# 1) Notes 120(1): Criticisms of Black Hole Theory.

Black Hole theory is based entirely on the metric:

$$ds^2 = -\left(1 - \frac{2GM}{rc^2}\right)c^2 dt^2 + \left(1 - \frac{2GM}{rc^2}\right)^{-1} dr^2 + r^2 d\Omega^2 \quad -(1)$$

where $M$ is the mass of the gravitating object, $G$ is Newton's constant, $c$ is the vacuum speed of light and $r$ is the distance between $M$ and an object of mass $m$. Eq. (1) is obtained by assuming that:

$$G_{\mu\nu} = 0 \quad -(2)$$

where:

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu}. \quad -(3)$$

Here $G_{\mu\nu}$ is the Einstein tensor, $R_{\mu\nu}$ is the Ricci tensor, $R$ is the Ricci scalar, and $g_{\mu\nu}$ the symmetric metric. Eq. (2) implies that:

$$T_{\mu\nu} = 0 \quad -(4)$$

because the Einstein field equation is:

$$G_{\mu\nu} = k T_{\mu\nu}. \quad -(5)$$

Here $T_{\mu\nu}$ is the canonical energy-momentum density tensor and $k$ is Einstein's constant. Eq. (4) implies:

$$M = 0, \quad -(6)$$

while eq. (1) implies:

$$M \neq 0. \quad -(7)$$

2) Therefore eq. (1) cannot be a solution of eq. (5). It follows that black hole theory cannot be physically meaningful.

The root cause of this contradiction is that the true geometrical solution of eq. (2) is a purely geometrical solution of a purely geometrical problem. Carroll for example suggests a solution of the type:

$$ds^2 = -\left(1+\frac{\mu}{r}\right)c^2dt^2 + \left(1+\frac{\mu}{r}\right)^{-1}dr^2 + r^2 d\Omega^2. \quad -(8)$$

He then proceeds to take the weak field limit as:

$$r \rightarrow \infty \quad -(9)$$

when

$$\mu / r \ll 1, \quad -(10)$$

so

$$g_{00} \rightarrow -\left(1+\frac{\mu}{r}\right) \quad -(11)$$

$$g_{11} \rightarrow \left(1-\frac{\mu}{r}\right). \quad -(12)$$

This is as far as the geometry goes. It is then assumed incorrectly that:

$$g_{00} = -\left(1+2\Phi\right) \quad -(13)$$

$$g_{11} = \left(1-2\Phi\right) \quad -(14)$$

where

$$\Phi = -\frac{GM}{c^2 r}. \quad -(15)$$

The logical error is that eqs. (11) and (12) are solutions of eq. (3), in which $m = 0$, but it is then assumed that for these <u>same</u> solutions, $m \neq 0$.

K. Schwarzschild did not make this error in 1916, and mass does not appear in the 1916 paper. Many eminent scientists have pointed out that the singularities in the metric (1) have <u>no physical meaning</u>. These include Einstein himself. Additionally, it is now known that the Einstein field equation is geometrically incorrect because of its neglect of torsion. <u>These arguments are alone sufficient to reject black hole theory</u>.

Additionally, Crothers has pointed out that that Minkowski spacetime should be generalized to:

$$ds^2 = c^2 dt^2 - dr^2 - |r - r_0|^2 d\Omega^2, \quad -(16)$$

$$0 \leq |r - r_0| < \infty .$$

The most general metric that satisfies eq. (2) is:

$$ds^2 = A\left(C^{1/2}\right)c^2 dt^2 - B\left(C^{1/2}\right)d\left(C^{1/2}\right)^2 - C\, d\Omega^2 \quad -(17)$$

where

$$R_c = C^{1/2} \quad -(18)$$

is the radius of curvature. Here:

$$C(r) = C\left(|r - r_0|\right) \quad -(19)$$

Eqs. (2) and (17) give:

4)

$$ds^2 = \left(1-\frac{\alpha}{C^{1/2}}\right)c^2dt^2 - \left(1-\frac{\alpha}{C^{1/2}}\right)^{-1} d\left(C^{1/2}\right)^2 - C\,d\Omega^2 \quad -(20)$$

where:

$$C^{1/2} = R_c = \left(|r-r_0|^n + \alpha^n\right)^{1/n}, \quad -(21)$$

$$r \neq r_0. \quad -(22)$$

This metric (20) has no singularity. The radius of curvature cannot become zero, meaning that there is no black hole, a fundamental geometrical result. The original Schwarzschild solution of 1916 is:

$$n = 3, \quad r_0 = 0, \quad r > r_0 \quad -(23)$$

which is well defined on:

$$0 < r < \infty. \quad -(24)$$

In 1923, Eddington proved that eq. (2) has an infinite number of solutions, the simplest of which is Brillouin's solution:

$$n = 1, \quad r_0 = 0, \quad r > r_0 \quad -(25)$$

and

$$0 < r < \infty. \quad -(26)$$

Crothers has also pointed out that there is a distinction between $R_c$ and the geodesic proper radius $R_p$ in the general spherically symmetric spacetime.

For eq. (26):

$$R_c(r_0) = \alpha, \quad R_p(r_0) = 0 \quad -(27)$$

Therefore there are several ~~major~~ major criticism of the basic line element habitually used in black hole theory. The most fundamental one is that the Einstein field equation itself is geometrically incorrect. Any line element based on a symmetric connection is incorrect.

The standard black hole theory attempts to remedy this situation by arbitrary and meaningless "coordinate transformations", but it is now known that these procedures again violate the dual identity. Recently, Crothers has pointed out that:

$$\exp(2\alpha) = 1 - \frac{2GM}{rc^2} \quad -(28)$$

so the right hand side cannot be negative, as used in the obsolete and incorrect theory of black holes.

Conclusion

Black hole theory is incorrect and meaningless.

Note 120(2): Some Metrics for Evaluation by Computer.

These metrics form a large part of contemporary physics research but all violate the dual identity of geometry, so are useless for relativity theory. Some have already been analysed in papers 93, 95 and 117. This is a selection of metrics which are incorrect geometrically, but have a TV!

1) Wormhole Metric

$$ds^2 = -c^2 dt^2 + dl^2 + (k^2 + l^2) d\Omega^2 \quad -(1)$$

2) Wormhole with Varying Cosmological Constant

$$ds^2 = -e^{\gamma} dt^2 + e^{\mu} dr^2 + r^2 d\Omega^2 \quad -(2)$$

where:

$$e^{-\mu} = 1 - \frac{b(r)}{r} \quad -(3)$$

and $\gamma(r)/2$ is the redshift function, $b(r)$ being a shape function.

(F. Rahaman et al., gr-qc/0611133v1 (2006)).

3) Morris Thorne Wormhole

$$ds^2 = \left(1 - \frac{2m}{r}\right)\left(\frac{dr}{2\lambda r}\right)^2 - \left(1 - \frac{2m}{r}\right) dt^2 \quad -(4)$$

(S. A. Hayward, S.-W. Kim and H. Lee, J. Korean Phys. Soc., 42, 31 (2003)). They also give:

$$ds^2 = 2\left(1 - \frac{a}{r}\right)^{-1}\left(\frac{dr}{4\lambda r}\right)^2 - \frac{2}{r} dt^2 \quad -(5)$$

2)

4) Flat wormholes from Straight Cosmic Strings.

$$ds^2 = dt^2 - d\sigma^2 - dz^2 \quad -(6)$$

where:

$$d\sigma^2 = \prod_i |\zeta - a_i|^{-8Gm_i} d\zeta d\zeta^*,$$

$$\zeta = x + iy,$$

$$d\sigma^2 = du^2 + dv^2.$$

The bicone is defined by:

$$m_1 = m_2 = \frac{1}{8G},$$

$$d\sigma^2 = \frac{d\zeta d\zeta^*}{|\zeta^2 - b^2|}.$$

In this context the Einstein Rosen wormhole is a cylinder with two circles at infinity. The metric for a flat spacetime with n wormholes and 2p ordinary cosmic strings is:

$$d\sigma^2 = \prod_{i=1}^{p} \frac{|\zeta - c_i|^{-8Gm_i} d\zeta d\zeta^*}{|\zeta_n^2 - b^{2n}|} \quad -(7)$$

$$\zeta_n = \prod_{j=1}^{n} (\zeta - a_j)$$

(G. Clément, gr-qc/9607008v1 (1996)).

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5) Wheeler Misner Wormhole

This is generated by two cosmic strings:

$$n = p = 2,$$

with negative mass tension:

$$m_1 = m_2 = -\frac{1}{4G},$$

and is the one sheeted extension of:

$$d\sigma^2 = \frac{|\zeta^2 - c^2|^2}{|(\zeta^2 - a^2)^2 + b^4|} d\zeta\, d\zeta^*$$

6) Einstein Rosen Bridge (Phys Rev 48, 73 (1935))

$$ds^2 = \left(1 - \frac{2m}{r} - \frac{\epsilon^2}{2r^2}\right) dt^2 - \left(1 - \frac{2m}{r} - \frac{\epsilon^2}{2r^2}\right)^{-1} dr^2 - r^2 d\Omega^2 \quad — (8)$$

7) Massless ER Bridge

(K.K. Nandi and D. H. Xu, "Unified Model for the ER Charge: Squashing Wormhole?" (gr-qc / 0410052v2 (2004)).)

This metric is given by:

4)

$$ds^2 = a\,dt^2 - b\,(dr^2 + r^2 d\Omega^2), \quad -(9)$$

$$a = \left(1 - \frac{m^2+\beta^2}{4r^2}\right)^2 \left(1 + \frac{m}{r} + \frac{m^2+\beta^2}{4r^2}\right)^{-2},$$

$$b = \left(1 + \frac{m}{r} + \frac{m^2+\beta^2}{4r^2}\right).$$

8) General Morris Thorne Wormhole

$$ds^2 = \exp(2\phi(r))\,dt^2 - \frac{dr^2}{1-b(r)/r} - r^2 d\Omega^2$$

$$-(10)$$

9) Einstein Metric of 1936

$$ds^2 = \frac{\rho^2}{2m+\rho^2}\,dt^2 - 4(2m+\rho^2)(d\rho^2) \quad -(11)$$

$$-(2m+\rho^2)^2\,d\Omega^2,$$

where $\rho^2 = r - 2m$

10) Bekenstein Hawking Radiation Metric

$$ds^2 = -\frac{u^2}{4m^2}\,dt^2 + du^2 + dX^2, \quad -(12)$$

$$r = 2m + \frac{u^2}{2m}$$

5)

11) Eddington Finkelstein Metric

$$ds^2 = \left(1 - \frac{2m}{r}\right) dv^2 - 2\,dv\,dr - r^2 d\Omega^2 \qquad -(13)$$

where: $v = t + r + 2m \log_e \left(\frac{r}{2m} - 1\right)$.

12) Kruskal Metric

(http://io.uwinnipeg.ca/~vincent/4500.6-001/Cosmology/Black_Holes.htm)

$$ds^2 = -\left(\frac{32m^3}{r}\right) e^{-r/(2m)} \left(du^2 - dv^2\right). \qquad -(14)$$

$$u = \left(\frac{r}{2m} - 1\right)^{1/2} \exp\left(\frac{r}{4m}\right) \cosh\left(\frac{t}{4m}\right) \qquad -(15)$$

$$v = \left(\frac{r}{2m} - 1\right)^{1/2} \exp\left(\frac{r}{4m}\right) \sinh\left(\frac{t}{4m}\right) \qquad -(16)$$

13) General Spherically Symmetric

$$ds^2 = A\,dt^2 - 2B\,dt\,dr - C\,dr^2 - D\,d\Omega^2 \qquad -(17)$$

14) Particular Spherically Symmetric

$$ds^2 = e^{\alpha} dt^2 - e^{\beta} dr^2 - r^2 d\Omega^2 \qquad -(18)$$

6) Typical SuperSymmetry Metric

$$ds_{D1}^2 = h(r)^{-1/2}\left(-dt^2 + dx^{1\,2}\right), \quad -(19)$$
$$+ h(r)^{1/2}\left(dr^2 + r^2 d\Omega^2_{8-p}\right)$$
$$h(r) = 1 + \left(\frac{r_p}{r}\right)^6$$

This is a solitonic D1 brane, Poincaré invariant in 1 + 1 dimensions and isotropic in eight transverse dimensions.

(M. Majumdar, hep-th / 0512062v2 (2006)).

All these metrics violate the dual identity:

$$D_\mu T^{\kappa\mu\nu} = R_\mu{}^{\kappa\mu\nu} \quad -(20)$$

because they produce:

$$T^{\kappa\mu\nu} = 0, \quad R_\mu{}^{\kappa\mu\nu} \neq 0 \quad -(21)$$

through use of a symmetric connection (Ricci and Levi-Civita (1900)).

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130(3): Some Incorrect Metrics of the Obsolete Physics

Some commonly used gravitational metrics were evaluated with the dual identity of geometry:

$$D_\mu \tilde{T}^{\kappa\mu\nu} = \tilde{R}_\mu{}^{\kappa\mu\nu} \quad (1)$$

using computer algebra. In each case, the connection was symmetric so:

$$T^\kappa{}_{\mu\nu} = \Gamma^\kappa{}_{\mu\nu} - \Gamma^\kappa{}_{\nu\mu} = 0 \quad (2)$$

It was found by computer simulation that the dual identity (1) is not fulfilled in general by spherically symmetric metrics. Therefore we arrive at the basic theorem that the connection in general relativity must be asymmetric. The Einstein field equation is based on the use of a symmetric metric in the second Bianchi identity, so all solutions of it are physically meaningless. These include the Friedman Lemaitre Robertson Walker (FLRW) metric of Big Bang theory and all metrics of black hole theory. The latter is based on a coordinate transformation. It was found that the Eddington Finkelstein transformation merely deals with the case:

$$R_{\mu\nu} = 0 \quad (3)$$

so that it contains no physics. The Einstein field equation is:

2)

$$G_{\mu\nu} = k T_{\mu\nu} \quad - (4)$$

$$= R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu}$$

So if eq. (3) holds, eq. (4) means

$$T_{\mu\nu} = 0 \quad - (5)$$

and that there is no energy momentum density anywhere in the universe. This kind of vacuum metric is therefore meaningless in physics, because it deals only with a vacuum defined as having no energy density and no momentum density. It was also found that the Kruskal transformation is mathematically incorrect. Although it is based on the vacuum condition (3), the transformation results in a non-zero Einstein tensor, and also a violation of the dual identity (1). This is a disaster for gravitational physics and for twentieth century black hole theory. A change of coordinates must leave $T_{\mu\nu}$ unchanged, but the Kruskal transformation is based on an initially zero $T_{\mu\nu}$, and ends with a non-zero $T_{\mu\nu}$. Therefore conventional black hole theory is complete nonsense.

The Einstein Rosen bridge is in the same class of merely transforming a vacuum metric of the type of eq. (3). The Einstein Rosen

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bridge contains no physics. Similarly, cosmic strings are merely vacuum metrics of type (3) and again contain no physics.

There exists no Hawking radiation in nature, because the metric that describes it again violates the dual identity.

Some metrics that were tested are complete nonsense, for example Hayward Kim Lee wormholes do not even fulfil metric compatibility. This is also true of the general wormhole metric given in this paper.

Finally, the so called Schwarzschild metric is also based on eq. (3), so a such cannot contain mass $M$ in its solution. The orbital metric of paper 111 has replaced the Schwarzschild metric, and in dealing with the orbits of galaxies, the ECE field equations provide a first description.



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