

# Simple proof that black holes have no basis in General Relativity

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## ABSTRACT

The black hole is allegedly predicted by Einstein's General Theory of Relativity. However, by comparison of the Einstein field equations for Schwarzschild spacetime and de Sitter spacetime it is plainly evident that matter is allegedly present and absent by the very same mathematical constraint:  $T_{\mu\nu} = 0$ . Since this is impossible, and since de Sitter's empty universe contains no matter by virtue of  $T_{\mu\nu} = 0$ , Schwarzschild spacetime also contains no matter. Consequently, the black hole has no basis in General Relativity

I shall now prove, without any complicated mathematics, that General Relativity does not predict black holes, by proving that the 'Schwarzschild solution' is physically meaningless. All other types of alleged black hole rely on the 'Schwarzschild' black hole because they all subsume it, and are therefore also invalid.

First and foremost, Einstein's field equations,

*"couple the gravitational field (contained in the curvature of spacetime) with its sources."* (Foster and Nightingale 1995)

This means that there is a causal connexion between the material sources of Einstein's gravitational field and his spacetime curvature (spacetime geometry). Let's take a quick look at Einstein's field equations without the so-called *cosmological constant*, thus,

$$G_{\mu\nu} = -kT_{\mu\nu}$$

This is an intimidating and uninformative expression. We shall therefore reduce it to simple words, thus,

$$\textit{Einstein tensor} = -k (\textit{energy-momentum tensor})$$

So the  $G_{\mu\nu}$  thing on the left side of Einstein's field equations is called the *Einstein tensor* and the  $T_{\mu\nu}$  thing on the right side is called the *energy-momentum tensor*. The symbol  $k$  is just a coupling constant. This identifies the parts of Einstein's field equations, but doesn't convey any meaning, so we will write them more informatively as,

$$\textit{spacetime geometry} = -k (\textit{material sources})$$

According to Einstein if there are no material sources present (*material sources* = 0) his field equations reduce to,

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

So the  $R_{\mu\nu}$  thing on the left side of this set of equations is called the *Ricci tensor* (*Ric* for short). This identifies the parts of Einstein's field equations, but doesn't convey any meaning, so we will write them more informatively as,

$$spacetime\ geometry = 0$$

There are no material sources present in this expression. Einstein (1916) said that this expression describes “*the field equations of gravitation in the absence of matter*”. That's true, because *material sources* = 0 by mathematical construction. *Ric* = 0 contains no matter. Einstein first mathematically removes all material sources from his field equations by setting *material sources* = 0 (i.e. *energy-momentum tensor* = 0), and then, in his very next breath, linguistically reinstates the presence of a material source by saying that *spacetime geometry* = 0 describes his gravitational field “*outside*” a body such as a star. Let's recall what Einstein said about the ‘Schwarzschild solution’ for *Ric* = 0:

“*M denotes the sun's mass, centrally symmetrically placed about the origin of co-ordinates; the solution (109a) is valid only outside of this mass, where all the  $T_{\mu\nu}$  vanish.*” (Einstein 1967)

Einstein's argument for *Ric* = 0 is contradictory and therefore invalid.

We can easily reaffirm the absence of material sources in *Ric* = 0 (where *material sources* = 0) by considering Einstein's field equations “*in the absence of matter*” with inclusion of the so-called *cosmological constant*. The *cosmological constant* is represented by the Greek letter  $\lambda$ . In this case Einstein's field equations are,

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

Once again we have before us an intimidating and uninformative mathematical expression. We shall again reduce this to simple words, thus,

$$Ricci\ tensor = \lambda(metric\ tensor)$$

So the  $g_{\mu\nu}$  thing on the right side is the *metric tensor*. The cosmological constant  $\lambda$  is just a constant. This identifies the parts of Einstein's field equations, but doesn't convey any meaning, so we will write them more informatively as,

$$spacetime\ geometry = \lambda(metric\ tensor)$$

Note that there are no material sources in this expression either because there is no energy-momentum tensor; in other words *energy-momentum tensor* = 0 because *material sources* = 0. The  $\lambda(metric\ tensor)$  term is not a material source - it is not an *energy-momentum tensor*. The solution to this set of field equations is called de Sitter's empty universe. Now,

*“the de Sitter line element corresponds to a model which must strictly be taken as completely empty.”* (Tolman 1987)

Eddington (2007) reaffirms that de Sitter’s solution is,

*“the solution for an entirely empty world.”*

d’Inverno (1992) remarks on de Sitter’s universe that,

*“This is not a model of relativistic cosmology because it is devoid of matter.”*

Weinberg (1972) also tells us that in the de Sitter model,

*“there is no matter at all!”*

The reason why de Sitter’s empty universe contains no matter is because in the field equations for which it is the solution, *material sources* = 0; in other words, precisely because *energy-momentum tensor* = 0.

We can now reaffirm why Einstein’s alleged field equations  $Ric = 0$  for “outside” a body such as a star are false. In the case of *spacetime geometry* = 0 the *energy-momentum tensor* = 0 because *material sources* = 0 there, yet Einstein still claimed that a massive source such as a star is present in  $Ric = 0$ , and according to his followers this star can ‘collapse’ to form a black hole. However, in the case of de Sitter’s empty universe, *energy-momentum tensor* = 0 because *material sources* = 0 there too. Thus, *energy-momentum tensor* = 0 is alleged to both include a material source and to preclude all material sources. That’s impossible! It’s a contradiction. Since *material sources* = 0 in both the equations  $Ric = 0$  and  $Ric = \lambda(\text{metric tensor})$  the *energy-momentum tensor* = 0 in both equations, so there are no material sources in either set of equations. Thus,  $Ric = 0$  does not contain a star or a black hole. It contains no matter by mathematical construction for the very same reason de Sitter’s empty universe contains no matter by mathematical construction. But it is from Hilbert’s solution (so-called ‘Schwarzschild solution’) for  $Ric = 0$  that the black hole was first spawned. So the black hole is a fantasy. It is not even predicted by General Relativity because  $Ric = 0$  contains no matter by mathematical construction. Newton’s theory certainly does not predict the black hole either because the theoretical Michell-Laplace dark body does not possess the alleged properties of the black hole.

## REFERENCES

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