59(6): Summary of Solutions Found by Dr. Horst Eckardt

The solutions are those to the equation:

$$\underline{g} = (\underline{v}_F \cdot \underline{\nabla})\underline{v}_F \quad -(1)$$

$$= -\frac{mG}{r^2}\underline{e}_r$$

in three dimensions, and are:

$$\underline{v}_{F1} = \frac{\sqrt{2}\,(mG)^{1/2}}{(X^2+Y^2+Z^2)^{3/4}}\left(-Y\underline{i} + X\underline{j}\right) \quad -(2)$$

$$\underline{v}_{F2} = \frac{\sqrt{2}\,(mG)^{1/2}}{(X^2+Y^2+Z^2)^{3/4}}\left(-Z\underline{i} + X\underline{k}\right) \quad -(3)$$

$$\underline{v}_{F3} = \frac{\sqrt{2}\,(mG)^{1/2}}{(X^2+Y^2+Z^2)^{3/4}}\left(-Z\underline{j} + Y\underline{k}\right) \quad -(4)$$

giving the gravitational acceleration components:

$$\underline{g}_{F1} = \frac{-mG}{2(X^2+Y^2+Z^2)^{3/2}}\left(X\underline{i} + Y\underline{j}\right) \quad -(5)$$

$$\underline{g}_{F2} = \frac{-mG}{2(X^2+Y^2+Z^2)^{3/2}}\left(X\underline{i} + Z\underline{k}\right) \quad -(6)$$

$$\underline{g}_{F3} = \frac{-mG}{2(X^2+Y^2+Z^2)^{3/2}}\left(Y\underline{j} + Z\underline{k}\right) \quad -(7)$$

Therefore:

2)

$$\underline{g} = \underline{g}_{F1} + \underline{g}_{F2} + \underline{g}_{F3} \quad -(18)$$

$$= -mG \frac{(X\underline{i} + Y\underline{j} + Z\underline{k})}{(X^2+Y^2+Z^2)^{3/2}} \quad -(19)$$

$$= -mG \frac{\underline{r}}{r^3} = -\frac{mG}{r^2}\underline{e}_r$$

Q.E.D.

Here:

$$\underline{r} = X\underline{i} + Y\underline{j} + Z\underline{k} \quad -(20)$$

$$= r\,\underline{e}_r .$$

The three Lambda charges are:

$$q_{F1} = \underline{\nabla}\cdot\underline{g}_{F1} = -\frac{mG}{2}\left(\frac{2Z^2 - Y^2 - X^2}{(X^2+Y^2+Z^2)^{5/2}}\right) \quad -(21)$$

$$q_{F2} = \underline{\nabla}\cdot\underline{g}_{F2} = \frac{mG}{2}\left(\frac{Z^2 - 2Y^2 + X^2}{(X^2+Y^2+Z^2)^{5/2}}\right) \quad -(22)$$

$$q_{F3} = \underline{\nabla}\cdot\underline{g}_{F3} = \frac{mG}{2}\left(\frac{Z^2 + Y^2 - 2X^2}{(Z^2+X^2+Y^2)^{5/2}}\right) \quad -(23)$$

So

$$q_{F1} + q_{F2} + q_{F3} = 0 \quad -(24)$$

which is a vacuum symmetry associated with the Newtonian gravitational field.

3) The Newtonian gravitational field generates the following three gravitomagnetic fields or vorticities:

$$\underline{w}_{1F} = \underline{\nabla} \times \underline{v}_{1F} = \frac{(mG)^{1/2}}{2^{3/2}(x^2+y^2+z^2)^{7/4}} \left(3xz\,\underline{i} + 3yz\,\underline{j} + (4z^2+y^2+x^2)\,\underline{k} \right) \quad -(25)$$

$$\underline{w}_{2F} = \underline{\nabla} \times \underline{v}_{2F} = \frac{(mG)^{1/2}}{2^{3/2}(x^2+y^2+z^2)^{7/4}} \left(-3xy\,\underline{i} - (z^2+4y^2+x^2)\,\underline{j} - 3yz\,\underline{k} \right) \quad -(26)$$

$$\underline{w}_{3F} = \underline{\nabla} \times \underline{v}_{3F} = \frac{(mG)^{1/2}}{2^{3/2}(x^2+y^2+z^2)^{7/4}} \left((z^2+y^2+4x^2)\,\underline{i} + 3xy\,\underline{j} + 3xz\,\underline{j} \right) \quad -(27)$$

The total velocity field is:

$$\underline{v}_F = \underline{v}_{F1} + \underline{v}_{F2} + \underline{v}_{F3} \quad -(28)$$

$$= \frac{\sqrt{2}\,(mG)^{1/2}}{(x^2+y^2+z^2)^{3/4}} \left(-(y+z)\,\underline{i} + (x-z)\,\underline{j} + (x+y)\,\underline{k} \right)$$

The total gravitomagnetic field is:

$$\underline{w} = \underline{w}_{1F} + \underline{w}_{2F} + \underline{w}_{3F} \quad -(29)$$

and satisfies the ECE2 equation:

$$\underline{\nabla} \cdot \underline{w} = 0 \quad -(30)$$

By definition:

4)

$$\underline{\nabla} \times \underline{g}_F + \frac{\partial \underline{W}_F}{\partial t} = \underline{0} \quad - (31)$$

because:

$$\underline{g}_F = - \frac{\partial \underline{v}_F}{\partial t} - \underline{\nabla} h_F \quad - (32)$$

and

$$\underline{g}_F = \underline{g} = (\underline{v}_F \cdot \underline{\nabla}) \underline{v}_F \quad - (33)$$

Therefore:

$$\underline{\nabla} \times \underline{g}_F = - \frac{\partial}{\partial t} (\underline{\nabla} \times \underline{v}_F) = - \frac{\partial \underline{W}_F}{\partial t} \quad - (34)$$

It follows that

$$\underline{\nabla} \times \underline{g}_F + \frac{\partial \underline{W}_F}{\partial t} = \underline{0} \quad - (35)$$

Q.E.D. In material matter:

$$\underline{\nabla} \cdot \underline{W} = 0 \quad - (36)$$

and

$$\underline{\nabla} \times \underline{g} + \frac{\partial \underline{W}}{\partial t} = \underline{0} \quad - (37)$$

These are two of the ECE2 gravitational field eqs. and they are also vacuum equations. In electrodynamics they become:

$$\underline{\nabla} \cdot \underline{B} = 0 \quad - (38)$$

$$\underline{\nabla} \times \underline{E} + \frac{\partial \underline{B}}{\partial t} = \underline{0} \quad - (39)$$

i.e. the ECE2 Gauss law and Faraday law of induction.

Note carefully that Eqs. (36) and (37) are also vacuum equations:

$$\underline{\nabla} \cdot \underline{W}_F = 0 \quad - (40)$$

$$\underline{\nabla} \times \underline{g}_F + \frac{\partial \underline{W}_F}{\partial t} = 0 \quad - (41)$$

) and that Eqs. (38) and (39) are also vacuum equations: the homogeneous field equations.

The result (24) means that:

$$\underline{\nabla} \cdot g_F = q_F = 0 \quad -(42)$$

and this is one of the inhomogeneous ECE2 gravitational field equations in the vacuum.

The Kambe current is:

$$\underline{J}_F = a_0^2 \, \underline{\nabla} \times (\underline{\nabla} \times \underline{v}_F) - \frac{\partial}{\partial t} \left((\underline{v}_F \cdot \underline{\nabla}) \underline{v}_F \right) \quad -(43)$$

so

$$\underline{\nabla} \times \underline{w}_F - \frac{1}{a_0^2} \frac{\partial \underline{g}_F}{\partial t} = \frac{1}{a_0^2} \underline{J}_F \quad -(44)$$

If it is assumed that:

$$\frac{\partial \underline{g}_F}{\partial t} = \underline{0} \quad -(45)$$

then

$$\underline{J}_F = a_0^2 \, \underline{\nabla} \times (\underline{\nabla} \times \underline{v}_F) \quad -(46)$$

This can be worked out from eq. (28).

Interpretation

The interpretation is based on:

$$\boxed{-\left(\frac{mG}{r^2} \underline{e}_r \right) (\text{matter}) = \left((\underline{v}_F \cdot \underline{\nabla}) \underline{v}_F \right) (\text{spacetime})} \quad -(47)$$

6) So $\underline{g}$ (matter) $= \underline{g}_F$ (spacetime). — (48)

Therefore the familiar Newtonian $\underline{g}$ (matter) induces in the vacuum the quantities $\underline{V}_{F1}$, $\underline{V}_{F2}$, $\underline{V}_{F3}$, $\underline{g}_{F1}$, $\underline{g}_{F2}$, $\underline{g}_{F3}$, V_{F1}, V_{F2}, V_{F3}, $\underline{W}_{F1}$, $\underline{W}_{F2}$, $\underline{W}_{F3}$, and $\underline{J}_{F1}$, $\underline{J}_{F2}$, $\underline{J}_{F3}$.

Eqs. (2) to (4) are possible solutions of eq. (1), but there are other solutions as in earlier notes.
