

BLACK HOLES IN LIGHT OF NEW FIELD THEORY

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ABSTRACT. In this short paper I will present new calculations of black holes that could solve many problems in modern cosmology.

CONTENTS

1. EEFE- Extended Einstein field equations	3
1.1. Non rotating black holes	4
References	5

1. EEFE- EXTENDED EINSTEIN FIELD EQUATIONS

Matter will extend as a field in whole space, that could explain why there is missing matter in the universe, it's stored in field itself. But where to start? That is key question, let first write EFE but expand all elements to curvature tensor:

$$R_{bcd}^c - \frac{1}{2}R_{ncm}^c g^{nm} g_{bd} = \kappa T_{bd} \quad (1.1)$$

Where I did use bd index as base one. Now we can see a reaping pattern here, there is curvature tensor then it's contractions. Only thing that does not follow this rule is energy momentum tensor that does not have any contractions. What if this symmetry of contraction is preserve so let me rewrite this equation:

$$R_{bcd}^c - \frac{1}{2}R_{ncm}^c g^{nm} g_{bd} = \kappa T_{bcd}^c \quad (1.2)$$

Now there is a clear pattern, in truth we are acting on four rank tensors in whole equation. On one side of equation there is curvature tensor and it's contractions that are a bit complex on left side there is some unknown tensor that reduces to energy momentum tensor by contraction. So EFE are not a final word as it can be seen we can calculate curvature tensor directly by using one metric tensor that will contraction cancel one contraction, and this will lead to:

$$g^{kc} R_{bcd}^c - \frac{1}{2}g^{kc} R_{ncm}^c g^{nm} g_{bd} = \kappa g^{kc} T_{bcd}^c \quad (1.3)$$

$$R_{bkd}^c - \frac{1}{2}R_{nkm}^c g^{nm} g_{bd} = \kappa T_{bkd}^c \quad (1.4)$$

$$R_{bkd}^c - \frac{1}{2}R_k^c g_{bd} = \kappa T_{bkd}^c \quad (1.5)$$

$$g_{pc} R_{bkd}^c - \frac{1}{2}g_{pc} R_k^c g_{bd} = g_{pc} \kappa T_{bkd}^c \quad (1.6)$$

$$R_{pbkd} - \frac{1}{2}R_{pk} g_{bd} = \kappa T_{pbkd} \quad (1.7)$$

EEFE can be written in two forms as seen here mixed and fully covariant, I will use fully covariant one for all calculations presented here but they are both equal from fact it's a tensor equation.

1.1. Non rotating black holes. Simplest case of black holes are static non rotating ones. I will start by solving field equation in simplest case, that is only diagonal elements of Ricci tensor and Energy momentum tensor for perfect fluid. I will write all calculations in one line then will discuss them:

$$R_{\alpha\alpha} = -2\kappa T_{\alpha\alpha} \quad (1.8)$$

$$g^{\alpha\alpha} R_{\alpha\alpha} = -2\kappa g^{\alpha\alpha} T_{\alpha\alpha} \quad (1.9)$$

$$R = -2\kappa T \quad (1.10)$$

$$R = -2\kappa\rho_0\pi^2 \left(1 + \frac{2GM}{rc^2}\right) \quad (1.11)$$

$$\lim_{r \rightarrow 0^\pm} -2\kappa\rho_0\pi^2 \left(1 + \frac{2GM}{rc^2}\right) = \pm\infty \quad (1.12)$$

$$R(0^+) = +\infty \quad (1.13)$$

$$R(0^-) = -\infty \quad (1.14)$$

$$R(0^+) + R(0^-) = 0 \quad (1.15)$$

From equation follows that there is no singularity at $r = 0$ as one side there is plus infinity on another side there is minus infinity so they cancel out. It means that black holes connect two possible universes in one point of spacetime from each universe perspective all spacetime stays in one universe till singularity point where those two connect. It shows clear that EEFE are singularity free. Compared to EFE that generated a point that can't be removed and where all geodesic end. Here central point is where all geodesic connect. It means that this point represents a flow of all information from two connected universes. And non moving observer can stay in that point for any amount of proper time measured by its clock. From point of view of any other observer that is not at that point, that observer is both in all possible future and in all possible past. If observer inside does move it will go to any possible location in time, where that location itself is random and cant be determined as all spacetime paths are solutions. This can be written as:

$$R(\mathbf{x}^+) + R(\mathbf{x}^-) = 0 \quad (1.16)$$

It means that black holes act as a bridge between two spacetimes. That bridge has only one point where it can be seen. But when getting out of that point all points of spacetime act as solution afterwards observer is split to one universe that means that it can have positive or negative value in frame of reference of singularity but in its frame it's just:

$$R(\mathbf{x}) + R(\mathbf{x}) = 2R(\mathbf{x}) \quad (1.17)$$

It means that I can re-write field equation :

$$2R = -2\kappa T \quad (1.18)$$

$$R = -\kappa T \quad (1.19)$$

That is correct result seen in previous work [1].

REFERENCES

- [1] <https://vixra.org/abs/2309.0054>

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