67 : Rebuttal of arXiv 0607190 v1

This is a repeat of previous rebuttals of G. Bruhn a retired individual in Darmstadt.

1. The "dubious alternative" method is in fact the same method as taught in any reputable University. The definitions (1.2), (1.7) and (1.8) are the same definitions as used in ECE theory. So what is Bruhn trying to say?

2. The assertion by Bruhn as goes from his eq. (2.1) to (2.2) is not made in ECE ~~theory~~. This is an example of disinformation. The correct method is already given in M. W. Evans, "Generally Covariant Unified Field Theory" (Abramis Academic, 2005 and 2006) vol. 1. pp. 261 ff.

Start with the Einstein equation:

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

Introduce:

$$R_{\mu\nu} = R^a_\mu q^b_\nu \eta_{ab} \quad -(2)$$

$$T_{\mu\nu} = T^a_\mu q^b_\nu \eta_{ab} \quad -(3)$$

$$g_{\mu\nu} = q^a_\mu q^b_\nu \eta_{ab}. \quad -(4)$$

Eq. (4) is the standard decomposition of the metric into the product of two tetrads (e.g. Carroll)

2) This method is used in eqs. (2) and (3) to define R_μ^a and T_μ^a, which are vector valued one forms. One of the Evans field equation is:

$$G_\mu^a = -\frac{1}{4} R q_\mu^a \quad -(5)$$

$$T_\mu^a = \frac{1}{4} T q_\mu^a \quad -(6)$$

Eqs (5) and (6) are derived from the definitions of R and T originally used by Einstein:

$$R = g^{\mu\nu} R_{\mu\nu}, \quad T = g^{\mu\nu} T_{\mu\nu}. \quad -(7)$$

Use the Einstein convention:

$$g^{\mu\nu} g_{\mu\nu} = 4 \quad -(8)$$

and the Cartan convention:

$$q_\mu^a q_a^\mu = 1 \quad -(9)$$

to obtain:

$$R = g^{\mu\nu} R_{\mu\nu} = q_\mu^a q^\nu_b \eta^{ab} R_\mu^a q_\nu^b \eta_{ab} \quad -(10)$$

where we have used eq. (2).

Multiply both sides of eq. (10) by q_μ^a to obtain:

$$R_\mu^a = \frac{1}{4} R q_\mu^a . \quad -(11)$$

This is because the R.H.S. of eq. (10) is:

$$\left(\eta^{ab}\eta_{ab}\right)\left(q^\nu_b q_\nu^b\right)\left(q_\mu^a R_\mu^a\right) = 4 q_\mu^a R_\mu^a \quad -(12)$$

3) Multiply both sides of eq (12) by q^a_μ to obtain:

$$R^a_\mu = \frac{1}{4} R q^a_\mu \quad -(13)$$

So:

$$G^a_\mu = R^a_\mu - \frac{1}{2} R q^a_\mu = -\frac{1}{4} R q^a_\mu \quad -(14)$$

This is eq. (5), <u>Q.E.D.</u>

The contracted form of eq (1) is:

$$R = -kT \quad -(15)$$

(Einstein, "The Meaning of Relativity"). Multiply both sides of eq (15) by q^a_μ:

$$R q^a_\mu = -kT q^a_\mu \quad -(16)$$

Substituting eqs. (5) and (1) into eq. (16) gives:

$$\boxed{G^a_\mu = kT^a_\mu} \quad -(17)$$

Write eq. (17) in the form:

$$\frac{1}{4} R q^a_\mu - \frac{1}{2} R q^a_\mu = \frac{1}{4} kT q^a_\mu \quad -(18)$$

Multiply both sides of eq. (18) by $q^b_\nu \eta_{ab}$

4)
$$\frac{1}{4} R q^a_\mu q^b_\nu \eta_{ab} - \frac{1}{2} R q^a_\mu q^b_\nu \eta_{ab} \quad -(19)$$
$$= \frac{1}{4} kT q^a_\mu q^b_\nu \eta_{ab}$$

Using eqs. (2) – (4), and (5) and (6), this is eq. (1), Q.E.D.

S. Bruhn has deliberately falsified this proof. This has been pointed out many times before.

Starting from eq. (16) we may contract:
$$R q^a_\mu q^b_\nu \eta_{ab} = - kT q^a_\mu q^b_\nu \eta_{ab} \quad -(20)$$
$$-(21)$$
i.e. $R g_{\mu\nu} = - kT g_{\mu\nu}$.

We may also contract the wedge product:
$$R q^a_\mu \wedge q^b_\nu = - kT q^a_\mu \wedge q^b_\nu \quad -(22)$$

The remark on page 3 of Bruhn has also been corrected many times before. We may define the quantity:
$$R^{cA}_{\mu\nu} := R q^a_\mu \wedge q^b_\nu \quad -(23)$$
analogously with:

5)

$$q^{c(A)}_{\mu\nu} := q^a_\mu \wedge q^b_\nu \quad -(24)$$

I assume that this is what Bruhn is trying to say. The definition of wedge product that I use is the same as that used by everyone else, (e.g. Carroll), and is given in detail in vol. 1, chapter 17, Appendix C, equation (C.5):

$$(A \wedge B)_{\mu_1 \ldots \mu_{p+q}} = \frac{(p+q)!}{p!\,q!} (p+1) A_{[\mu_1 \ldots \mu_p} B_{\mu_{p+1} \ldots \mu_{p+q}]} \quad -(25)$$

Examples are given in Eq. (C.11) and (C.13).

a) There is no type mismatch in eqn. (23) and (24).

b) There is no "illegal removal" of indices.

This is misinformation by Bruhn, who tries to create confusion.

Further Deliberate Misinformation by Bruhn.

Bruhn's eq. (3.10)/(8) on his page 4 is incorrect. The correct equation

b) is eq. (2.26) of volume 1:

$$\underline{e}_1 \times \underline{e}_2 = \underline{e}_3^* \quad -(26)$$

et cyclicum

Bruhn omits the star (denoting complex conjugate). This shows that he does not know what he is doing. He cannot even copy out my work correctly.

The line element is

$$ds^2 = g_{\mu\nu} dx^\mu dx^\nu \quad -(27)$$

This is a scalar, not a symmetric two form.

c) Bruhn confuses a scalar with a symmetric two-form. This is deliberate misinformation.

d) Bruhn incorrectly asserts that the Hodge dual of a two-form cannot be defined. This is, I assume, what he is trying to do on page 5. It is well known that the Hodge dual of a two-form in 4-D is another two-form (e.g. Carroll).

7) There is deliberate misinformation by Bruhn concerning tensors $q^{\mu\nu (S)}$ and $q^{\mu\nu (A)}$ on his page 5. He misrepresents my definitions, and makes non-consequential deductions. My definitions are as follows:

$$q^{(S)}_{ij} = \begin{bmatrix} l_1 \\ l_2 \\ l_3 \end{bmatrix} \begin{bmatrix} l_1 & l_2 & l_3 \end{bmatrix} \quad -(27)$$

$$= \begin{bmatrix} l_1^2 & l_1 l_2 & l_1 l_3 \\ l_2 l_1 & l_2^2 & l_2 l_3 \\ l_3 l_1 & l_3 l_2 & l_3^2 \end{bmatrix}$$

Q.E.D.

This does not have anything to do with Bruhn's remarks.

Bruhn is again spreading disinformation. The remarks at the foot of his page 5 make no sense in Cartan geometry. ECE is based on Cartan geometry.

Finally, the obscure disinformation on page 6 of Bruhn makes no sense in light of the self consistent mathematics of this rendition.