109(1): The Basic Flaw in EH Theory

In this paper some new consideration are given to a central failure of the twentieth century standard model, the geometrical inconsistency of the EH field equation. It has been shown in comprehensive detail during the development of ECE theory that the Bianchi identity is a rigorous identity of Cartan geometry. The EH field equation neglects the Cartan torsion and so is inconsistent with the Bianchi identity. The latter is written in differential geometry as:

$$D \wedge T := R \wedge q \qquad -(1)$$

and in tensor notation eq. (1) is:

$$D_\mu T^\kappa{}_{\nu\sigma} + D_\sigma T^\kappa{}_{\mu\nu} + D_\nu T^\kappa{}_{\sigma\mu} := R^\kappa{}_{\mu\nu\sigma} + R^\kappa{}_{\sigma\mu\nu} + R^\kappa{}_{\nu\sigma\mu} \qquad -(2)$$

i.e.

$$\boxed{D_\mu \tilde{T}^{\kappa\mu\nu} := \tilde{R}^{\kappa}{}_{\mu}{}^{\mu\nu}} \qquad -(3)$$

where the tilde denotes Hodge dual. Eqs. (2) and (3) are the same equation, but written in different ways. The Hodge dual in the general manifold is defined as:

$$\tilde{T}^{\kappa\alpha\beta} = \frac{1}{2} \| g \|^{1/2} \epsilon^{\alpha\beta\mu\nu} T_{\mu\nu} \qquad -(4)$$

$$\tilde{R}^{\kappa}{}_{\sigma}{}^{\alpha\beta} = \frac{1}{2} \| g \|^{1/2} \epsilon^{\alpha\beta\mu\nu} R^\kappa{}_{\sigma\mu\nu} \qquad -(5)$$

where $\| g \|^{1/2}$ is the square root of the metric determinant, and $\epsilon^{\alpha\beta\mu\nu}$ is the anti-symmetric

2) tensor in the Minkowski spacetime. An example of eq. (3) is for $\nu = 1$:

$$D_0 \tilde{T}^{\kappa 01} + D_2 \tilde{T}^{\kappa 21} + D_3 \tilde{T}^{\kappa 31}$$
$$= \tilde{R}^{\kappa}{}_{0}{}^{01} + \tilde{R}^{\kappa}{}_{2}{}^{21} + \tilde{R}^{\kappa}{}_{3}{}^{31} \quad -(6)$$

Taking Hodge duals on either side of eq (6), using eqs. (4) and (5), gives:

$$D_0 T^{\kappa}{}_{23} + D_2 T^{\kappa}{}_{30} + D_3 T^{\kappa}{}_{02}$$
$$= R^{\kappa}{}_{023} + R^{\kappa}{}_{230} + R^{\kappa}{}_{302} \quad -(7)$$

because the $\|g\|^{1/2}$ factor cancels out and because $\epsilon^{\alpha\beta\mu\nu}$ is the well known Minkowski space symbol by definition. Summation over repeated μ indices of eq. (3) has been used to give eq. (6), with ν fixed at 1.

<u>The Computer Algebra Results</u> of <u>Paper 93</u>

For many different exact solutions of the EH equation it was shown that:

$$\tilde{R}^{\kappa}{}_{\mu}{}^{\mu\nu} = 0, \quad \tilde{T}^{\kappa\mu\nu} = 0, \quad -(8)$$

i.e.

$$R^{\kappa}{}_{\mu\nu\sigma} + R^{\kappa}{}_{\sigma\mu\nu} + R^{\kappa}{}_{\nu\sigma\mu} = 0, \quad -(9)$$

which is known in the standard model as the first Bianchi identity. This is true if and only if:

3)

$$g_{\mu\nu} = g_{\nu\mu}, \quad \Gamma^{\kappa}_{\mu\nu} = \Gamma^{\kappa}_{\nu\mu}. \quad -(10)$$

In the standard model it is taught as if it were an exact identity, but the correct and exact identity is eq. (2).

The EH equation is true if and only if the Cartan torsion is zero:

$$T^{\kappa}_{\mu\nu} = \Gamma^{\kappa}_{\mu\nu} - \Gamma^{\kappa}_{\nu\mu} = 0. \quad -(11)$$

This is rather a drastic assumption, because in general:

$$[D_\mu, D_\nu] V^\rho := R^\rho{}_{\sigma\mu\nu} V^\sigma - T^{\lambda}_{\mu\nu} D_\lambda V^\rho \quad -(12)$$

The fundamental definition of the Riemann tensor and torsion tensor rest on eq. (12) for any connection, with or without metric compatibility:

$$T^{\lambda}_{\mu\nu} = \Gamma^{\lambda}_{\mu\nu} - \Gamma^{\lambda}_{\nu\mu} \neq 0 \quad -(13)$$

$$R^\rho{}_{\sigma\mu\nu} = \partial_\mu \Gamma^\rho_{\nu\sigma} - \partial_\nu \Gamma^\rho_{\mu\sigma} + \Gamma^\rho_{\mu\lambda} \Gamma^\lambda_{\nu\sigma} - \Gamma^\rho_{\nu\lambda} \Gamma^{\lambda}_{\mu\sigma} \neq 0 \quad -(14)$$

where in general:

$$g_{\mu\nu} \neq g_{\nu\mu}, \quad \Gamma^{\kappa}_{\mu\nu} \neq \Gamma^{\kappa}_{\nu\mu} \quad -(15)$$

It has been shown during ECE theoretical development

4)

that the two tensors (13) and (14) obey eq. (2) or (3) under all conditions, given the ~~metric compatibility condition~~ tetrad postulate:

$$D_\mu q^a_\nu = 0. \quad — (16)$$

without eq. (16) Cartan geometry is essentially undefined.

So the Bianchi identity (1) is due to the fundamental eq. (12). The latter is also a rigorous and exact identity which shows that both the curvature and torsion are produced by the commutator $[D_\mu, D_\nu]$ acting on the four vector V^ρ.

To neglect the torsion tensor $T^\lambda_{\mu\nu}$ is an arbitrary assumption. The EH equation is based on this arbitrary assumption, and EH is not true in general.

The Hodge dual of the commutator operator is defined as:

$$[D^\alpha, D^\beta]_{HD} := \frac{1}{2} \|g\|^{1/2} \epsilon^{\alpha\beta\mu\nu} [D_\mu, D_\nu] \quad — (17)$$

and in four dimensions is another antisymmetric tensor.

Therefore it follows that:

5)

$$[D^\alpha, D^\beta]_{HD} V^\rho = \tilde{R}^\rho{}_\sigma{}^{\alpha\beta} V^\sigma - \tilde{T}^{\lambda\alpha\beta} D_\lambda V^\rho \quad -(18)$$

Indices may be lowered using:

$$[D_\mu, D_\nu]_{HD} = g_{\mu\alpha} g_{\nu\beta} [D^\alpha, D^\beta]_{HD} \quad -(19)$$

$$\tilde{R}^\rho{}_{\sigma\mu\nu} = g_{\mu\alpha} g_{\nu\beta} \tilde{R}^\rho{}_\sigma{}^{\alpha\beta} \quad -(20)$$

$$\tilde{T}^\lambda{}_{\mu\nu} = g_{\mu\alpha} g_{\nu\beta} \tilde{T}^{\lambda\alpha\beta} \quad -(21)$$

A possible solution is therefore:

$$[D_\mu, D_\nu]_{HD} V^\rho = \tilde{R}^\rho{}_{\sigma\mu\nu} V^\sigma - \tilde{T}^\lambda{}_{\mu\nu} D_\lambda V^\rho \quad -(22)$$

for any metric $g_{\mu\nu}$, and any connection $\Gamma^\lambda_{\mu\nu}$. The same covariant derivatives are used in eqs (12) and (22). Therefore the same connections are used.

It follows ~~that~~:

$$\tilde{T}^\lambda{}_{\mu\nu} = \left(\Gamma^\lambda_{\mu\nu} - \Gamma^\lambda_{\nu\mu}\right)_{HD} \neq 0 \quad -(23)$$

$$\tilde{R}^\rho{}_{\sigma\mu\nu} = \left(\partial_\mu \Gamma^\rho_{\nu\sigma} - \partial_\nu \Gamma^\rho_{\mu\sigma} + \Gamma^\rho_{\mu\lambda}\Gamma^\lambda_{\nu\sigma} - \Gamma^\rho_{\nu\lambda}\Gamma^\lambda_{\mu\sigma}\right)_{HD} \neq 0 \quad -(24)$$

These are self anti-symmetric tensors in 4-D. Eqs (23) and (24) have the same mutual relation to each other as Eqs. (13) and (14).

It follows that:

$$D_\mu \tilde{T}^{\kappa}{}_{\nu\sigma} + D_\sigma \tilde{T}^{\kappa}{}_{\mu\nu} + D_\nu \tilde{T}^{\kappa}{}_{\sigma\mu} = \tilde{R}^{\kappa}{}_{\mu\nu\sigma} + \tilde{R}^{\kappa}{}_{\sigma\mu\nu} + \tilde{R}^{\kappa}{}_{\nu\sigma\mu} \quad -(25)$$

i.e.

$$\boxed{D_\mu T^{\kappa\mu\nu} = R^{\kappa}{}_{\mu}{}^{\mu\nu}} \quad -(26)$$

Results of Computer Algebra

For a number of exact solutions of the EH eq. it was shown in paper 93 that:

$$R^{\kappa}{}_{\mu}{}^{\mu\nu} \neq 0, \quad T^{\kappa\mu\nu} = 0 \quad -(27)$$

so the Christoffel symbol is incompatible with eq. (26)

Cross Check

The tensor $R^{\kappa}{}_{\mu}{}^{\mu\nu}$ is a special case of

$$R^{\kappa}{}_{\mu}{}^{\sigma\nu} = g^{\sigma\alpha} g^{\nu\rho} R^{\kappa}{}_{\mu\alpha\rho} \quad -(28)$$

From eqs (11) and (12) it is seen that the torsion tensor must vanish for a Christoffel symbol, but the Riemann tensor $R^{\kappa}{}_{\mu\alpha\rho}$ is non-zero for the same Christoffel symbol. So eq. (26) cannot be satisfied by a Christoffel symbol, QED.

7)

Discussion

Eq. (25) is a consequence of the fundamental structure of the two tensors of eqs. (23) and (24). Any two tensors of the general type:

$$R^{\rho}{}_{\sigma\mu\nu} = \partial_\mu \Delta^{\rho}_{\nu\sigma} - \partial_\nu \Delta^{\rho}_{\mu\sigma} + \Delta^{\rho}_{\mu\lambda}\Delta^{\lambda}_{\nu\sigma} - \Delta^{\rho}_{\nu\lambda}\Delta^{\lambda}_{\mu\sigma} \quad -(25)$$

$$T^{\lambda}_{\mu\nu} = \Delta^{\lambda}_{\mu\nu} - \Delta^{\lambda}_{\nu\mu} \quad -(26)$$

obey:

$$D \wedge T := R \wedge q. \quad -(27)$$

Eqs. (23) and (24) are examples of the types (25) and (26) where:

$$\Delta^{\lambda}_{\mu\nu} - \Delta^{\lambda}_{\nu\mu} = \tilde{\Gamma}^{\lambda}_{\mu\nu} - \tilde{\Gamma}^{\lambda}_{\nu\mu} \quad -(28)$$

and where the right hand sides of eqs. (24) and (25) are the same.

Overall Conclusion

For a Christoffel connection:

$$\boxed{R^{\kappa}{}_{\mu}{}^{\mu\nu} \neq 0 \text{ but } \tilde{R}^{\kappa}{}_{\mu}{}^{\mu\nu} = 0}$$

is exact solution of the EH equation. This result is fundamentally inconsistent with the Bianchi identity