82(1): Effect of Gravitation on IFE and FE

From previous work the effect of gravitation on IFE and FE is developed in paper 82 using the rule:

$$m \rightarrow \frac{\hbar}{c} (kT)^{1/2} \quad — (1)$$

which comes from:

$$kT = \frac{m^2 c^2}{\hbar^2} . \quad — (2)$$

Eq. (2) holds for the free fermion, so the presence of gravitation will change $(mc/\hbar)^2$ to kT. The fermion (electron) is no longer free because it is influenced by a gravitational field. The latter's influence may be developed in a series of approximations. In the first approximation it may be assumed that the electromagnetic field is not affected by the gravitational field. In a better approximation both the fermionic and e/m fields are affected by the gravitational field.

In the first approximation, ϕ and $\underline{A}$ are not changed, but m is changed wherever it occurs by the rule (1). From paper 81 we have seen that the kinematics of IFE and FE for the free fermion on the classical level are as follows.

2)

Angular Momentum of Electron

$$\underline{J} = \gamma_0 \underline{r_0} \times \underline{p} + e \underline{r_0} \times \underline{A} + e \int \underline{A}\, dt \times \underline{v} + \frac{e^2}{m\gamma} \int \underline{A}\, dt \times \underline{A} \quad -(3)$$

and its magnitude is:

$$J = \left(r + \frac{eA}{\gamma m \omega} \right) \left(\gamma m v + eA \right). \quad -(4)$$

Kinetic Energy of Electron

$$T = \frac{(\gamma m v + eA)^2 c^2}{mc^2 (1+\gamma) + e\phi} \quad -(5)$$

Angular Velocity of Electron

$$\Omega = \frac{(\gamma m v + eA) c^2}{\left(r + \frac{eA}{\gamma m \omega} \right) \left(mc^2 (1+\gamma) + e\phi \right)} \quad -(6)$$

Angular Velocity of Electromagnetic Field.

$$\omega = \frac{eA\Omega}{\gamma m (x - \Omega r)}, \quad -(7)$$

$$x = \frac{(\gamma m v + eA) c^2}{mc^2 (1+\gamma) + e\phi}. \quad -(8)$$

3) So all these kinematics are affected by gravitation according to rule (1).

In the second approximation the electromagnetic field is also affected by gravitation. So the minimal prescription:

$$p^\mu \rightarrow p^\mu - eA^\mu \quad -(9)$$

is changed. This means that:

$$\underline{A} \rightarrow \left(\frac{\hbar}{mc} (kT)^{1/2} \right) \underline{A} \quad -(10)$$

$$\phi \rightarrow \left(\frac{\hbar}{mc} (kT)^{1/2} \right) \phi \quad -(11)$$

In an even better approximation the relation between potential and field is also changed, because the homogeneous current is now non-zero:

$$j = \frac{A^{(0)}}{\mu_0} \left(R \wedge q - \omega \wedge T \right) \neq 0 \quad -(12)$$

So the spin connection must now be considered.

So paper 82 will proceed in this way.