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# 7 STRONG GRAVITATIONAL FIELDS AND THE NEW KIND OF BLACK HOLE

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# 7.1 Photon Orbits in Strong Fields

According to NL frequency conservation and to the Huygen´s principle, the orbit of a photon in a G field depends only on the NL refraction index of the space.

In central fields, for example, the photon trajectory, can be derived from *E5.41, E5.42b,* or E5.43. For each photon trajectory, according to NL angular momentum conservation, all of them: the NL angular momentum ($j_{r*}$), the NL impact parameters $r^{im}$, and $z^{im}$, have constant values.

Let us assume, for simplicity, that the NL observer is in the point P of Fig. 6.1, far away from the central field source of NL mass $M_{r*} = M$. Let $r*$ and $q(r*)$ be the initial radius and angle of a photon emitted in the observer position, respectively, as shown in such figure. According to NL angular momentum conservation, or E5.41b, it is possible to define the following NL impact parameters,

$$r^{im}_{r*} = r*\sin\theta(r*) = cons\tan t = j_{r*}c\,; \qquad z^{im} = \frac{GM}{r^{im}} = \frac{GM_{r*}}{j_{r*}c} = cons\tan t$$

E7.1

On the other hand, the differential equation for photon orbits is fixed by E6.10. In the present case $K$ = zero either because $b$ =one or because photons have not rest mass. After using E7.1,

$$r^2 + \left\{\frac{dr}{d\phi}\right\}^2 = \left\{\frac{r^2 n_{r*}(r)}{r^{im}}\right\}^2 \cong \left\{\frac{r^2\exp(2z)}{r^{im}}\right\}^2 \;;\quad z = \frac{GM}{r}$$

E7.2

This looks simpler by using z as the main variable:

$$z^2 + \left\{\frac{dz}{d\phi}\right\}^2 = \left(z^{im}\right)^2\exp(4z)$$

E7.3

Indeed the photon trajectory is fixed by the inclination angle $q$ between the photon quantum vector and the vector radius ***r*** pointing away from the field source. In this way, if $q$ is less or larger that 90º, we can know if the photon is going upwards, horizontal, or downwards. Such angle can be obtained directly from the NL angular momentum conservation law given in E5.41 and by using the NL speed of light for central fields given by E5.27. For an observer far away from the system:

$$j_{r*} = \frac{r^{im}_{r*}}{c} = \frac{r_{r*}\sin\theta}{c_{r*}(r)} = \frac{r_{r*}\sin\theta}{c_{r*}(r*)}\exp\left[\frac{2GM}{r}\right].$$

E7.4

$$\sin\theta = \frac{r^{im}}{r}\exp\left[-\frac{2GM}{r}\right] = \frac{z}{z^{im}}\exp[-2z].$$

E7.5

Then a plot of *sinq* versus *r/GM* gives a gross information on the photon path

$$y = \sin\,\theta = \frac{x^{im}}{x}\exp\left[-\frac{2}{x}\right] \quad ; \quad x = \frac{r}{GM} \; ; \quad 0 \le y \le 1$$

. E7.6

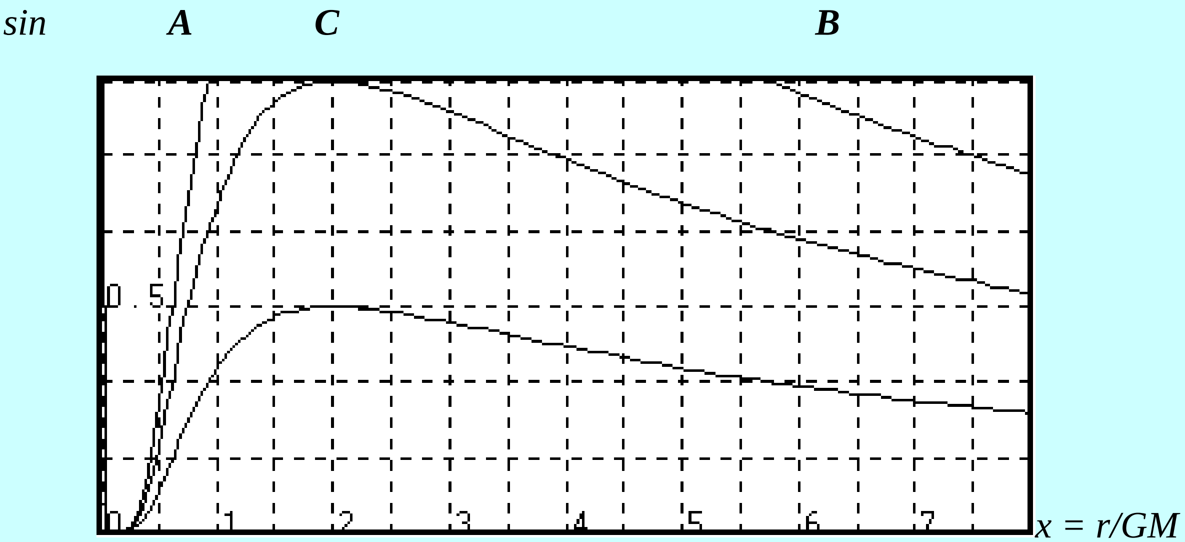

**Fig 7.1** Plot of *sin* versus *r/GM* for three impact parameters: $r^{im} = eGM$, $2eGM$ and $3eGM$. The middle curve is for the critical impact parameter.

In Fig 7.1, the lower curve is for $r^{im} = eGM$. The incoming photon never becomes horizontal (*sin = 1*) and, therefore, it falls into the central body. Vice versa, *a photon can escape from the central body along the same curve but in the opposite direction. This is done within finite time intervals because there is not a singularity at* x = 2. This is an important difference with general relativity.

# 7.2 black hole Properties

In Fig. 7.1, light traveling along the intermediate curve becomes horizontal when *sin =1*, at ***C***. This occurs for $x = 2$ and $r^{im} = 2eGM$. This curve corresponds to an angular momentum density equal to *2eGM/c*. This is a *critical orbit* that has the equation

$$\sin\,\theta = \frac{2eGM}{r}\exp\left\{-\frac{2GM}{r}\right\} = 2ez\,\exp(-2z) = \frac{2e}{x}\exp\left\{\frac{-2}{x}\right\}$$

. E7.7

The incoming photon may either remain at $x = 2$ orbiting for a while in a circular orbit, in the intersection point with the horizontal condition, before falling into the central body. It may also escape from the field evolving towards the right of such point. The critical photon orbit has a radius

$$r^{crit} = 2GM$$

. E7.8

Such critical photon can fall into the central body surface of radius $r^{s}$ with a *critical incident angle* $q^{s}$

given by:

$$\sin\theta' = \frac{2eGM}{r'}\exp\left\{-\frac{2GM}{r'}\right\} = 2ez'\exp(-2z') = \frac{2e}{x'}\exp\left\{\frac{-2}{x'}\right\}; \qquad z' \geq \frac{1}{2} . \qquad \text{E7.9}$$

Vice versa, a photon emitted in the surface of the central body with *a critical escape angle just equal* $^{s}$*; it* would evolve towards the right along the same curve. This critical escape condition is similar to the one in the *critical reflections* of light after a sudden drop of the refraction index.

From E7.9, the critical escape angles can be smaller than */2* only for bodies with radius $r^s < 2GM$. Notice that here, the radius $r = 2GM$ is not a singular radius. This is a fundamental difference with General Relativity. However, to avoid of introducing different names for bodies with $r < 2GM$ , it is better to use same name: "*black hole*". Here, this is defined as "*any body whose radius is smaller that 2GM* ". In this way, the definition is independent on any theory used for determining its theoretical properties. Here, for example, the new properties are fundamentally different to those predicted from the theory of general relativity.

In Fig. 7.1, the upper curves ***A*** and ***B***, are for $r^{im} = 3eGM$. An incoming photon, described by the curve ***B***, becomes horizontal at $r = 5.8\ GM$ . After that, it goes away in a symmetrical path described by the same curve ***AB*** but towards the right of this diagram. Such photon cannot be captured by the black hole.

Vice versa, a photon escaping from the black hole with the same angular momentum density of *3eGM/c*, given by *E7.1* would become horizontal at ***A****,* in a radius lower than that of the critical photon orbits. After such position it would fall along the symmetrical path described by curve ***A*** but in the opposite direction[1]

Notice that radiation can escape from inside of the radius $r = 2GM$, if the escape angle from the internal body, $q_s$, is equal or smaller to that given by E7.9. Thus, to the contrary of general relativity, *there is not a real singularity at r = 2GM.*

The new properties of the black holes, which are ultimately fixed by the Explicit Equivalence Principle, have some important differences with those predicted by the theory of GR. Here, for example, the central core of a black hole would be just a micronucleus, normally called *neutron star*. This one would be made up mainly of neutrons whose NL properties rather predictable from current physics, after previous transformations for a common NL unit system.

Photons escaping from a black hole would do it within relatively short NL time because the NL speed of light is never zero. From above, the photons would keep constant their highly redshifted NL frequencies. On the other hand, photons emitted with angles larger than the critical one would be reflected backwards by the gradient of the NL refraction index in the space around the black hole.

A very massive black hole with $r^s << 2GM$, would have *very small critical escape angles* and, therefore, the escape probability for relativistic particles and radiation would be very small. Most of them would travel throughout strong gradient of NL refraction index that would reflect them backward towards the black hole surface. In this way the high gradient of the NL refraction index around the black hole would be like a perfect dielectric *mirror* that would confine most of the radiation within a kind of wave cavity of radius *2eGM*. However, statistically, a small fraction of light and relativistic particles can in principle escape from the black hole along the magnetic axis.

According to the GTD phenomenon, the NL frequencies of the radiation emitted in the surface of a black hole would be very low compared with the ones of the same atoms located far away from the black hole. They would be red shifted, with respect to an external observer, by the factor exp*[-z(r)]*. Thus, the net energy lost by a massive black hole would be extremely low as compared with an ordinary *black body*. This is due both, to the small escape probability and to the low NL frequency of its radiation.

On the other hand, a black hole would have a relatively high *capture cross-section*, which is fixed by a radius *2eGM*. At a difference with an ordinary blackbody, it would emit much lower energy compared with the one that it may capture from the space. Thus a massive black hole would absorb and store most of the radiation’s traveling within the "critical impact parameter", equal to 2eGM, *i. e.*, it would be like a *nearly perfect sink* for any kind of radiation. It would be, for long time, like a “trash can” for anything traveling in space.

## 7.2.1 Gravitational energy conversion done by macro nuclei

From E5.27, the NL energy released per unit of NL mass during a free fall is:

$$Y = \frac{m_{r\bullet}(0,r^*) - m_{r\bullet}(0,r)}{m_{r\bullet}(0,r^*)} = 1 - \exp\left[z(r^*) - z(r)\right] \cong z(r) - z(r^*) \cong \frac{GM}{r} - \frac{GM}{r\,*} \quad .$$

E7.10

This energy yield, per unit of mass-energy, would be much larger than the yield of nuclear reactions (of about 0.7%.  For a critical black hole with $z(r^s) > 1/2$, for example, $Y > 40\%$. *This value is of a higher order of magnitude compared with the binding energies of the neutrons in the nucleus of atoms.*

*Let us define a neutron star as a macronucleus with a G binding energy larger than the ordinary binding energy neutrons in helium atoms, i.e., about 0.07.* Then the most probable kind of nuclear reaction between the BS and atoms heavier than *H*, is that of *nuclear stripping* (the Oppenheimer kind). In this case, such reaction can be more specifically called neutron *stripping*. According to it and to NL mass-energy conservation, atoms falling into the core would loose some neutrons that would be captured by the core. On the other hand, the remaining nuclei (like protons or proton rich nuclei) should be rejected by the macronucleus (or neutron star). The rejected nuclei would take away the NL mass-energy difference between the original and final states of the neutrons. According to this, it may be concluded that:

*The high-energy nuclei escaping from a neutron star or a black hole should be richer in protons compared with the incoming nuclei*.

2. *Nuclear stripping reactions can occur with nuclei that have uncharged nucleons, i.e.*, they can occur more easily with atoms heavier than H, like helium.

3. *Nuclear stripping turns out to be an efficient mechanism for the gravitational energy conversion of neutron-rich nuclei*.

4. *The G energy is converted into high energy proton rich nuclei that are richer in nuclear latent energy*.

*When Y is too high, high-energy positrons can be ejected.*

This kind of reaction can only occur when the NL rest mass of the neutrons in the neutron star is lower than that in the incoming nuclei. Then this reaction can occur after the free fall of atomic nuclei on naked neutron stars whose value of *z(r)*, from E7.10, is larger than 0.007.

Notice that such G energy conversion regenerate new H out from burnt out products, like He, that comes from nuclear fusion reactions. Such reaction should be most important to understand the phenomena occurring in the strong fields of the universe.

## 7.2.2 Cosmic ray generation

The magnetic fields of a neutron star would slow the transversal flow of ions, mainly along equatorial regions but not in the polar ones. Thus, the same as in the case of the “aurora’s” in the earth, the magnetic fields would rather drive the ions towards the magnetic polar regions where they would fall more freely along the magnetic lines. Vice versa, the axial magnetic lines would drive away the charged particle rejected in such Polar Regions.

Assume for example that a heavy nucleus falls freely in a polar region of a neutron star or black hole. During the fall, according to NL mass-energy conservation, its NL (relativistic) mass remains constant until it collides with the central neutron star.

Assume that the core captures some number *n* of neutrons while the rest of the nucleus is rejected. From a NL mass-energy balance, according to NL mass-energy conservation, let:

$$m^{A}_{r*}(0,r^{*}) = m^{A}_{r*}(\beta,r) = n m^{N}_{r*}(0,r^{N}) + n^{c} m^{c}_{r*}(\beta,r) = cons\tan t \quad . \qquad \text{E7.11}$$

Let $m^{A}_{r*}(0,r^{*})$ be the atomic NL rest mass of atomic nuclei *before the fall.*

*Let* $m^{N}_{r*}(0,r^{N})$ be the NL rest mass of the *neutrons* captured in the neutron star (or black hole).

Let $m^{c}_{r*}(\beta,r)$ be the NL mass of the *cosmic ray particle rejected by the macronucleus.*

Let $n^{c}$ be the number of cosmic ray particles emitted in this nuclear reaction.

For a massive black hole, the NL rest mass of the neutrons captured by the core is negligible compared with the initial ones. Accordingly, the NL (relativistic) mass of the cosmic particle would be:

$$m^{c}_{r*}(\beta,r) = \frac{m^{A}_{r*}(0,r^{*}) - n^{c} m^{N}_{r*}(0,r^{N})}{n^{c}} \cong \frac{m^{A}_{r*}(0,r^{*})}{n^{c}} \quad . \qquad \text{E7.12}$$

In the case of the fall of a $^{4}He$ atom, after the capture of its two neutrons, the NL relativistic mass of each proton is, after E7.11,

$$m_{r^*}^{p}(\beta,r)=\tfrac{1}{2}\left[m_{r^*}^{He}(0,r^*)-2m_{r^*}^{N}(0,r^{NS})\right]=\tfrac{1}{2}\left\{m_{r^*}^{He}-2m_{r^*}^{N}(0,r^*)\exp\left[-z(r^{NS})\right]\right\}. \qquad \text{E7.13}$$

Neglecting the NL rest mass of the neutrons in the neutron star,

$$m_{r^*}^{p}(\beta,r)\cong\tfrac{1}{2}m_{r^*}^{He}\cong 2m_{r^*}^{p}(0,r^*). \qquad \text{E7.14}$$

The proton NL quantum vector, from E4.9 and E3.9b

$$Q_{r'}^{p}(\beta,r^*)=p_{r'}^{p}(\beta,r^*)c=\sqrt{\left(m_{r'}^{p}(\beta,r^*)\right)^2-\left(m_{r'}^{p}(0,r^*)\right)^2}\cong m_{r^*}^{p}(0,r^*)\sqrt{3}. \qquad \text{E7.15}$$

The *magnetic rigidity* (*pc/ze*) is:

$$R=\frac{Q}{ze}\cong\frac{m_{r^*}^{p}\sqrt{3}}{ze}\cong\frac{m_{r^*}^{p}(0,r^*)^{new}c^2\sqrt{3}}{ze}. \qquad \text{E7.16}$$

In which *pc* = *Q* and *ze* is the charge per particle. This value of 1.6x109 volts is consistent with a peak observed by Mc Donald[18] in a low solar activity period.

## 7.2.3 Cosmic jets and pulsed radiation’s

According to angular momentum, conservation, the condensation of nuclei into a neutron star or a black hole, would produce a core with high angular velocities and strong magnetic fields. Such fields would have a strong influence on the geometry of the accretion of any external plasma activated by the high energy radiated by the system.

In a way similar to the earth "auroras," most of the plasma would be driven by the magnetic fields towards magnetic Polar Regions. These regions would be the main "targets" for a large fraction of the relativistic nuclei falling into the neutron core.

Due to the low small mass of the electrons compared with that of protons, the magnetic fields would retard more efficiently the fall of the electrons as compared with the fall of the protons. This would produce during the fall

- An increase of the gradient of E field potential around the core.
- Synchrotron radiation coming from electron rotating along the magnetic lines,
- A high core positive potential that would reject positive charged particles.

Nuclear stripping reactions producing high-energy protons and positrons.

The increasing magnetic field intensities produced by the increased number of *positive charges* rotating in the core would tend to increase rather exponentially, the reaction of the system against a sudden increase of the fall of charged particles (Lenz rule). In this way, the electromagnetic fields would react, strongly, against the sudden plasma flow. However, this would not occur in the Polar Regions where the falling nuclei, travelling along the magnetic lines, would fall with very small angles with the magnetic axis. Due to the larger momentum of the rejected particles, they would escape from the neutron star surface with smaller angles compared with the incident. Thus, they would produce jets of protons escaping from it with very small angles with the magnetic axis, according to E7.9.

When a rather naked neutron stars is surrounded by a rather thin external envelope of gas, the cosmic ray particles produced by nuclear stripping reactions of the nuclei with the neutron star would interact with the external plasma. Thus would transform a variable fraction of their energies into radiation and cosmic rays.

Then it is inferred that for more massive neutron stars, most probably in the black hole range, the discharges of external plasma over the polar magnetic regions should produce narrow jets of high-energy cosmic radiation traveling in opposite directions, along the magnetic axis. They may eventually pass through the external shell and would travel far away in the space. Electrons coming along the external magnetic lines would travel away as spirals around the proton jets thus keeping a magnetic field parallel to the jet. They would form a kind of tunnel where the protons would be traveling. Thus the protons, in the average, would recombine with electrons after long distances.

This case seems to be obvious in the case of the *supernova 1987A (Plate I).* In this case, the shell of gas over the massive neutron star would be precessing and, therefore their jets would rotate along cones. The intersections of these cones with a rather spherical shell of gas, coming from an earlier star explosion, would account for the luminous rings observed far away from the star.

This case is most important because the object is obviously the result of an explosion of a blue star. This one also comes from an earlier explosion that has left BH with some less dense star-like envelope that cannot stop the narrow jets emitted in its center.

Similar structures, with better details are described in the Plates II, III, IV, V, and VI. They give a fair proof in that neutron stars and black holes do exist inside of some powerful kinds of stars that explode occasionally. The Hourglass nebula, in the bottom of Plate II is just similar to SN1987A. The Egg Nebula in plate III gives a clear insight of the global distribution of the rather spherical shell of gasses that are tunneled by the cosmic jets. The same holds for Eta Carinae in plate IV. The three images of Plate V, for another nebula, shows similar details, including the dark disc of plasma accumulated in the equatorial region around the BH. The jets in the center of M84 are directly measured in plate VI.

Another interesting case is the small *red star* SS433, a radiowave and X ray source located in the center of the supernova remnant W50. This one shows three sets of *emission lines*: one of normal red shift and two other sets that change periodically with the time. In the average, one is red shifted and the other blue shifted[35]. They correspond to jets emitted in opposite directions, in a way similar to those of the above cases. They show *a precession period of 164 years.* These jets have produced an outstanding expansion of the supernova remnants in the jet’s orientations.

A similar case occurs in the Crab Nebula[37], which is the remnant of a supernova explosion. One of the rotating beams, as seen in the X-ray image, form a cone of higher X-ray luminosity. The NS was most probably on the edge of a gas cloud so that the opposite beam was absorbed by it, forming a bright and round X-ray image. Thus, the whole X-ray pattern had the form of a “fried egg”. In such case, the X-ray and the light pulses occur about 30 times per second, in the *pulsar* range.

These examples strongly suggest that the pulsar mechanism is associated with the same mechanism of matter capture followed by jet emissions. Thus the main energy emitted from the pulsars most probably comes both, from the nuclear stripping reactions occurring in the polar magnetic regions of the BH and from the spin down of the NS after the capture of new matter with lower angular momentum density with respect to the BH. Eventual spin up would occur if the system enters in a cloud with higher angular momentum density. This is something is sometimes observed in some pulsars[2].

Jets are normally inside of galaxies. In some cases, they may go far away from the emission sources. They most probably would be captured by the halo of black remnants.

More massive and more stable black holes are expected to exist in the centers of galaxies. *They are consistent with the jets observed in the central regions of the galaxies*[35, 36]. These regions are just the ones that have higher probabilities for the existence of massive black holes.

Due to the preferred angular momentum of a galaxy, along its symmetry axis, the preferred BH orientation resulting from matter condensation is parallel to such axis. This is why most of the jets are parallel to the galactic axis. These jets are normally seen after radiowaves. In the center of our galaxy, these jets are crossing the galactic plane just perpendicularly.

In the case of Centaurus A, in plate X (Hale Observatories), the radiowave lobes emitted from the center have been superposed. They are perpendicular to the dark matter lane that crosses this galaxy. This indicates that the dark lane is made up of the remnants of the disc stars of the old spiral galaxy. Thus, the luminous region is just a fraction of an old galaxy in which the central bulge is luminous. The jets have supplied regenerated fuel to three optical visible nebulae that are far away from the luminous region[38]. Chains of hot blue stars are observed here, most probably after condensation of gas over old star remnants of this galaxy. This could not occur unless that some star remnants exist there, and that the jet materials have carried up new hydrogen for long time[3].

For neutron stars with $r < 2GM$, the escape angles given by E7.9 are so large that the energy resulting from neutron stripping can be dissipated in the same star neighborhood.

For some particular range of plasma density, this mechanism can eventually occur in a way analogous to a hydraulic ram, *i.e.*, as pulsed plasma discharges way followed by some relaxation time. Under resonant conditions, most of the plasma would fall after periodical discharges in the Polar Regions followed by the emission of a narrow pulse of particles.

After a pulsed discharge of plasma, the temporal flow of high-energy particles and the higher magnetic fields should temporally the stop the plasma flow. This can produce some relaxation time before a new plasma discharge. Thus, the fall is likely to occur periodically, in a way similar to the discharges of a charged condenser.

The rather periodical discharges of gas over the black holes are consistent with the quasi-periodical changes of the intensity of the jets observed in 3C273, M87 (Plate VIII)

The rather naked neutron stars with r>2GN, left over after stellar explosions would be not being able to produce narrow jets. Therefore, the ejected protons are likely to dissipate most of the energy produced by the capture of matter near the polar magnetic regions that may also be precessing.

When a dense gas cloud surrounds a neutron star, it may capture a voluminous external gas envelope.

The external plasma would absorb the energy released by neutron stripping in the neutron star interface. Thus, the whole system would look like *a more compact star*[4].

It may be concluded that "neutron stripping" is likely to be the most efficient and universal way for stepping down the high average energy yield produced by matter condensation from gas up to neutron star or black hole state. Such process would make possible the partial regeneration of new gas of high nuclear and kinetic energies, at the cost of rather burnt out materials like He or heavier elements. Such *recycled materials*, of renewed available energies, can extend the luminous lifetimes of galaxies much beyond the limits expected from current models based on just nuclear energy.

## 7.2.4 The entropy switches

From above it may be concluded that the most massive black holes of the universe would be concentrating the dispersed energy of the Universe into their neutrons. This phenomenon would be increasing the NL mass-energies of their neutrons and would eliminate, low energy photons. Thus, this mechanism should counterbalance the current increase of the entropy observed in nature. This would prevent that the average entropy of the universe may increase with the time.

In other terms, in the long run *the average NL mass of the nucleons of a black hole would increase with the time*, due to the radiation’s captured and stored throughout the time. After a long time, which depends on the average radiation density around the black hole, the nucleon masses may get close to that of the hydrogen in free state. This means that, after a very long while, a black hole will be able to emit neutrons or protons with a kinetic energy high enough to escape from the black hole. Such particle escape could be triggered either by the fields of external bodies[5] or by the fall of gas in Polar Regions. The last one would produce local overheating and nuclear stripping reactions. This would produce jets of new hydrogen rich material that would be thrown far away from the BH. This mechanism can also trigger the black hole explosion because the outflow of matter would decrease the value of *z(r)*, which in turn opens the escape angles thus increasing the escape probabilities rather exponentially.

During the proton escape, its NL mass would remain constant. However its velocity () would decrease, compared with the original one (${}_o$) in the core, after a gain of G potential. The same as in a free fall, according to E4.7 and E5.27,

$$m_{r*}(\beta_o, r_o) = m_{r*}(\beta, r) = \frac{m_{r*}(0, r)}{\sqrt{1-\beta^2}} = \frac{m_{r*}(0, r^*)}{\sqrt{1-\beta^2}} \exp\left(G\frac{M}{r^*} - G\frac{M}{r}\right)$$

E7.17

The explosion would transform the black hole into a low-density gas flowing throughout older stellar remnants orbiting around it. This would also transform kinetic energy into potential and rotational energies.

The final gas composition would depend on the primary nuclear reactions occurring during the rather brief expansion time. In this way, the theoretical gas composition, after this *small bang*, is likely to be similar to that of the primeval gases of the conventional *hot big-bang theories*. It should be made mainly of *H*, *He*, and some of their isotopes.

# 7.3 Cosmic Jets and Cosmic Rays as Crucial Tests for Linear Gravity

The existence of cosmic rays and cosmic jets provide new tests for the Explicit Equivalence Principle and for the Particle Model.

## Cosmic ray test I.

The plasma fall around a black hole would be preferentially focused by the combination of gravitational, electric and magnetic fields towards the Polar Regions. These regions would be well-defined and flat targets for the incoming particles travelling along the magnetic lines. Thus, nuclear stripping would occur in very small surfaces in the Polar Regions. Due to the larger vertical moment per unit o mass given up by the neutron star to the rejected particle, compared with that of the incident particles, the rejection angle must be much smaller than the incident one.  This accounts for the smallness of the divergence angle of the *Cosmic jets* observed in the center of galaxies[35, 36].

[Notice that the magnetic field would prevent the escape of charged particles from the star, in most of the orientations. However, this would not hold along the magnetic axis]

Thus, the existence of cosmic jets of small divergence angles indirectly reveals that the particles have been emitted “coherently” from “well-defined” (flat) targets in the surface of the neutron star.

On the other hand, according to a gross approximation of E7.13, for protons emitted by neutron stripping in a black hole with GM/r >1/2, they would have a relativistic mass:

$$m_{r*}(\beta, r^*) > m_{r*}(0, r^*)[4 - 2e^{-1/2}] = 1.4 m_{r*}(0, r^*)$$

This means a kinetic energy larger that 40% of its rest mass-energy, which is common to find in cosmic rays. Then it is reasonable that the cosmic jets produced by massive objects come from regions in which r > 2GM, i.e., below the Schwarzchild radius.  This would prove that the black holes don’t have the singularity predicted by the Einstein’s theory of general relativity.

Since the probability for the existence of very massive neutron stars and black holes would be larger near the galactic centers, then *these jets should be more often found in such regions*. Effectively, this is consistent with the common location of the cosmic jets, most of them in central regions of galaxies.

# Cosmic ray test II

From E7.16, it is concluded that the number of protons with energies larger than *the double of its rest mass would decrease for higher energies.*

This result is consistent with the small peak of cosmic radiation with a *magnetic rigidity* (*pc/ze*) of *1.6 Gv* observed by Mc Donald during a very quiet solar period[18].

# Cosmic ray test III

It is obvious that neutron-stripping reactions produce cosmic rays with a higher proportion of proton (proton rich materials). This is clearly consistent with the observed facts, starting with the higher abundance of H in cosmic rays compared with the normal composition of the stars. This higher ratio is just more important for the H/He ratio.

# Cosmic ray test IV

According to NL mass-energy conservation, the higher is the fraction of neutrons captured by the black hole, the higher would be kinetic energy of the rejected nuclei. This is also consistent with work of H. Reeves[19] that found *a decreasing proportion of neutron rich isotopes in Cosmic rays of increasing energies*

# Quasar and Cosmic Jet tests

The last luminous bulges of galaxies should have massive black holes capturing gas clouds coming mostly from stellar explosion, thus producing cosmic jets. They would be located in the centers of partially black galaxies in which *z(r) is maximum*. Thus, such light sources would emit photons with high G redshifts. Then the last luminous regions of galaxies would have *a very weak luminosity compared with that of the original galaxy*.

This is also consistent with the observation of jets in quasar-like objects that are similar to the ones found in the center of ordinary galaxies. Observe that, in the present context, *the last luminous stages of galaxies should correspond with the quasars.*

The rather irregular patches in jets observed much beyond the luminous regions of quasars[35], like the ones in plates IX and X, would prove that such space is crowded with black bodies of the external black galaxy whose center is just the quasar.  This is neatly observed, for example, in the jets of the quasars 3C273 (M87) and 2300-189. The same holds for the irregularities of the radiowave jets emerging from the central luminous bulges of galaxies. This may also hold for the cases of Centaurus A, M84 (Plate VI), and M87.

More detailed tests are described below, in the **Section 9.7.6** and in the **Illustrations**

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[1] The left and the right segments, A and B, correspond to the same angular momentum density.

[2] So far, the current mechanisms proposed for the pulsar emissions are not clear at all. Some of them are just incredible assumptions.

[3] This puts into relief the central regions of more massive and partially dark galaxies may look like elliptical galaxies.

[4] This subject is analyzed in more detail below.

[5] Such explosions may also start as simple jets occurring along the polar regions in which the nucleons are not appreciably deviated by the magnetic fields