CLASSICAL UNIFIED FIELD THEORY OF THE EDDINGTON EFFECT

Define the Eddington effect as the refraction of light by spacetime near the sun. We consider the spacetime as a dielectric described by the basic equations:

$$d \wedge F = \mu_0 j \quad -(1)$$

$$d \wedge \tilde{F} = \mu_0 J. \quad -(2)$$

In the simplest case we assume that the interaction with matter does not change $\underline{E}$ and $\underline{B}$ of the source free field. This is the standard approximation used in the MH theory. This approximation means that:

$$j = -\frac{A^{(0)}}{\mu_0}\left(q \wedge R + \omega \wedge T\right) = 0 \quad -(3)$$

because for free space electromagnetism uninfluenced by the gravitational field:

$$q \wedge R + \omega \wedge T = 0. \quad -(4)$$

We now assume that for electromagnetism:

$$q \wedge \tilde{R} + \omega \wedge \tilde{T} = 0 \quad -(5)$$

in eqn. (2). This assumption is a minimal prescription and simplifies eqn (2) to:

$$d \wedge \tilde{F} = \mu_0 J = -A^{(0)} q \wedge \tilde{R} \quad -(6)$$

where $q \wedge \tilde{R}$ is the gravitational geometry of the Einstein Hilbert field theory.

2) In the Einstein Hilbert field theory:

$$q \wedge R = 0 \quad - (7)$$

$$\omega \wedge T = 0 \quad - (8)$$

but

$$q \wedge \tilde{R} \neq 0. \quad - (9)$$

In general, J of eqn. (6) is a sum of two terms:

$$J = J_f + J_p \quad - (10)$$

where J_f is due to free charge and J_p is due to polarization and magnetization in a dielectric. This can be seen from the structure of the Maxwell Heaviside inhomogeneous equations:

$$\underline{\nabla} \cdot \underline{D} = \rho \quad - (11)$$

$$\underline{\nabla} \times \underline{H} = \frac{\partial \underline{D}}{\partial t} + \underline{J} \quad - (12)$$

where:

$$\underline{D} = \epsilon_0 \underline{E} + \underline{P} \quad - (13)$$

$$\underline{H} = \frac{1}{\mu_0} \underline{B} - \underline{M} \quad - (14)$$

Eqn (12) can be rewritten in terms of the free fields $\underline{E}$ and $\underline{B}$ as:

$$\underline{\nabla} \times \underline{B} = \frac{1}{c^2} \frac{\partial \underline{E}}{\partial t} + \mu_0 \left(\underline{J} + \underline{J_p} \right) \quad - (15)$$

where:

$$\underline{J}_p = \frac{\partial \underline{P}}{\partial t} + \underline{\nabla} \times \underline{M} . \quad -(16)$$

In the absence of free charge, i.e. in a dielectric such as glass:

$$\underline{J} = \underline{0} \quad -(17)$$

and

$$\boxed{\underline{\nabla} \times \underline{B} = \frac{1}{c^2} \frac{\partial \underline{E}}{\partial t} + \mu_0 \underline{J}_p} \quad -(18)$$

We may generalize eqn. (18) to:

$$\boxed{d \wedge \tilde{F} = \mu_0 J_p} \quad -(19)$$

Finally we assume that:

$$J_p = -\frac{A_p^{(0)}}{\mu_0} q \wedge \tilde{R} . \quad -(20)$$

where $A_p^{(0)}$ is the equivalent of $A^{(0)}$ for an uncharged dielectric.

The Eddington effect is described by eqns. (19) and (20) as <u>the refraction of light in a dielectric</u>. The mass of the sun creates $q \wedge \tilde{R}$ in the regions where starlight grazes the sun in an eclipse.

4) The refraction of light in a dielectric is a standard problem of classical electrodynamics (e.g. Jackson, chapt 7, 3rd. ed.). It is accompanied by a change in refractive index brought about by the fact that ϵ and μ of the dielectric are different from the ϵ_0 and μ_0 of free space, defined by:

$$\epsilon_0 \mu_0 = \frac{1}{c^2} \quad -(21)$$

The refraction causes the beam of light to be deflected in a solar eclipse. This effect cannot be explained by the Maxwell Heaviside field theory because it is not a unified field theory, so:

$$q \wedge \tilde{R} = 0 \quad -(22)$$

effectively.

In the Evans unified field theory the Eddington effect is due to $\frac{1}{J_p}$ of eqn. (20), $q \wedge \tilde{R}$ being due to the mass of the sun.

Quantitative Calculation

The quantity $q \wedge \tilde{R}$ can be calculated from standard general relativity given the curvature of the sun, and given the

5) Schwarzschild metric. Therefore the only unknown is $A_p^{(0)}$. This is a primordial or universal quantity and as such must be determined experimentally. It is a new fundamental constant of physics.

Classically therefore the unified field theory of the Eddington effect produces all the familiar phenomena of e/m radiation interacting with a dielectric. These are kinematic and dynamic in nature as described by Jackson 3rd ed., pp. 303 ff. We expect the refraction to be accompanied by change in intensity and phase. So we expect change in frequency akin to the gravitational red shift, and absorption and dispersion as in dielectric spectroscopy.

Note carefully that all these changes are due to $q \wedge \tilde{R}$, and do not occur in Maxwell Heaviside field theory.

SO THIS INITIATES A NEW ERA IN PHYSICS.