Proof of no "Black Hole" Binary in Nova Scorpii

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This paper proves in a simple way, with minimal mathematics, that there is no black hole or close black hole binary system in Nova Scorpii, contrary to the published claims of Schmidt et al. (2002). It also proves that the concept of the black hole violates the physical principles of General Relativity and is therefore invalid.

Brian Schmidt[1] et al. authored the paper "Formation of the Black Hole in Nova Scorpii", *The Astrophysical Journal* **567**: 491-502 (1 Mar 2002) [1].

I remark that all alleged 'black hole solutions' to Einstein's field equations pertain to a universe that contains only one mass, namely, the mass of the alleged black hole itself, by mathematical construction. There are no known solutions to the field equations for two or more masses and there is no existence theorem by which it can even be asserted that the field equations contain latent solutions for two or more masses.

In the model and analysis for the close black hole binary system in Nova Scorpii the authors have inadvertently applied the Principle of Superposition where the Principle of Superposition does not apply. In Newton's theory of gravitation the Principle of Superposition applies and so one can simply pile up masses in space at will, although the gravitational interaction of these masses soon becomes intractable. In Einstein's theory the gravitational field, manifest in the curvature of spacetime, is coupled to its sources by the field equations, the sources being described by an appropriate energy-momentum tensor, and so the Principle of Superposition does not apply. This means that one cannot simply pile up masses in any given spacetime because the field equations must be solved separately for each and every configuration of matter proposed. The proposed model for Nova Scorpii has not done this. For instance, upon what energy-momentum tensor do the authors rely for the black hole close binary system they claim to be present, and hence upon what solution to the field equations do they rely for this binary system? There is in fact no known set of field equations for the black hole binary system model proposed by the authors for Nova Scorpii.

The authors' model begins with a Newtonian universe and ends with a non-Newtonian universe, manifest as an inadvertent blending of two different and incompatible theories, by means of an inappropriate application of the Principle of Superposition; a Newtonian universe containing a non-Newtonian entity (a black hole), which is impossible; or conversely, a Relativistic universe that contains additional masses besides that of the black hole, which is also impossible, as paragraphs two and three above show. Concerning the fact that the Principle of Superposition does not apply in General Relativity, Landau and Lifshitz remark [2]:

> "In a gravitational field, the distribution and motion of the matter producing it cannot at all be assigned arbitrarily --- on the contrary it must be determined (by solving the field equations for given initial conditions) simultaneously with the field produced by the same matter."

Similarly, McMahon [3] also points out that the Principle of Superposition does not apply in General Relativity:

> "An important characteristic of gravity within the framework of general relativity is that the theory is nonlinear. Mathematically, this means that if g_{ab} and γ_{ab} are two solutions of the field equations, then $ag_{ab} + b\gamma_{ab}$ (where a, b are scalars) may not be a solution. This fact manifests itself physically in two ways. First, since a linear combination may not be a solution, we cannot take the overall gravitational field of the two bodies to be the summation of the individual gravitational fields of each body."

Owing to the foregoing one cannot, by an analogy with Newton's gravitational theory, assert that the black hole can exist in multitudes, merge or collide or otherwise interact with one another or other matter, be located at the centres of galaxies, or that a black hole can be a component of a binary system. Thus the model for the close black hole binary system in Nova Scorpii is invalid.

The subject paper does not clearly specify what type of black hole is allegedly formed in Nova Scorpii. The signatures of the simplest black hole, whether or not it is rotating, are an infinitely dense point-mass singularity and an event horizon. Now it is an irrefutable fact that nobody has ever found an infinitely dense point-mass singularity or an event horizon and so nobody has ever assuredly found a black hole. This is not surprising owing to paragraphs two to five above. Additionally, all reports of the black hole being found in multitudes and being located at the centres of galaxies is wishful thinking due to a misapplication of the Principle of Superposition.

According to Einstein his Principle of Equivalence and his Special Relativity must hold in sufficiently small regions of his gravitational field and that these regions can be located anywhere in his gravitational field. Now a simple calculation proves that Special Relativity forbids infinite densities. Thus an infinitely dense point-mass singularity is forbidden by the Theory of Relativity no matter how it is alleged to be formed, and so there can be no black hole present in Einstein's gravitational field. It is worth noting that infinitely dense point-mass singularities occur in Newton's gravitational theory too; they are merely 'centres of masses'. But a centre of mass is not a physical object – it is a mathematical artifice, nothing more. A point is a mathematical entity, not a physical object, whereas a mass is a physical object that has extension, not a mathematical entity without extension,

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i.e. a point. In the case of the black hole the infinitely dense point-mass singularity is claimed to be a real object, which is impossible. Nonetheless, according to Hawking [4],

> "The work that Roger Penrose and I did between 1965 and 1970 showed that, according to general relativity, there must be a singularity of infinite density, within the black hole."

Furthermore, the Principle of Equivalence is defined in terms of the a priori presence of multiple arbitrarily large finite masses and Special Relativity is defined in terms of the a priori presence of multiple arbitrarily large finite masses and photons. According to Einstein [5],

> "Let now K be an inertial system. Masses which are sufficiently far from each other and from other bodies are then, with respect to K, free from acceleration. We shall also refer these masses to a system of co-ordinates K', uniformly accelerated with respect to K. Relatively to K' all the masses have equal and parallel accelerations; with respect to K' they behave just as if a gravitational field were present and K' were unaccelerated. Overlooking for the present the question as to the 'cause' of such a gravitational field, which will occupy us later, there is nothing to prevent our conceiving this gravitational field as real, that is, the conception that K' is 'at rest' and a gravitational field is present we may consider as equivalent to the conception that only K is an 'allowable' system of co-ordinates and no gravitational field is present. The assumption of the complete physical equivalence of the systems of coordinates, K and K', we call the 'principle of equivalence'; this principle is evidently intimately connected with the law of the equality between the inert and the gravitational mass, and signifies an extension of the principle of relativity to co-ordinate systems which are in non-uniform motion relatively to each other. In fact, through this conception we arrive at the unity of the nature of inertia and gravitation. For, according to our way of looking at it, the same masses may appear to be either under the action of inertia alone (with respect to K) or under the combined action of inertia and gravitation (with respect to K')."

> "Stated more exactly, there are finite regions, where, with respect to a suitably chosen space of reference, material particles move freely without acceleration, and in which the laws of special relativity, which have been developed above, hold with remarkable accuracy."

Thus, neither the Principle of Equivalence nor Special Relativity can manifest in a spacetime that by construction contains no matter or a spacetime that allegedly contains only one mass. Hence, the black hole violates the physical foundations of General Relativity because it exists in a universe that contains no other masses. According to the **Dictionary of Geophysics, Astrophysics, and Astronomy** [6],

> "Black holes were first discovered as purely mathematical solutions of Einstein's field equations. This solution, the Schwarzschild black hole, is a nonlinear solution of the Einstein equations of General Relativity. It contains no matter, and exists forever in an asymptotically flat space-time."

The so-called 'Schwarzschild solution' upon which black hole theory mostly relies is in actual fact not Schwarzschild's solution at all, but a corruption of Schwarzschild's solution due to David Hilbert [7]. Schwarzschild's actual solution forbids the black hole. One can easily confirm this by a reading of Schwarzschild's original paper on the subject [8]. In addition, Schwarzschild spacetime is claimed to describe a static empty spacetime because the energy-momentum tensor is set to zero in relation to this spacetime. Owing to the relation between the gravitational field and its sources as explained in paragraph three above, Schwarzschild spacetime must in fact contain no sources! Therefore, the inclusion of a mass in Schwarzschild spacetime is spurious. Indeed, the alleged black hole mass therein is inserted post hoc by placing the square of Newton's expression for escape velocity into Hilbert's solution. Despite the fact that only one mass term is present in Newton's expression for escape velocity, this expression is implicitly a two-body relation: one body escapes from another body. Indeed, one cannot derive Newton's expression for escape velocity without recourse to a Newtonian two-body relation either by means of Newton's expression for gravitational force or by consideration of the classical conservation of energy related to Newton's theory of gravitation. Now it is impossible for an implicit two-body relation to appear in what is alleged to be an expression that describes a universe that contains only one body (but which actually describes a universe that is totally empty by virtue of the removal of all sources at the outset by mathematical construction).

Unfortunately most astronomers and astrophysicists are completely unaware of Schwarzschild's actual paper because it has become buried and all but forgotten in the literature, and the metric which bears his name has thereby become incorrectly associated with him. It is from Hilbert's corruption that the black hole was incorrectly spawned, as pointed out by the late American theoretical physicist Dr. Leonard S. Abrams [9].

Some other interesting and relevant issues arise from the foregoing. Scientists frequently assert that the escape velocity of a black hole is that of light in vacuum and that nothing, not even light, can escape from the black hole. In fact, according to the same scientists, nothing, including light, can even leave the black hole. But there is already a serious problem with these claims. If the escape velocity of a black hole is that of light in vacuum, then light, on the one hand, can escape. On the other hand, light is allegedly not able to even leave the black hole; so the black hole has no escape velocity. If the escape velocity of a black hole is that of light in vacuum, not only can light both leave and escape, material objects can also leave the event horizon, but not escape, because, according to the Theory of Special Relativity, they can only have a velocity less than that of light in vacuum. This just means that if the black hole has an escape velocity then material bodies can in fact leave the black hole and eventually stop and fall back to the black hole, just like a ball thrown into the air here on Earth with an initial velocity less than the escape velocity for the Earth. However, as explained above, there can be no other material bodies present in a black hole universe because the alleged black hole universe contains only the black hole mass, so there are no material bodies present that can leave a black hole or fall into a black hole. It is clearly evident that the concept of black hole escape velocity is meaningless as is the notion that the black hole sucks in external matter. Let us consider further the determination of the Newtonian expression for escape velocity and gravitational potential. As noted above, even though one mass appears in the expression for Newton's escape velocity, it cannot be determined without recourse to a fundamental two-

body gravitational interaction. Newton's theory of gravitation is defined in terms of the interaction of two bodies and the Principle of Superposition. Recall that Newton's Universal Law of Gravitation is

$$F_g = -G\frac{mM}{r^2}, \tag{1}$$

where G is the gravitational constant and r is the distance between the centre of mass of m and the centre of mass of M. The velocity required by a mass m to escape from the gravitational field due to masses M and m is determined by,

$$F_g = -G\frac{mM}{r^2} = ma = m\frac{dv}{dt} = mv\frac{dv}{dr}. \tag{2}$$

Separating variables and integrating gives

$$\int_v^0 mv\, dv = \lim_{r_f \to \infty} \int_R^{r_f} -GmM\frac{dr}{r^2}, \tag{3}$$

whence

$$v = \sqrt{\frac{2GM}{R}}, \tag{4}$$

where R is the radius of the mass M. Thus, escape velocity necessarily involves two bodies: m escapes from M. In terms of the conservation of kinetic and potential energies

$$K_i + P_i = K_f + P_f, \tag{5}$$

whence

$$\frac{1}{2}mv^2 - G\frac{mM}{R} = \frac{1}{2}mv_f^2 - G\frac{mM}{r_f}. \tag{6}$$

Then as $r_f \to \infty, v_f \to 0$, and the escape velocity of m from M is

$$v = \sqrt{\frac{2GM}{R}}. \tag{7}$$

Once again, the relation is derived from a two-body gravitational interaction.

Similarly, Newton's gravitational potential Θ is defined as

$$\Theta = \lim_{\sigma \to \infty} \int_\sigma^r -\frac{F_g}{m} dr = -G\frac{M}{r}, \tag{8}$$

which is the work done per unit mass in the gravitational field due to masses M and m. This is a two-body concept. The potential energy P of a mass m in the gravitational field due to masses M and m is therefore given by

$$P = m\Theta = -G\frac{mM}{r}, \tag{9}$$

which is clearly a two-body concept as well.

It has also become commonplace in the literature, and in textbooks for students, to claim that Newton's theory predicts the existence of a kind of black hole. But the black hole is not predicted by Newton's theory of gravitation either, despite the claims of the astrophysical scientists that the theoretical Michell-Laplace dark body is a kind of black hole. The Michell-Laplace dark body possesses an escape velocity, whereas the black hole

has no escape velocity; it does not require irresistible gravitational collapse to form, whereas the black hole does; it has no infinitely dense point-mass singularity, whereas the black hole does; it has no event horizon, whereas the black hole does; there is always a class of observers that can see the dark body but there is no class of observers that can see the black hole; the Michell-Laplace dark body can persist in a space which contains other Michell-Laplace dark bodies and other masses and interact with one another and other masses, but the spacetime of the black hole is devoid of masses other than that of the alleged black hole itself and so it cannot interact with any other masses. Thus the Michell-Laplace dark body does not possess the signatures of the alleged black hole and so it is not a black hole. A very simple mathematical proof that the Michell-Laplace dark body is not a black hole was given by the British astronomer G. C. McVitte[10].

It is clear from the foregoing that there is in fact no black hole and no close black hole binary system in Nova Scorpii.

Finally, it is proven in [11] that the concept of the black hole is invalid because Einstein's field equations actually violate the usual conservation of energy and momentum and are therefore in conflict with experiment on a deep level, rendering General Relativity itself invalid.

Dedication

I dedicate this paper to my late brother:

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Paul Raymond Crothers
12th May 1968 – 25th December 2008

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