358(1): The gravitational Field as a Spacetime or Aether Fluid Field.

The spacetime electric field of previous work is defined as:

$$\underline{E}_F = (\underline{v}_F \cdot \underline{\nabla})\underline{v}_F = -\frac{\partial \underline{v}_F}{\partial t} - \underline{\nabla} h_F$$

$$= -\underline{\nabla}\,\Phi_F - \frac{\partial \underline{v}_F}{\partial t} \quad -(1)$$

where $\underline{v}_F$ is the velocity field of spacetime and where

$$\Phi_F = h_F \quad -(2)$$

where Φ_F is the scalar potential and h_F is the enthalpy.

The spacetime magnetic field is the vorticity:

$$\underline{B}_F = \underline{w}_F = \underline{\nabla} \times \underline{v}_F \quad -(3)$$

It follows from eqs. (1) and (3) that:

$$\underline{\nabla} \times \underline{E}_F + \frac{\partial \underline{B}_F}{\partial t} = \underline{0} \quad -(4)$$

The units of $\underline{E}_F$ are acceleration, $m\,s^{-2}$, so it follows that:

$$\boxed{\underline{g}\,(\text{matter}) = \underline{E}_F\,(\text{spacetime})} \quad -(5)$$

This is a new fundamental equation of

gravitation. The gravitational field, or acceleration due to gravity, is the spacetime electric field defined by Eq. (1).

For example, the Newtonian acceleration due to gravity is:

$$\boxed{\underline{g} = -\frac{MG}{r^2}\,\underline{e}_r = (\underline{v}_F \cdot \underline{\nabla})\,\underline{v}_F} \quad -(6)$$

Eqs. (5) and (6) can be interpreted as two way processes originating in the equilibrium between $\underline{g}$ (matter) and $\underline{E}_F$ (spacetime). The gravitational field induces $\underline{E}_F$ in spacetime, and therefore a spacetime velocity field $\underline{v}_F$. Any spacetime velocity field induces a gravitational field $\underline{g}$ in matter. The same spacetime velocity field induces an electric field strength $\underline{E}$ (matter). An electric field strength $\underline{E}$ (matter) can therefore be used to engineer an acceleration due to gravity in matter through the intermediary of spacetime.

The gravitational field equations of ECE2 are:

$$\underline{\nabla} \cdot \underline{\Omega} = 0 \quad -(7)$$

$$\underline{\nabla} \times \underline{g} + \frac{\partial \underline{\Omega}}{\partial t} = \underline{0} \quad -(8)$$

$$\underline{\nabla} \cdot \underline{g} = 4\pi G \rho_m = \underline{\kappa} \cdot \underline{g} \quad -(9)$$

$$\underline{\nabla} \times \underline{\Omega} - \frac{1}{c^2} \frac{\partial \underline{g}}{\partial t} = \frac{4\pi G}{c^2} \underline{J}_m = \underline{\kappa} \times \underline{\Omega} \quad -(10)$$

where:

$$\underline{g} = -\underline{\nabla} \phi_g - \frac{\partial \underline{v}_g}{\partial t} \quad -(11)$$

and

$$\underline{\Omega} = \underline{\nabla} \times \underline{v}_g \quad -(12)$$

in the notation of previous work.

Therefore there is an exact analogy between the ECE2 gravitational field equations and the equations of fluid dynamical spacetime. The latter were first derived by Kambe and are:

$$\underline{\nabla} \cdot \underline{B}_F = 0 \quad -(13)$$

$$\underline{\nabla} \times \underline{E}_F + \frac{\partial \underline{B}_F}{\partial t} = \underline{0} \quad -(14)$$

$$\underline{\nabla} \cdot \underline{E}_F = q_F \quad -(15)$$

$$\underline{\nabla} \times \underline{B}_F - \frac{1}{a_0^2} \frac{\partial \underline{E}_F}{\partial t} = \frac{1}{a_0^2} \underline{J}_F \quad -(16)$$

+) It follows that the gravitomagnetic field in matter is the vorticity of spacetime:

$$\boxed{\underline{\Omega}\,(\text{matter}) = \underline{\nabla} \times \underline{v}_F = \underline{w}_F} \quad -(17)$$

and that the gravitomagnetic field is governed by the vorticity equation of spacetime, derivable from the Navier Stokes equation of spacetime.

It also follows that:

$$\underline{g}\,(\text{matter}) = \left(-\underline{\nabla}\phi_g - \frac{\partial \underline{v}_g}{\partial t}\right)(\text{matter}) \quad -(18)$$

$$= \left(-\underline{\nabla}\,\Phi_F - \frac{\partial \underline{v}_F}{\partial t}\right)(\text{spacetime})$$

and that:

$$\underline{\Omega}\,(\text{matter}) = \left(\underline{\nabla} \times \underline{W}\right)(\text{matter}) \quad -(19)$$

$$= \left(\underline{\nabla} \times \underline{v}_F\right)(\text{spacetime})$$

so

$$\boxed{\underline{W}\,(\text{matter}) = \underline{v}_F\,(\text{spacetime})} \quad -(20)$$

The vector potential of material gravitomagnetism is the velocity field of spacetime.