1)

THE NEWTON AND COULOMB INVERSE SQUARE LAWS FROM THE SCHWARZSCHILD METRIC.

The Newton inverse square law can be expressed as:

$$\underline{\nabla} \cdot \underline{g} = - G \rho_m = - 6.67 \times 10^{-11} \rho_m \quad - (1)$$

and the Coulomb inverse square law as:

$$\underline{\nabla} \cdot \underline{E} = - \frac{1}{\epsilon_0} \rho_e = - 1.129 \times 10^{11} \rho_e . \quad - (2)$$

Here $\underline{g}$ is the acceleration due to gravity, G is the Newton gravitational constant, ρ_m is mass density in $kgm\, m^{-3}$ and ρ_e is charge density in $C\, m^{-3}$. In eq. (2) $\underline{E}$ is electric field strength in volt m^{-1} and ϵ_0 the $\underline{SI}$ vacuum permittivity. From these equations it is clear that the electric field is ~~twe~~ twenty two orders of magnitude stronger on earth than the $\underline{g}$ for unit ρ_m and ρ_e. In the Evans field theory these laws are unified as follows:

$$\boxed{\begin{aligned} \underline{\nabla} \cdot \underline{E}^{0} &= - \frac{1}{\epsilon_0} \rho_e = - \phi^{(0)} R \quad - (3) \\ \underline{\nabla} \cdot \underline{g} &= - G \rho_m = - c^{2} R . \quad - (4) \end{aligned}}$$

Here $\phi^{(0)}$ is a fundamental voltage, c is the speed of light in vacuo, and R is scalar curvature.

2)

Therefore unification is achieved in terms of geometry, represented by scalar curvature, R. This is the curvature of spacetime. The notions of mass density and charge density are replaced by geometry of spacetime.

The basic structure of eqs. (3) and (4) is clear, but their interpretation requires care, and reference to experimental data.

Various metrics can be used to calculate R. If we use the Schwarzschild metric, for example, then:

$$\boxed{R = -\frac{2GM}{c^2 r^3}} \quad -(5)$$

where G is the Newton gravitational constant, M is mass and r is distance.

Check on Units

$$G = 6.67 \times 10^{-11} \ m^3 kg^{-1} s^{-2} \quad -(6)$$

thus:

$$R = \frac{m^3 kg^{-1} s^{-2} \ kgm}{m^2 s^{-2} \ m^3} = m^{-2}. \quad -(7)$$

We have therefore checked that we are working in the correct S.I. units.

From eqs. (4) and (5):

$$\boxed{\underline{\nabla} \cdot \underline{g} = \frac{+2GM}{r^3}} \quad -(8)$$

3) Integrating eq. (8):

$$\underline{g} = -\frac{GM}{r^2}\underline{k} \quad - (9)$$

$$= \frac{\underline{F}}{m}$$

Therefore:

$$\boxed{\underline{F} = -\frac{GmM}{r^2}\underline{k}} . \quad - (10)$$

This is the force in newtons between mass m and mass M separated by a distance $\underset{\sim}{r}$ along the Z axis (unit vector $\underline{k}$).

Therefore we have obtained the famous Newton inverse square law from the Evans equation (4) using the Schwarzschild metric.

This is a conclusive indication of the fact that the Evans theory is the only correct unified field theory which can be obtained from Einsteinian natural philosophy. It follows from eqns (3) and (5) that the Coulomb inverse square law is:

$$\underline{\nabla} \cdot \underline{E}^{\circ} = 2\phi^{(0)}\frac{GM}{c^2 r^3} \quad - (11)$$

$$\underline{E}^{\circ} = \frac{\underline{F}}{e_1} = -\phi^{(0)}\frac{GM}{\dots} \quad - (12)$$

4) <u>Interpretation</u>

The Newton laws and Coulomb laws originate in different aspects of geometry. The former originates in curvature and the latter in torsion. This is seen from the fact that <u>the Newton law is obtained from</u>:

$$\boxed{\begin{aligned} q \wedge R &= 0 \quad &-(13) \\ \text{and} \qquad T &= 0. \quad &-(14) \end{aligned}}$$

The Newton law is obtained from $q \wedge \tilde{R}$, which translates into eqn. (5) in the Schwarzschild metric. If it is assumed that there is a quantity $\underline{g}$ defined by R according to eqn. (4) then the inverse square law of Newton follows as in eqns (9) and (10). The Newton second law also follows from the Evans wave equation in the non-relativistic limit. The quantity $\underline{g}$ is therefore identified as <u>the acceleration due to gravity</u>. This procedure is very rich in interpretation and we have only scratched the surface here.

The Coulomb law is obtained from:

$$\boxed{\begin{aligned} d \wedge \tilde{T} &= \cancel{A}\, q \wedge \tilde{R} \quad &-(15) \\ T &\neq 0. \quad &-(16) \end{aligned}}$$

From comparison of eqns. (14) and (16) it is seen that the torsion is zero in the Newton law and non-zero in the Coulomb law.

However, both laws have an inverse square dependence because both depend on scalar curvature R. The geometrical quantity common to both theories is

5) the quantity $q \wedge \tilde{R}$. In the Schwarzschild metric this given by eqn. (5). Therefore from eqn (12) the force between two charges is:

$$\boxed{\underline{F} = -\frac{e_1}{r^2}\left(\phi^{(0)}\frac{GM}{c^2}\right) = \frac{e_1 e_2}{4\pi\epsilon_0 r^2}} \quad -(17)$$

By convention the Coulomb law of electrostatics is written without a minus sign and with a factor 4π in the denominator. The Newton inverse square law of dynamics is written with a minus sign.

From eqn. (17) we obtain a fundamental mass / charge equivalence:

$$\boxed{\begin{aligned} e_2 &= -4\pi\epsilon_0 \phi^{(0)}\frac{GM}{c^2} \\ &= -8.25 \times 10^{-38}\phi^{(0)} M \end{aligned}} \quad -(18)$$

using:

$$4\pi\epsilon_0 = 1.112650 \times 10^{-10}\ J^{-1}C^2 m^{-1}$$

$$G = 6.67 \times 10^{-11}\ m^3 kg^{-1} s^{-2}$$

$$c = 2{,}997925 \times 10^{8}\ m\, s^{-1}$$

Eqn. (18) is a fundamental result which was also obtained in paper (3) of the unified field series. This is another cross-check. Eqn (18) means that for unit $\phi^{(0)}$ it takes 10^{38} units of mass to be

6) equivalent to one unit of charge. Apart from a minus sign and the factor 4π, eqn (18) is the same as eqn. (103) of paper 3.

Therefore the same result has been obtained using two entirely different methods, one based on the tetrad postulate, one on the Maurer Cartan structure equation.

The most important philosophical result is that the Newton and Coulomb inverse square laws have been unified. The most important engineering result is that the ability of mass to influence charge is given by eqn. (18). It takes enormous amounts of mass to be equivalent to one coulomb.

Recall that this calculation has been made in the approximation that the inhomogeneous equation can be written as in eqn. (15). This means that scalar curvature R is given by the Einstein theory and Schwarzschild metric. In this approximation it is seen from eqn (4) that the electric field has zero influence on g. To obtain such an influence one must use the

7) geometry defined by:

$$\boxed{\begin{aligned} d \wedge T &= -(\omega \wedge T + q \wedge R) \neq 0 \\ d \wedge \tilde{T} &= -(\omega \wedge \tilde{T} + q \wedge \tilde{R}) \neq 0 \end{aligned}}$$

— (19)

In this geometry the torsion and curvature are non-zero and the electromagnetic and gravitational fields interact. The field equations in this geometry are:

$$\boxed{\begin{aligned} d \wedge F &= -A^{(0)}(\omega \wedge T + q \wedge R) = \mu_0 j \\ d \wedge \tilde{F} &= -A^{(0)}(\omega \wedge \tilde{T} + q \wedge \tilde{R}) = \mu_0 J \end{aligned}}$$

— (20)

Only in this situation will electromagnetism have any effect on gravitation. The converse situation is also governed in general by these field equations. The Newton and Coulomb inverse square laws are only approximations, but excellent ones in the laboratory. In a cosmological context they are no longer such good approximations.