosmology is based on the tacit hypothesis that "*the rods do not expand during universe expansion*". Such hypothesis is in contradiction with the matter expansion produced by the general increase of distances found either from the G transformations or the GEP[iii] (See Appendix C). It is simple to prove that matter expands in just the same proportion as the intergalactic distances (Vera 1986, 1996, 1997, 1999)

1.6 The new kind of "linear black hole"

The new G field equation fixed by the GEP is "*linear*", i.e., without a true singularity (Vera 1081a, 1981b, 1997, 2000). However, for $GM>>r/2$, critical refraction angles prevent the escape of most of the photons but the capture cross-section increases with M^2.

Thus a new kind of "*linear black hole*" (LBH)[B] turns out to be a nearly perfect absorber for all kinds of radiation (Vera 1981b, 1997). The energy absorbed by it would increase the average NL mass of its neutrons with respect to an external observer, i.e.; it would decrease its entropy. The same as in nuclear physics, the LBH becomes unstable when the average nonlocal mass per neutron, with respect to an observer far away from it, is larger than the one of a neutron in free state. Then in principle such body can explode thus generating a huge cloud of H.

2 THE NEW UNIVERSE FIXED BY EXPERIMENTS

From above it is concluded: "*the universe has no well-defined limits of time either in the past or in the future, even if it were expanding*". The age and lifetime of the universe must be, at least, 4 orders of magnitude higher than the current estimations, may be infinite. Thus the entropy of the universe remains constant thanks to the LBHs.

2.1 The matter cycles in the universe

Then, *matter must be evolving, rather indefinitely, in closed cycles between the states of low-density gas and LBH, and vice versa* (Vera 1981b, 1986,1996,1997,1999).

A LBH after absorbing energy from the rest of the universe, must explode, i.e., to should throw H gas throughout older star remnants and planetesimals that was travelling around it. This process must generate a high proportion of randomly oriented angular momentum. The last bodies, after capturing gas, must become new star clusters of rather spherical shape, like globular clusters and elliptical galaxies. After progressive cancellation of the randomly oriented angular momentum, and energy emission, a new LBH, surrounded by a new "*black cluster*" of non-luminous bodies, would be formed, an so on.

2.2 The main energy source in star clusters and galaxies

Since the G binding energy of a neutron of a massive **neutron star** (NS), or a LBH, is of higher order of magnitude than the nuclear one, then:

- "*The net G energy released per unit of mass, "in a matter cycle", is of a larger order of magnitude than that the original nuclear potential energy of the H*. This means that:
- *Most of the G energy must be transformed into other forms of energy in regions close to the neutron stars surfaces*[iv]*, either steadily or explosively* (Vera 1993,1997) (See Appendix D).
- *A neutron star (NS) must be growing up inside of the more powerful stars, like in "main sequence stars" and blue giants..*

In previous works (Vera 1981b, 1986, 1993, 1995, 1996, 1997), the mechanism of nuclear stripping has been proposed for the transformation of G energy into kinetic and nuclear potential energy. It accounts for cosmic ray generation; the higher energy yields of main sequence stars and the low neutrino emission of the Sun

The formation of a NS inside of some stars can occur either by internal *collapses* or rather *gradually*, with the help of radioactive elements generated during stellar collapses. Thus old (dead) stars can recover a new and bluer lifetime, for longer periods, after the capture of wasted gas contaminated with elements heavier than H.

[B] Originally, it was called "semi black body" (Vera 1981b)

3 A GALAXY CYCLE

3.1 The black period of a galaxy

Most of the galaxies, after angular momentum exchange and emission of available energies, a luminous galaxy must end as a cool “black galaxy” (BG) with a couple of more massive LBHs in its center. The other LBHs, altogether with: neutron stars, dead (dwarf) stars, planets and planetesimals should surround them. The LBHs, that absorbs all kinds of radiation from the space, must cool down all of these “black remnants”. Most of the net angular momentum should be concentrated in black remnants near the galactic plane.

Statistically, the relative number of black galaxies of the universe must be proportional to the average energy-recovering period, which must be of higher orders of magnitude, compared with the luminous one. Then *the proportion of black galaxies in the universe must also be of higher orders of magnitude compared with the luminous ones*.

The cool set of black galaxies must emit some well-defined low temperature microwave background. This one must account for the CMB of 2.73 ºK observed in the universe. *Thus the CMB must be not a cosmological relic. It must be the spectrum of the black galaxies of the universe*,

The black galaxies must also account for all of the phenomena occurring in the intergalactic space, like:

- Cosmic radiation and Gamma bursts
- Iron in the intergalactic space
- Higher velocities observed in the cumuli of galaxies
- G diffraction and G refraction (LENS) effects.

3.2 The luminous period of a galaxy

The luminous period of a regular galaxy must start after the explosion of the central LBHs. The new energy liberated must trigger a chain of explosions of the other LBHs that are ready to explode. The rest of them would explode later on during the luminous period of galaxies thus forming **globular clusters**.

3.2.1 The true elliptical period of a galaxy

The chain of LBH explosions, that regenerates a luminous galaxy, must occur in a space crowded with its older non-luminous bodies. Then the new (clean) gas must be condensed over them as stars with a high proportion of randomly oriented angular momentum compared with the net galactic momentum. This must account for the rather spherical form of elliptical galaxies and for their angular momentum problems. Then *the true elliptical galaxies would be not old galaxies*. To the contrary, they are the best evidences of *the recent generation of new luminous galaxies*.

3.2.2 The black galaxy growing up within a luminous period

Sooner or later the stars of a galaxy must become black ones, once that they rundown of available energies. Thus, during a luminous galactic period, some matter cycles must be paused while other ones must start. In other words, some star clusters must become dark ones and some other ones must become luminous after recent LBH explosions.

Due to the net luminosity of a galaxy, the average, the number of black components of a galaxy must increase with the time. The last ones must form like a new BG merging within

the luminous galaxy. They must absorb radiation of the same galaxy. Thus they must account for the fact that galaxies emits much less energy than the one emitted by their stars and for the missing mass problems of the galaxies.
On the other hand, some nearly dead stars must recover a new luminous lifetime after the formation of a NS inside of them. This process must be accelerated by the capture of wasted gas coming from other stars. Thus the *"G energy"* must increase the temperature and prolong the luminous lifetime of some stars in some regions of the galaxy.

3.2.3 The disc and spiral periods

Due to the higher cancellation rates of the randomly oriented angular momentum of the stars, compared with the angular momentum of preferred orientations, the spherical set of stars should contract at a higher rate compared with the set of stars orbiting near the galactic plane. Thus the elliptical galaxies must take the shape of *disc and spiral galaxies*. Notice that the last ones are necessarily *older* than the elliptical ones.
The last ones must have more dense and bluer stars running with G energy that would last somewhat longer regardless of their higher temperatures (Vera 1997).

3.2.4 The AGN periods

When spiral stars become dark rings or lanes around the spherical bulge of dead star remnants, the galaxy must look like a “false” elliptical galaxy. The external rings may stand out as shadows, like in Centaurus A. The high-energy yields released by the more massive (older) neutron stars are obvious from the radio jets.

3.2.5 The quasar period

The last luminosity of a galaxy must come from recycled gas within a small region around the central black holes, which must be surrounded by the “BG” with its non-luminous components. It must be in an extremely low G potential so that it would emit light with a *strong gravitational redshift*. They must correspond with the ***TRUE QUASARS*** of high *G redshift* and *variable luminosity*, i.e., with the *radio noisy ones* (They must not be confused with QSO galaxies of high *cosmological redshift*.) (Vera 1995, 1997, 1999).

3.3 Star Cluster Formation

3.3.1 Globular clusters

An old LBH of can finish up its energy-recovering period with the help of the higher density of radiation coming from the luminous regions of the galaxy. A crowd of planets and planetesimals and some few dead stars should be travelling around it. Then the chaotical explosion of the LBH must generate a high density of *randomly oriented angular momentum*. Them the above bodies, after capturing gas, must become low-density stars made up with rather clean H gas. Some main sequence stars can result from condensation of gas over dead (dwarf) stars or neutron stars.

3.3.2 Open clusters

With the time, most of the stars of a globular cluster would run down of nuclear energies and become dark ones. However the few stars that have got neutron star cores would get “higher powers (bluer) and longer lifetimes “. Thus, *open clusters are likely to come form evolution earlier globular clusters. Thus, strictly, the first ones should be older than the last ones where they come from.*

Notice that *the new concept of* ***star age****, starting from its real birth with really new gas*, turns out to be opposed to the traditional one. A dead star that recovers luminosity after the capture of wasted gas should be older than the star where it comes from. Strictly, it is a more evolved star, i.e., *it is not a new star*.

4 Conclusions

The current interpretations of the phenomena occurring in galaxies and star clusters strongly depend on <u>*theories and models that are not simultaneously consistent with the most accurate experiments in gravitation*</u>.

According to **the new context directly fixed by the experimental facts**,

1. Matter is not invariable after a change of G potential.
2. *The relative properties of bodies are functions of their velocities and G potentials with respect to the observer.*
3. To the contrary of the Einstein's hypothesis, the G field has no energy. The new kind of *linear black hole* has not a real singularity.
4. A universe expansion cannot change the relative distances, indefinitely.
5. The age and lifetime of the universe are rather *infinite*.
6. Matter must evolve, indefinitely, between states of gas and LBH. The last one, after absorbing radiation, must explode, regenerating gas.
7. Most of the energy liberated in a matter cycle must be gravitational one. It must be released by the fields of the densest states of matter, like neutron stars.

Consequently, galaxies and star clusters must also evolve, rather indefinitely, in rather closed CYCLES between luminous and black states and vice-versa.

Star clusters and galaxies must come from single and chain explosion of LBHs of earlier black galaxies. They would start their cycles in ***globular and elliptical*** forms, respectively. They are fair testimonies of recent LBH explosions.

With the time, most of their luminous stars, after emitting energy, must become ***black ones***. Some of them must last longer and become ***bluer*** due to the liberation of G energy around neutron stars inside of them. Indeed *they are older stars with a new vitality* coming from a <u>new kind of G energy source</u> aside of the nuclear one. Such energy is obvious in the Sun, from the higher energy yields per neutrino emitted. Them, the last stars are obviously "older" than the original (red) ones. This is in clear opposition with the current terms "younger" used for them in the current literature.

A typical galaxy, after emission of energy and cancellation of randomly oriented angular momentum, must pass through stages of disc, *spiral*, *AGN*, quasar of high G redshift and black galaxy. *Most of the universe must be in the form of "black galaxies" absorbing energy from the rest of the universe*. They must account for the low temperature CMB.

The "**globular clusters**" must come from recent (delayed) explosion of a LBH occurring in the center of a cluster of black star remnants. After a long time, most of their stars would become non luminous. Their last luminous stars must look as "***open clusters***". They must be bluer and last longer due to the G energy released by the fields of neutron stars that are growing up inside of them. *They must be older than globular clusters*.

The evolution of galaxies and star clusters, directly predicted from the EP and the G tests, is consistent with the astronomical observations but not with the current interpretations.

---

[i] APENDIX A The gravitational transformations fixed by the experimental facts

From the GEP, all of them: the frequencies, the masses and the lengths of any part of an instrument, with respect to an observer at rest (V = 0) must change in the same proportion, with respect to such observer, after any common change of G potential. On the other hand, from GTD experiments, when a clock is raised isostatically from the observer radius $r = a$, up to a radius $r = b$, some exact energy $\Delta E_a(0,b)$ must be given up to it. From the results of the GTD experiments and the GEP, the proportional changes occurring to the clock are as follows (Vera 2000):

$$\frac{\Delta \nu_a(0,b)}{\nu_a(0,a)} = G\sum_j \frac{M^j}{r^{aj}}\frac{\Delta r^{aj}}{r^{aj}} = \frac{\Delta E_a(0,b)}{m_a(0,a)} = \frac{\Delta m_a(0,b)}{m_a(0,a)} = \frac{\Delta \lambda_a(0,b)}{\lambda_a(0,a)} = \frac{1}{2}\frac{dc_a(b)}{c_a(a)} = \Delta \phi_a(b) \quad (1)$$

The three first members describe the results of the GTD experiments both in terms of the changes of relative positions and of the change of G potentials of the clock with respect to the field sources. The last one is given in terms of the energy used up to raise a small test mass $m_a(0,a)$ (Here, for simplicity, *the mass unit is the joule*, so that M = **M** [*kg*] c^2 and G =**G** [*mks*] c^{-4}).
The 4th and 5th members come from the application of the GEP to any mass (m), length (λ) or wavelength in the instrument.
The 6th member comes from the application of the 1st and 5th member to "*a photon in stationary state*" in which the "*NL velocity of light*" at b, with respect to the observer at a, is $c_a(b) = \nu_a(0,b)\,\lambda_a(0,b)$.
In previous works it has been proven that *Eq. (1) accounts for all of the G tests* [4-6].

[ii] Appendix B. Inconsistency of the theory of general relativity

From the 3rd and 4th member of (1) it is inferred that

$\Delta E_a(0,b) = \Delta m_a(0,b)$ (2)

The energy given up to the body is stored in the body as an extra mass, it is not stored in the G field. *To the contrary of what Einstein postulated, there is not a real exchange of energy with the body and the G field.* Vera 1981a, 1981b, 1997,2000)
From the results of a free fall from b to a, and from special relativity and (2)

$m_a(V,a) = m_a(0,a) + \Delta E_a(0,b) = m_a(0,a) + \Delta m_a(0,b) = m_a(0,b)$

In a free fall, the body's relativistic mass, with respect to a fixed observer, remains constant.

[iii] Appendix C. Inconsistency of current cosmology

Global demonstration. From the GEP II, particle models can emulate all of the well-defined particles of the universe with photons in stationary states. Then the space turns out to be crossed with a high density of wavelets with nearly random phases coming back and forth between all of the quanta of the universe. Such wavelets must interfere constructively only at the sites where photons are located.

During a homogeneous universe expansion, according to "wave continuity" and "Doppler shift", the wavelengths of all of the wavelets must increase just in the same proportion, without changing the net number of wavelengths between the particles of the universe.

Then it would be not possible detect any change produced by universe expansion because it would be not possible to find a single body that does not expands in the same proportion as the rest of the universe.

Quantitative demonstration. From the 2nd and 5th members of Eq. 1, the increase of G potentials produced by a universe expansion produces *a G expansion of every length and wavelength in any place*. A more exact demonstration is given in (Vera 1995, 1997, 1999).

[iv] APENDIX D The nuclear-gravitational reactions

In principle they can take place when the G binding energy of the neutrons in neutron star is higher than the nuclear binding energy of the neutrons in the He atoms (Vera 1981). Thus Helium (He) falling into the neutron star can react with it thus rejecting protons or proton rich nuclei with high kinetic energies (cosmic radiation).

(Vera 1986,1993,1997) has proposed that such mechanism also occurs rather hidden inside *of the more denser and luminous kinds of stars*, like **the main sequence stars and blue giants**. The G energy released must increase the luminosity, temperature and lifetime of such stars. This mechanism accounts for THE LOW NEUTRINO LUMINOSITY OF THE SUN and for its activity. It also accounts for the existence of blue giants between consecutive supernovas.

References

1. Misner,Ch. W., Thorne, K. S., and Wheeler, J. A. 1973, Gravitation. (Freeman, San Francisco), 386
2. Vessot F. et al,. 1980, Phy. Rev. Lett. 45, 2081-84.
3. Vera, R. A. 1981a, in Proc. of The Einstein centennial symp on fundamental physics, Bogotá, (ed. by S. M. Moore, A. M. Rodriguez-Vargas and G Violini, Universidad de Los Andes, Bogotá,), 597-625.
4. Vera, R. A. 1981b,. Int. J. Theor. Phy, (Plenum Publishing Corporation, (It is available in <http://sites.netscape.net/rafaelveram/index.htm>, 20, 19-50.
5. Vera, R. A. 1986, in Proceedings of the 4th Marcel Grossmann Meeting on GR, Roma, ed. by R. Ruffini (Elsevier Science Publishers V. B.,) 1743-1752
6. Vera, R. A.1993, in: Inside of the Stars. (IAU. Coll 137. ASP Conference Series, 40,. ed. Werner. Weiss, A Balgin.(Book Crafters Inc.) 798-800
7. Vera, R. A. 1995, Preprint astro-ph@xxxlanl.gov , 9509053.
8. Vera, R. A.1996,. in Proc 7th Marcel Grossmann Meeting on GR, Stanford, ed. by. R. Jantzen, G. Mc Keiser, R. Ruffini. (World Sci, Singapore,), A, 511-513.
9. Vera, R. A. 1997, The New Universe Fixed by the Equivalence Principle and Light Properties (Ediciones Universidad de Concepcion. Chile.) (This book is available in <http://sites.netscape.net/rafaelveram/index.htm>
10. Vera, R. A. 1999, in Proc. 8th Marcel Grossmann Meeting on GR, Jerusalem, ed. by Tsvi Piran and R. Ruffini, (World Sci, Singapore,), A, 303-306, B, 1229-1231
11. Vera, R. A. 2000, Preprint gr-qc@xxxlanl.gov , 0009085