

To Have and Not to Have - the Paradox of Black Hole Mass

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FOREWORD

Cosmologists always claim that their black holes, mathematical fabrications entire as they are, have a finite mass. This mass, they say, is concentrated at their ‘singularity’, where volume is zero, density is infinite, and their spacetime infinitely curved. Their singularity they say is not a mathematical artifice, not a limiting fiction, but a real physical entity which absorbs all other matter that encounters it. In this way cosmologists have even asserted that their black holes can become obese. Their black hole was first conjured from their solution to what Einstein called The Field Equations of Gravitation in the Absence of Matter. Notwithstanding the absence of matter, Einstein claimed that a material source is still present, because his gravitational field is spacetime curvature induced by the presence of a material source. Without matter there is no gravitational field. And what is matter? According to Einstein it is everything except his gravitational field. Now there is only one other form of Einstein’s field equations: The Field Equations of Gravitation in the Presence of Matter. Thus, in both cases, Einstein and his followers claim that a material source is present. However, in a mathematical theory, matter cannot be both present and absent by the very same mathematical constraint. Cosmologists routinely call their contradictions ‘paradoxes’ that defy ‘common sense’. Nonetheless, common sense does in fact know that a contradiction is a contradiction; no less than a rose by any other name is still a rose. Not only does the black hole defy common sense, it defies physics and mathematics.

1. Einstein’s Matter

Einstein’s gravitational field is not matter. According to Einstein [1],

“We make the distinction hereafter between ‘gravitational field’ and ‘matter’ in this way, that we denote everything but the gravitational field as ‘matter’.”

Thus, according to Einstein, not only is mass matter, but so too the electromagnetic fields. But Einstein’s gravitational field is not matter and so it is neither mass nor electromagnetic fields. Nevertheless, cosmologists frequently claim that Einstein’s gravitational field is matter, because it has a mass of its own. For Example, the cosmologist Gerardus ‘t Hooft (Nobel Laureate for Physics) asserts that certain critics of General Relativity,

“suffer from the misconception that a gravitational field cannot have a mass of its own.” [2]

Einstein’s gravitational field having a mass of its own is like the man who thought himself a poached egg.

2. Einstein’s Field Equations in the Presence of Matter

Here they are:

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} + \lambda g_{\mu\nu} = -\kappa T_{\mu\nu}$$

The constant λ did not initially appear in the field equations: Einstein added it later. It is called the ‘cosmological constant’, which is cosmologist-speak for ‘fudge factor’. The term $T_{\mu\nu}$ has the fancy name ‘energy-momentum tensor’, for the material sources that cause

Einstein's gravitational field. The left side of the expression describes the geometry of Einstein's spacetime and hence the curvature of spacetime, i.e. Einstein's gravitational field. Matter on the right side induces the geometry on the left side.

3. Einstein's Field Equations in the Absence of Matter

Since $T_{\mu\nu}$ is the matter term in Einstein's field equations, setting $T_{\mu\nu} = 0$ removes all matter from them. If $\lambda = 0$ as well, Einstein and his followers claim that his field equations then reduce to,

$$R_{\mu\nu} = 0$$

which they all say describes his gravitational field outside a body such as a star. However, the words 'outside a body such as a star' immediately reinstates the material source that was initially removed mathematically by setting $T_{\mu\nu} = 0$. Einstein's argument is a vicious circle and therefore invalid.

That $R_{\mu\nu} = 0$ contains no matter is easily reaffirmed by $T_{\mu\nu} = 0$ and $\lambda \neq 0$. In this case Einstein's field equations reduce to,

$$R_{\mu\nu} = \lambda g_{\mu\nu}$$

the solution to which is de Sitter's empty universe; which is empty because it contains no matter, on account of $T_{\mu\nu} = 0$.

"This is not a model of relativistic cosmology because it is devoid of matter." [3]

"the de Sitter line element corresponds to a model which must strictly be taken as completely empty." [4]

"the solution for an entirely empty world." [5]

"there is no matter at all!" [6]

Hence, in both cases, $T_{\mu\nu} = 0$. Thus, according to the cosmologists, matter is both present and absent by the very same mathematical constraint: $T_{\mu\nu} = 0$. This is impossible. Consequently, $R_{\mu\nu} = 0$ contains no matter for the very same reason de Sitter's universe contains no matter, and so $R_{\mu\nu} = 0$ cannot produce a black hole. Being a space that excludes matter $R_{\mu\nu} = 0$ has no physical meaning.

4. The Black Hole 'Solution'

It is from the solution to $R_{\mu\nu} = 0$ that the black hole was first conjured. Although it is physically meaningless, what is the solution to $R_{\mu\nu} = 0$? It is none other than the so-called 'Schwarzschild solution' [2, 7], which, according to Einstein [8] is,

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$$ds^2 = \left(1 - \frac{A}{r}\right) dt^2 - \left[\frac{dr^2}{1 - \frac{A}{r}} + r^2 (\sin^2 \theta d\phi^2 + d\theta^2) \right]$$

(109a)

$$A = \frac{\kappa M}{4\pi}$$

M denotes the sun's mass centrally symmetrically placed about the origin of co-ordinates; the solution (109a) is valid only outside this mass, where all the $T_{\mu\nu}$ vanish."

The mass M Einstein refers to was introduced *post hoc* by he and his followers in order to satisfy the false assertion that $R_{\mu\nu} = 0$ describes his gravitational field 'outside a body such as a star'. The Sun is a star. Moreover, the mass M was inserted by means of Newton's expression for escape speed [9],

$$v = \sqrt{\frac{2GM}{r}}$$

This is easily recognised by setting Einstein's constant κ to,

$$\kappa = \frac{8\pi G}{c^2}$$

so that Einstein's A becomes,

$$A = \frac{2GM}{c^2}$$

Then when $r = A$ in Einstein's equations (109a),

$$r = \frac{2GM}{c^2}$$

This is the so-called 'Schwarzschild radius' of the black hole, fancifully squeezed out of equations (109a) by the cosmologists. Solving this equation for c gives,

$$c = \sqrt{\frac{2GM}{r}}$$

which is just Newton's expression for escape speed, with $v = c$, the speed of light. According to the cosmologists, c is the escape speed at the event horizon of their black hole. However, this is also false, because their black holes possess the schizophrenic properties of having and not having an escape speed simultaneously at the same place (their event horizon), which is impossible [9]. Furthermore, Newton's expression for escape speed is an implicit two-body relation: one body escapes from another: and so it cannot rightly appear in what is supposed to be a solution for a universe that contains only one mass [9, 10]. But since $R_{\mu\nu} = 0$ contains no matter the black hole is fallacious.

5. The Lesson Learned

Contrary to the claims of Einstein and the cosmologists, matter cannot be both

present and absent by the very same mathematical constraint. The 'Schwarzschild solution', from which the black hole was first conjured, contains no matter for the very same reason de Sitter's empty universe contains no matter. Consequently the black hole is a phantasm. Instead of relying upon the word of cosmologists, it is better to think about their word. The word of an Authority is no substitute for rational thought, which physics has now lost.

Note: This article is the fifth in a series [7, 9-11].

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