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The No-Hair Theorem Parameters can be Reduced to solely the Black Hole's Specific Angular Momentum

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The physicist John Wheeler is told having made a famous remark, "Black holes have no hair." This referred to the postulate that all black hole solutions of the general relativity, better, of the Einstein-Maxwell equations of gravitation, and of electromagnetism, can be completely characterized by only three externally observable classical parameters: mass, electric charge, and angular momentum, when observed from outside its event horizon.

I show here that consequently, Gravitomagnetism is fully compatible with the No-Hair Theorem. Also, I deduce here that for a globally electrically neutral black hole, the No-Hair Theorem can be reduced to the knowledge of its specific angular momentum only, without the need of its gravitational attributes. Finally, I deduce the black hole's angular momentum out of the black holes' observed gravitational properties upon an orbiting object.

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1. The No-Hair Theorem

According to the General Relativity Theory (GR), black holes cannot be observed directly, because light doesn't escape from them. The limit where light stays absorbed by the black hole, and cannot leave it, is called the event horizon. For rotating black holes, the location of the event horizon is dependent from its mass, its electric charge (mostly zero) and its angular momentum. The No-Hair Theorem expresses that, since nothing within the event horizon can be perceived, the properties of the black hole can be considered as limited to the observer, so that the black hole's quantum state isn't of any relevance for the observer outside the event horizon.

The challenge of this paper is to prove that, in the case of an electrically neutral black hole, only the specific angular momentum is required.

2. Compatibility of Gravitomagnetism with the No-Hair Theorem

The Maxwelian Gravitomagnetism is generally considered as the linearized weak field approximation of the GR. In reality, I show in my former papers [1] that the Maxwelian Gravitomagnetism allows to calculate in detail a multitude of cosmic phenomena. The similitude with GR is only accidental, though close.

With Gravitomagnetism, I prove that the same event horizons exist as well, and I differentiate light horizons (="event") and mass horizons (where all mass is annihilated).

Anyway, it is clear that the same No-Hair Theorem is *a priori* valid for Gravitomagnetism.

3. The required knowledge of the Gravitational 'Constant' value

Few scientists nowadays would affirm that the Gravitational Constant is universal. Investigation shows that on Earth, the Constant is only definable up to four or five digits, and even the official reference kilograms are showing measurable differences since they were fabricated.

It is well known that, for instance, red giants have huge dimensions and lose mass very easily. Nevertheless, the global mass remained almost the same (at least the order of magnitude) as before it were a red giant. In other words, red giants have a much lower Gravitational Constant than a regular star like the Sun.

In my earlier papers [2], I found that the Gravitational Constant is defined by the solar dynamics. The equation that relies mass, the gravitational constant, the Sun's mass, radius and rotation frequency is given by:

$$\upsilon_{eq} = \frac{G\, m_{Sun}}{2\, c\, R_{eq}^2} \qquad (1)$$

Herein : $G = 6.67\text{x}10^{-11}\ \text{m}^3\ \text{kg}^{-1}\ \text{s}^{-2}$, $c = 3.00\text{x}10^8\ \text{m s}^{-1}$
and for the Sun: $m_{Sun} = 1.98\text{x}10^{30}$ kg , $R_{eq} = 6.96\text{x}10^8$ m ,
and υ_{eq} is the according solar rotation frequency.

Written in terms of angular velocity, this gives:

$$\omega_{eq} = \frac{\pi G m_{Sun}}{c R_{eq}^2} \tag{2}$$

It is remarkable that such a relationship exists and one could wonder if this isn't just a coincidence. Therefore, I have investigated the relationship more in detail and I came to the determination of the physical meaning of the equation. The gravitational interaction between particles is originated by a Coriolis interaction between a "graviton" (whatever this exactly is) that escapes from a particle, and a second spinning particle: $2\vec{\omega}_2 \times \vec{c}$. The intersection occurs somewhere on the circumference of the second particle, and hence, the average acceleration is in reality $-\vec{a}_{1,2} = (2\vec{\omega}_2 \times \vec{c})/(2\pi)$. By putting the angular velocity of Eq.(2) in this, one obtains the Newtonian gravitational acceleration [2].

I postulated two types of escaping gravitons: the radial ones, which help particles, hit by them, to orbit prograde about the emitting particles, and the orbital gravitons, which cause Newtonian Gravity. The latter type is used in this paper, the former will be analyzed in coming papers.

Further examination gave me the causes of the expanding Earth and the expanding Sun: since the particles with a mass are no scalars, but are oriented by their spin, the Gravitational Constant of spinning objects changes with time [3], tending to put all the orientations of the elementary particles, atoms and molecules more oriented as north-south, like the rotation axis of the rotating body itself. The result is an increasing north-south orientation of particles all over the objects, causing a decreasing overall attraction with time.

I suspect that all possible types of natural forces, including inertia, are explained by this Coriolis interaction [2], being purely mechanical, without any artifice.

Above, I explained how important it is to know the Gravitational Constant, besides the star's mass. I showed that the regular stars and the red giants differ by their Gravitational Constant, but it is of course known that also their dimensions and angular rotation speed differ very much. Wouldn't it be that the equations (1) and (2) are valid for all stars, since these equations represent in fact the Newtonian Gravity equation? I fully support this hypothesis.

With regard to the No-Hair Theorem, the above extra requirement of the 'Variable Gravitational Constant' augments the number of No-Hair parameters. Indeed, since the Gravitational Constant is in reality a variable and not a constant, it must be considered on top of the No-Hair variables, mass, electric charge, and angular momentum.

Don't we then diverge from our target?

4. Eliminating the Gravitational Constant and the mass

The solution of the problem is found by remarking that the 'Variable Gravitational Constant' is always in presence of the mass of the considered object.

Amazingly, the equations (1) and (2) allow me to eliminate a set of fundamental parameters of the No-Hair Theorem.

Rewriting (1) and (2) for black holes as :

$$G_{BH}\, m_{BH} = 2c R_{eq}^2 \upsilon_{eq} = \frac{c\, \omega_{eq} R_{eq}^2}{\pi} \tag{3}$$

allows me to eliminate both the mass and the 'Variable Gravitational Constant' of the star. Equation (3) says that the black hole's specific angular velocity exactly matches the specific gravity, apart from a constant.

Consequently, when one measures the black hole's gravity at a radius outside the event horizon, one can find its specific gravity and immediately its specific angular velocity. By knowing the black hole's spin rate, its radius can be estimated.

But, based upon the Maxwelian Gravitomagnetism, the gravity measurements of black holes cannot be restricted to the Newtonian gravity only. Moreover, the Newtonian gravity likely doesn't exceed the event horizon.

Spinning black holes however got event horizons that disappear near the poles, allowing gravity to escape from there [5].

Maxwelian Gravitomagnetism can indeed be seen as the addition of the Newtonian gravity with a second, magnetic-like component that occurs by the interaction of the spin of the mass with its own gravity [1]. The picture of that magnetic-like component is exactly that of a electromagnet coil of the same shape, with an electric wiring of the same orientation as the rotating paths of the equivalent infinitesimal masses about the central axis.

5. Link between the black hole's measured gravity and its specific angular momentum

It is clear that, since the Newtonian gravity is not detectable outside the event horizon, only the magnetic-like equipotential lines that leave from the poles are detectable. These lines are curving from north to south as with a regular magnet. At the black hole's equatorial plane, these lines are parallel with the spin axis but with an opposite direction.

Notice that the magnetic part of gravitomagnetism only reacts upon masses in motion. Therefore, one should measure the black hole's gravity from object that orbits about it.

In the Appendix, we have calculated the black hole's specific angular velocity based upon an object that is in orbital motion with regard to that isolated black hole. The calculus is not valid for disk galaxies since the galaxies' mass strongly perturbs the precision.

Based upon the distance *r* and the velocity *v* of the orbiting object, the black hole's specific angular momentum is given by:

$$\boxed{\omega_{BH} R_{BH}^2 = r\sqrt{2\pi c\, v/\lambda_{BH}}} \tag{4}$$

Herein, ω_{BH} and R_{BH} are the black hole's angular velocity and the radius, and λ_{BH} its 'shape constant' with regard to the inertial moment (λ = 1 for a ring, λ = 19/16 for a donut with a central hole of dimension zero, and λ = 2/5 for a sphere).

Except for the correction factor of λ , which probably is close to one, the right hand of Eq. (4) measures indirectly the black hole's specific angular momentum, and consequently its specific gravity due to Eq. (3), through an orbiting object. The result is independent from the orbiting object's mass, as expected, because we calculated accelerations, not forces.

Knowing the black hole's mass is not that easy. Only indirectly, by observing the black hole's physical energy losses according to $E = mc^2$ or the path deviations of objects near the black hole's poles, according to $F = ma$, one can separate the mass information from the specific gravity information. Then, the Gravitational Constant can be found as well.

6. Conclusion

By observing an orbiting object about a black hole, outside the event horizon, it is possible to find the black hole's specific angular momentum and its specific gravity. Since both the specific angular momentum and the specific gravity are interchangeable, apart from a constant, see Eq. (3), a fundamental simplification of the required parameters for studying a black hole is possible, despite the fact that the Gravitational Constant is a supplementary variable and a not constant as commonly accepted. The No-Hair Theorem, which expresses these required parameters, can at once be simplified. This results opens interesting perspectives to analyze stars, black holes, and stellar systems. However, it is not directly possible to know the four parameters G, m, ω and R separately out of this study.

References

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Appendix

In an earlier paper [4], I have calculated the influence of the spin of a spherical star upon an orbiting object, due to the magnetic-like field of the Maxwellian Gravitomagnetism. I came to:

$$\frac{v^2}{r} = \frac{Gm}{r^2} + \frac{GmR^2\omega v}{5r^3c^2} \tag{A1}$$

for a circular orbit at a distance r, an orbiting object at speed v, and G, m, ω and R are the properties of the central spherical star. Extending eq.(A1) to any star shape, based upon the above definition of λ, gives:

$$\frac{v^2}{r} = \frac{Gm}{r^2} + \frac{\lambda GmR^2\omega v}{2r^3c^2} \tag{A2}$$

Outside the black hole however, the Newtonian gravity is supposed to not escape, while the magnetic part of gravitation, which is spin-dependent, escapes from the poles and curves like the classical equipotential lines of a magnet.

In the next equation, the first term of the right hand of Eq. (A2) has been removed, the equation simplified, and the specific gravity replaced with the right hand of Eq. (3).

$$\boxed{\omega_{BH}R_{BH}^2 = r\sqrt{2\pi c\, v/\lambda_{BH}}} \tag{A3}$$

This equation expresses that the specific angular velocity of a black hole can be expressed (apart from the shape constant λ_{BH}) to the sole variables v and r (the orbit velocity and the distance) of the orbiting object outside the black hole's event horizon.