121(5): Some Future Applications of ECE Theory

It may be possible to develop a new thermodynamics where conservation of particle number is not valid. This possibility emerges from using covariant derivatives in the continuity equation (paper 116). Also it may be possible to develop a general thermodynamics with transition of particles, with application to nuclear fusion processes. This leads to the idea of continuous creation in the universe from cosmic dimensions, continuous small large thermodynamics in these are interesting ideas by Dr. Horst Eckardt.

The Einstein formalism may be developed to include torsion in a perturbation theory. For example start with the Bianchi identity and a symmetric metric. A correct geometry in this case must lead to:

$$D_\mu T^{\kappa\mu\nu} = R_\mu{}^{\kappa\mu\nu} = 0 \quad -(1)$$

because:

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

i.e.

$$\Gamma^\kappa{}_{\mu\nu} = \Gamma^\kappa{}_{\nu\mu}. \quad -(3)$$

Eq. (3) is the symmetric metric introduced by Ricci and Levi-Civita in 1900. The Einstein formalism is:

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

where $G_{\mu\nu}$ is the Einstein tensor, k is the Einstein constant and:

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

2) is the canonical energy-momentum density tensor. Eq. (4)
is based on eq. (3) and on:

$$g_{\mu\nu} = g_{\nu\mu} \quad -(6)$$

where $g_{\mu\nu}$ is the metric. Therefore eq. (4) should obey
eq. (1), i.e. should produce:

$$\boxed{R^{\kappa\ \ \mu\nu}_{\ \ \mu} = 0.} \quad -(7)$$

However, contemporary computer algebra shows that:

$$R^{\kappa\ \ \mu\nu}_{\ \ \mu} \neq 0 \quad -(8)$$

from eq. (4), while:

$$T^{\kappa\mu\nu} = 0 \quad -(9)$$

from eq. (4). This is a complete disaster for Einsteinian gravitational theory, which has been replaced by ECE theory.

In eq. (4):

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} \quad -(10)$$

where $R_{\mu\nu}$ is the Ricci tensor:

$$R_{\mu\nu} = R_{\nu\mu} \quad -(11)$$

and R is the Ricci scalar. Eq. (4) is a

3) particular solution of:

$$D^\mu G_{\mu\nu} = k D^\mu T_{\mu\nu} \quad - (12)$$

$$= 0$$

in which the "second Bianchi identity" of Riemann geometry is made proportional to the covariant version of the Noether theorem. The "second Bianchi identity" is:

$$D^\mu G_{\mu\nu} = 0 \quad - (13)$$

which is a re-expression of:

$$D_\mu R^\kappa{}_{\sigma\nu\rho} + D_\rho R^\kappa{}_{\sigma\mu\nu} + D_\nu R^\kappa{}_{\sigma\rho\mu} = 0. \quad - (14)$$

In differential form notation, eq. (14) is:

$$D \wedge R^a{}_b = 0 \quad - (15)$$

The covariant Noether theorem (conservation of canonical energy momentum density) is:

$$D^\mu T_{\mu\nu} = 0 \quad - (16)$$

Eq. (13) is true if and only if eq. (3) is true.

It is NOT a general identity.

4) The key error in the obsolete physics was the uncritical use of eq. (3), which leads to zero torsion by definition, or construction. The correct Bianchi identity is the Cartan identity:

$$D \wedge T^a = R^a{}_b \wedge q^b \quad -(17)$$

$$\neq 0.$$

In the incorrect and obsolete physics:

$$T^a = 0 \quad -(18)$$

by construction, so:

$$R^a{}_b \wedge q^b = 0, \quad -(19)$$

or in tensor notation:

$$R_{\sigma\mu\nu\rho} + R_{\sigma\rho\mu\nu} + R_{\sigma\nu\rho\mu} = 0 \quad -(20)$$

This is known in the obsolete physics as "the first Bianchi identity", but again is true if and only if eq. (3) is true.

The Cartan - Evans identity is:

$$D \wedge \tilde{T}^a = \tilde{R}^a{}_b \wedge q^b \quad -(21)$$

and is an example of eq. (17). The tilde denotes the Hodge dual.

5) Eq. (21) in tensor notation is:

$$\boxed{D_\mu T^{\kappa\mu\nu} = R^{\kappa\ \ \mu\nu}_{\ \ \mu} \neq 0} \qquad -(22)$$

In general:

$$T^{\kappa\mu\nu} \neq 0, \quad R^{\kappa\ \ \mu\nu}_{\ \ \mu} \neq 0, \qquad -(23)$$

therefore:

$$\boxed{\Gamma^{\kappa}_{\mu\nu} \neq \Gamma^{\kappa}_{\nu\mu}} \qquad -(24)$$

<u>Theorem</u>

<u>The connection in general relativity must be asymmetric, and the torsion tensor must be finite.</u>

Therefore perturbation methods can be used with eq. (3). For example, take the output for connections computed with a symmetric metric, and iterate to a solution of eq. (22). At present, all solutions of eq. (4) for finite $T_{\mu\nu}$ give:

$$D_\mu T^{\kappa\mu\nu} \overset{?}{\neq} R^{\kappa\ \ \mu\nu}_{\ \ \mu} \qquad -(25)$$

because of eq. (3). The connection in eq. (3) is defined by eq. (6), i.e.:

6)

$$\left(\Gamma^{\sigma}_{\mu\nu}\right)_S = \frac{1}{2} g^{\sigma\rho}\left(\partial_\mu g_{\nu\rho} + \partial_\nu g_{\rho\mu} - \partial_\rho g_{\mu\nu}\right) \quad -(26)$$

by assuming metric compatibility:

$$D_\rho g_{\mu\nu} = D_\rho g^{\mu\nu} = 0. \quad -(27)$$

The subscript S in eq. (26) denotes "symmetric" as in eq. (3). The way in which eq. (26) was derived is to use, in cyclic permutation:

$$D_\rho g_{\mu\nu} = \partial_\rho g_{\mu\nu} - \Gamma^{\lambda}_{\rho\mu} g_{\lambda\nu} - \Gamma^{\lambda}_{\rho\nu} g_{\mu\lambda} = 0 \quad -(28)$$

$$D_\mu g_{\nu\rho} = \partial_\mu g_{\nu\rho} - \Gamma^{\lambda}_{\mu\nu} g_{\lambda\rho} - \Gamma^{\lambda}_{\mu\rho} g_{\nu\lambda} = 0 \quad -(29)$$

$$D_\nu g_{\rho\mu} = \partial_\nu g_{\rho\mu} - \Gamma^{\lambda}_{\nu\rho} g_{\lambda\mu} - \Gamma^{\lambda}_{\nu\mu} g_{\rho\lambda} = 0 \quad -(30)$$

Now substract eqns. (29) and (30) from eq. (28) and use eq. (3) to obtain eq. (26).

Therefore eq. (26) assumes a symmetric connection, leading to the incorrect result (25)

7) <u>Perturbation Theory</u>

Assume:

$$\Gamma^{\kappa}_{\mu\nu} = \left(\Gamma^{\kappa}_{\mu\nu}\right)_S + \delta\left(\Gamma^{\kappa}_{\mu\nu}\right)_A \quad -(31)$$

where:

$$\left(\Gamma^{\kappa}_{\mu\nu}\right)_S = \left(\Gamma^{\kappa}_{\nu\mu}\right)_S \quad -(32)$$

$$\boxed{\left(\Gamma^{\kappa}_{\mu\nu}\right)_A = -\left(\Gamma^{\kappa}_{\mu\nu}\right)_A} \quad -(33)$$

This result follows from the fact that any square matrix can be resolved into the sum of a symmetric and antisymmetric matrix:

$$a_{ik} = \frac{1}{2}\left(a_{ik} + a_{ki}\right) + \frac{1}{2}\left(a_{ik} - a_{ki}\right) \quad -(34)$$

(G. Stephenson, "Mathematical Methods for Science Students" (Longmans, 1968)), p. 292, eq. (47).

Therefore for each κ, μ and ν, compute $\left(\Gamma^{\kappa}_{\mu\nu}\right)_S$ from eq. (26), and add the perturbation $\delta\left(\Gamma^{\kappa}_{\mu\nu}\right)_A$. This method produces:

$$D_\mu \left(\delta T^{\kappa\mu\nu}\right)_A = \left(R^{\kappa\ \ \mu\nu}_{\ \mu}\right)_S + \delta\left(R^{\kappa\ \ \mu\nu}_{\ \mu}\right)_A \quad -(35)$$

in which $\left(R^{\kappa\ \ \mu\nu}_{\ \mu}\right)_S$ is computed from eq. (26) in the Maxima code of pages 93, 95, 117 and 120. Therefore:

$$\boxed{D_\mu \left(\delta T^{\kappa\mu\nu}\right)_A - \left(\delta R^{\kappa\ \ \mu\nu}_{\ \mu}\right)_A = \left(R^{\kappa\ \ \mu\nu}_{\ \mu}\right)_S} \quad -(36)$$

In eq. (36):

$$\left(T^{\kappa}_{\ \mu\nu}\right)_A = 2\left(\Gamma^{\kappa}_{\ \mu\nu}\right)_A \quad -(37)$$

and:

$$\left(R^{\rho}_{\ \sigma\mu\nu}\right)_A = \partial_\mu\left(\Gamma^{\rho}_{\ \nu\sigma}\right)_A - \partial_\nu\left(\Gamma^{\rho}_{\ \mu\sigma}\right)_A + \left(\Gamma^{\rho}_{\ \mu\lambda}\right)_A\left(\Gamma^{\lambda}_{\ \nu\sigma}\right)_A - \left(\Gamma^{\rho}_{\ \nu\lambda}\right)_A\left(\Gamma^{\lambda}_{\ \mu\sigma}\right)_A \quad -(38)$$

with:

$$\left(R^{\kappa\ \ \mu\nu}_{\ \mu}\right)_A = g^{\mu\alpha} g^{\nu\beta}\left(R^{\kappa}_{\ \mu\alpha\beta}\right)_A \quad -(39)$$

To define the asymmetric connection, use the fact that $T^{\kappa}_{\ \mu\nu}$ is proportional to a rotation generator and angular momentum / energy density, ~~and~~ so may be modelled by rotational motion.