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Criticisms of Black Hole Theory

by

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Abstract

The claims to existence of black holes in nature are refuted in several ways, and several fundamental errors of the theory are pointed out. The most basic error is that the Einstein field equation violates the Cartan/Evans dual identity of geometry, as shown in previous papers of this series. Several commonly used metrics of black hole theory are shown by computer algebra to violate basic geometry (the Cartan/Evans dual identity). These include the Kruskal metric and the metric used to claim the existence of Hawking radiation. The class of vacuum solutions refer only to a Ricci flat spacetime in which there is no energy momentum density and no physics. The so called Schwarzschild metric of black hole theory is incorrectly attributed to him and the conventional theory of singularities in this metric is fundamentally incorrect, as shown independently in this paper by Dunning-Davies and Crothers. The most fundamental error in black hole theory is the arbitrary neglect of space-time torsion. In the ECE equations of motion, the torsion is correctly re-instated, and plays a fundamental role in physics on all scales.

Keywords: criticism of black holes, torsion, ECE theory.

27.1 Introduction

The Einstein field equation is the archetypical construct of twentieth century physics, and general relativity is the best known idea of twentieth century science and thought in general. This was the great paradigm change in natural philosophy which gradually manifested itself in the years from 1887 (Michelson Morley experiment) to 1915 (when Einstein and Hilbert arrived at the famous field equation using different methods). This was the evolution of the theory of relativity, an attempt to describe nature objectively. The fundamental idea behind general relativity is that the laws or equations of physics must be generally covariant. This means that their tensor structure is governed by coordinate transformation in geometry. Therefore physics becomes geometry. It is of great importance to use the right geometry, and it has always been assumed that relativity has been based on the right geometry. In a series of papers [1–12] this claim has been refuted, the geometry used in 1915 omits spacetime torsion, and this leads to a violation of a development of the Cartan identity of 1922 [12] in which torsion is ineluctably linked to curvature. This became clear by using the Hodge transform in four dimensions to give the Cartan/Evans dual identity [1–12]. In tensor format this is:

$$D_\mu T^{\kappa\mu\nu} = R^{\kappa}{}_{\mu}{}^{\mu\nu} \tag{27.1}$$

where $T^{\kappa\mu\nu}$ is the torsion tensor and $R^{\kappa}{}_{\mu}{}^{\mu\nu}$ is the curvature tensor. Here D_μ denotes the covariant derivative. The torsion and curvature tensors are defined in Riemann geometry through the action of the commutator of covariant derivatives [1–12] on any tensor. It is incorrect to assert that the torsion tensor is zero. The torsion tensor is defined by:

$$T^{\kappa}_{\mu\nu} = \Gamma^{\kappa}_{\mu\nu} - \Gamma^{\kappa}_{\nu\mu} \tag{27.2}$$

where $\Gamma^{\kappa}_{\mu\nu}$ is the connection, and in general the torsion is not zero. In 1900, at the dawn of tensor theory and the twentieth century, Ricci and Levi-Civita [13] introduced the symmetric connection:

$$\Gamma^{\kappa}_{\mu\nu} = \Gamma^{\kappa}_{\nu\mu} \tag{27.3}$$

for which the torsion tensor is made zero in an arbitrary way, merely an assumption used apparently to simplify the calculations in 1900. The symmetric connection is commonly called the Christoffel, Levi-Civita, or Riemann connection, but was not introduced by Riemann or Christoffel. It was introduced by Ricci and Levi-Civita in 1900. Thereafter it was used uncritically by Einstein, who was not aware of the existence of torsion in 1915, and who based his field equation on a Bianchi identity without torsion. This is the so called "second Bianchi identity" in standard physics [14], now thoroughly obsolete. Einstein made this torsion-less identity proportional to the covariant Noether Theorem through k, the Einstein constant.

The fundamental importance of torsion was not realized clearly until about 1922, when Cartan developed his two structure equations in his elegant differential geometry. The first structure equation defines the torsion differential form (T^a) as the covariant derivative of the Cartan tetrad differential form (q^a), using the spin connection $\omega^a{}_b$ of Cartan:

$$T^a = d \wedge q^a + \omega^a{}_b \wedge q^b \tag{27.4}$$

where $\wedge$ denotes the wedge product [1–12]. The second Cartan structure equation defines the curvature differential form of Cartan ($R^a{}_b$) in terms of the spin connection:

$$R^a{}_b = d \wedge \omega^a{}_b + \omega^a{}_c \wedge \omega^a{}_b. \tag{27.5}$$

The spin connection and Riemann connection are related by the tetrad postulate of Cartan:

$$D_\mu q^a_\lambda = \partial_\mu q^a_\lambda + \omega^a_{\mu b} q^b_\lambda - \Gamma^\nu_{\mu\lambda} q^a_\nu = 0 \tag{27.6}$$

These equations imply [1–12] the Cartan identity:

$$d \wedge T^a + \omega^a{}_b \wedge T^b := R^a{}_b \wedge q^b \tag{27.7}$$

and the Cartan/Evans [1–12] dual identity

$$d \wedge \widetilde{T}^a + \omega^a{}_b \wedge \widetilde{T}^b := \widetilde{R}^a{}_b \wedge q^b \tag{27.8}$$

where the tilde denotes the Hodge dual transform in four dimensions. Eq. (27.8) is an example of Eq. (27.7), and Eq. (27.7) is written in a spacetime with torsion and curvature non-zero. The Riemannian definition of torsion and curvature is:

$$[D_\mu,\ D_\nu] V^\rho = R^\rho{}_{\sigma\mu\nu} V^\sigma - T^\lambda_{\mu\nu} D_\lambda V^\rho \tag{27.9}$$

where:

$$[D_\mu,\ D_\nu] = -[D_\nu,\ D_\mu] \tag{27.10}$$

is the anti-symmetric commutator of covariant derivatives and V^p a vector (rank one tensor). The definition (27.9) can be extended to the commutator operator acting on any tensor [1–12] of any rank. The Riemannian equivalents of the Cartan and Cartan/Evans identities have been given in comprehensive detail [1–12], and are exact identities which state that the cyclic sums of three curvature tensors or Hodge duals thereof are identically equal to the same cyclic sum of definitions of the same tensors. The so called "first Bianchi identity" and "second Bianchi identity" of the obsolete twentieth century gravitational physics incorrectly omit torsion by using the symmetric connection (27.3) of Ricci and Levi-Civita.

In Section 27.2 the Cartan/Evans dual identity (27.1) is used to show by computer algebra that the Einstein field equation is incorrect geometrically because of its omission of torsion. In the context of this paper, all black hole metrics are either physically meaningless Ricci flat metrics, or, whenever the canonical energy momentum density tensor is non-zero, they are incorrect. The reason is that they produce a non-zero curvature $R^{\kappa}{}_{\mu}{}^{\mu\nu}$, but a zero torsion $T^{\kappa\mu\nu}$ by construction, so violate the Cartan/Evans dual identity. This situation has been remedied by basing the equations of motion of general relativity directly on the Cartan identity (homogeneous field equations of ECE theory) and the Cartan/Evans dual identity (inhomogeneous field equations of ECE theory). In Section 3, further criticisms of black hole theory are given by Dunning-Davies and Crothers, notably, the Schwarszchild metric has been incorrectly attributed to him, and the singularity analysis of the so called Schwarzschild metric is incorrect because it violates geometry. The introduction of mass M into any Ricci flat (vacuum) class of metric is self-contradictory. In these vacuum metrics mass is initially eliminated by construction, and cannot be assumed thereafter to be non-zero. A Ricci flat assumption means that the symmetric canonical energy momentum density tensor $T_{\mu\nu}$ is zero by the Einstein equation, so mass is zero by construction and cannot be arbitrarily asserted thereafter to be non-zero. Mass cannot appear in any vacuum metric, the vacuum extends throughout the whole universe, there is no source mass by construction. This is again a major flaw of black hole theory, which is all based on the incorrect and mis-named "Schwarzschild metric". The original 1916 paper of this author does not contain mass. There are no black holes in nature, no Hawking radiation, no dark matter. These are pseudo-scientific concepts of an incorrect and obsolete physics.

27.2 Computer Evaluation of Some Commonly Used Black Hole Metrics

In papers 93, 95 and 117 of the ECE series (www.aias.us) all solutions of the Einstein field equation were shown to violate the Cartan/Evans dual identity of geometry, eq. (27.1). The same methods are used in this section to test some commonly used metrics of black hole theory. The code is programmed to use the symmetric connection (27.3) of the Einstein field equation. So if the field equation were correct, it should produce a zero $R^{\kappa}{}_{\mu}{}^{\mu\nu}$. Such is not the case whenever the canonical energy momentum density $T_{\mu\nu}$ is finite. If

$T_{\mu\nu}$ is zero there is no physics as argued in the introduction. The overall conclusion [1–12] is that the Einstein field equation is obsolete and has been replaced by the Einstein Cartan Evans (ECE) equations of general relativity and generally covariant classical and quantum unified field theory. The code (developed by Dr Eckardt and his group) also makes fundamental tests of each metric, notably tests its metric compatibility [1–12]:

$$D_\rho g_{\mu\nu} = D_\rho g^{\mu\nu} = 0 \tag{27.11}$$

and its compatibility with the Ricci cyclic equation:

$$R_{\mu\nu\rho} + R_{\rho\mu\nu} + R_{\nu\rho\mu} = 0 \tag{27.12}$$

which is mis-named "the first Bianchi identity" in the obsolete physics. If metrics fail either of these tests they are incorrect and self-inconsistent even within their assumptions. Surprisingly, it has been found that several obsolete metrics did fail these tests. One of these is the Kruskal metric of black hole theory as described in the following in more detail. Therefore not only is the standard physics obsolete, the standard mathematics are full of errors.

The metrics tested in this paper are as follows.

1) The wormhole metric [15]:

$$ds^2 = -c^2 dt^2 + d\ell^2 + (k^2 + \ell^2) d\ell^2. \tag{27.13}$$

2) A wormhole metric with varying cosmological constant [15]:

$$ds^2 = -e^\gamma dt^2 + e^\mu dr^2 + r^2 d\Omega^2 \tag{27.14}$$

where

$$e^{-\mu} = 1 - \frac{b(r)}{r}. \tag{27.15}$$

Here $\gamma(r)$ is a red-shift function and $b(r)$ is a shape function.

3) The Morris Thorne wormhole [16]:

$$ds^2 = \left(1 - \frac{2m}{r}\right)\left(\frac{dr}{2\lambda r}\right)^2 - \left(1 - \frac{2m}{r}\right) dt^2. \tag{27.16}$$

These authors also give a metric:

$$ds^2 = 2\left(1 - \frac{a}{r}\right)^{-1}\left(\frac{dr}{4\lambda r}\right)^2 - \frac{2}{r} dt^2 \tag{27.17}$$

4) A flat wormhole metric form straight cosmic strings [17]:

$$ds^2 = dt^2 - d\sigma^2 - dZ^2 \tag{27.18}$$

where

$$d\sigma^2 = \prod_i |\zeta - a_i|^{-8Gm_i} d\zeta d\zeta^*, \zeta = x + i\zeta, d\sigma^2 = du^2 + dv^2. \tag{27.19}$$

This author also gives a metric for flat space-time with n wormholes and $2p$ ordinary cosmic strings:

$$\begin{aligned} d\sigma^2 &= \frac{|\zeta^2 - c^2|^2}{|(\zeta^2 - a^2)^2 - b^4|} d\zeta d\zeta^*, \\ m_1 = m_2 &= -\frac{1}{4G}, \\ n = p &= 2. \end{aligned} \tag{27.20}$$

5) The Einstein Rosen Bridge [18]:

$$\begin{aligned} ds^2 &= -adt^2 + \frac{1}{a}dr^2 - r^2 d\Omega^2, \\ a &= 1 - \frac{2m}{r} - \frac{\epsilon^2}{2r^2}. \end{aligned} \tag{27.21}$$

6) The massless Einstein Rosen Bridge [19].

$$\begin{aligned} ds^2 &= adt^2 - b(dr^2 + r^2 d\Omega^2), \\ a &= \left(1 - \frac{m^2 + \beta^2}{4r^2}\right)^2 \left(1 + \frac{m}{r} + \frac{m^2 + \beta^2}{4r^2}\right)^{-2}, \\ b &= 1 + \frac{m}{r} + \frac{m^2 + \beta^2}{4r^2}. \end{aligned} \tag{27.22}$$

These authors also give the general Morris Thorne wormhole:

$$ds^2 = e^{2\phi(r)} dt^2 - \frac{dr^2}{1 - b(r)/r} - r^2 d\Omega^2. \tag{27.23}$$

7) Einstein Metric of 1936

$$ds^2 = \frac{\rho^2}{2m + \rho^2} dt^2 - 4(2m + \rho^2) d\rho^2 - (2m + \rho^2)^2 d\Omega^2 \tag{27.24}$$

where

$$\rho = r - 2m.$$

8) The Bekenstein Hawking Radiation Metric.

$$ds^2 = -\frac{u^2}{4m^2} dt^2 + du^2 + dX^2, \tag{27.25}$$

where

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

9) The Eddington Finkelstein Metric [20]

$$ds^2 = \left(1 - \frac{2m}{r}\right) dv^2 - 2dvdr - r^2 d\Omega^2 \tag{27.26}$$

where

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

10) The Kruskal Metric [20]

$$\begin{aligned} ds^2 &= -32\frac{m^3}{r} \exp\left(-\frac{r}{2m}\right)(du^2 - dv^2), \\ u &= \left(\frac{r}{2m} - 1\right)^{1/2} \exp\left(\frac{r}{4m}\right) \cosh\left(\frac{t}{4m}\right), \\ v &= \left(\frac{r}{2m} - 1\right)^{1/2} \exp\left(\frac{r}{4m}\right) \sinh\left(\frac{t}{4m}\right). \end{aligned} \tag{27.27}$$

11) The Spherically Symmetric Metric in Four Dimensions

$$ds^2 = Adt^2 - 2Bdt\ dr - Cdr^2 - Dd\Omega^2 \tag{27.28}$$

12) Particular Example of a Spherically Symmetric Metric [1–12].

$$ds^2 = e^{2\alpha} dt^2 - e^{2\beta} dr^2 - r^2 d\Omega^2. \tag{27.29}$$

The computer code found that the Cartan/Evans dual identity is not obeyed in general by spherically symmetric metrics in four dimensions if the connection is symmetric. This leads to the important inference that torsion must be non-zero for all spherically symmetric metrics in four dimensions, a general theorem. The connection cannot be symmetric in any spherically symmetric metric in four dimensions. Another general inference is that the Ricci tensor cannot be zero in physics, any metric that uses such an assumption is physically meaningless, i.e. the class of vacuum metrics is physically meaningless. This class includes the Eddington Finkelstein metric of black hole theory, and the central metric of black hole theory, the mis-named Schwarzschild metric. For these vacuum metrics the code showed that $R_{\mu}^{\kappa\mu\nu}$ is zero by construction. This is simply the result of assuming a Ricci flat condition initially. Both these metrics incorrectly include M, and as shown in the following section, the commonly used singularity analysis of both metrics is also incorrect. The Einstein Rosen bridge, the 1936 metric of Einstein, and the cosmic string metric are three further examples of physically meaningless vacuum metrics.

The worst error in black hole theory is the use of the Kruskal metric [1–12, 20]. The code found that this is mathematically erroneous because it produces a non-zero Ricci tensor and Einstein tensor, and also violates the Cartan/Evans dual identity. The Kruskal transformation, being a change of coordinates, must leave the physical energy momentum density unchanged, but it does not, it produces a non-zero Einstein tensor from an initially zero Einstein tensor. There exists no Bekenstein radiation or Hawking radiation in nature, because their metric (27.25) violates the Cartan/Evans dual identity and is geometrically incorrect and thus physically meaningless.

The Hayward Kim Lee metric (27.24) was found to fail the test of metric compatibility and Ricci cyclic compatibility, and also to violate the Cartan/Evans dual identity, so it is complete nonsense. This is also true of the general wormhole metric (27.23). Morris Thorne wormhole and similar.

It is therefore concluded that there are no black holes in nature. In paper 95 it was also shown that the Friedmann Lemaitre Robertson Walker (FLRW) metric of Big Bang theory is geometrically incorrect, again because of omission of torsion. In consequence there is no dark matter in nature, and none of the cosmologies based on the obsolete Einstein equation are correct. The Einstein Cartan Evans (ECE) version of general relativity is the correct one to use in physics and cosmology. Numerous other criticisms of black hole theory are given in section 27.3 by Dunning-Davies and Crothers. The details of the computations used in this section will be posted on www.aias.us as supplementary material for paper 120, and will be collected in a forthcoming publication [21].

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