179(1): The Generally Covariant Fermion Equation.

This equation can be derived straightforwardly from the ECE wave equation:

$$(\square + R)\,\phi = 0 \quad -(1)$$

where ϕ is a tetrad. The fermion equation is the limit:

$$R \rightarrow \left(\frac{mc}{\hbar}\right)^2. \quad -(2)$$

Conversely, the fermion equation can be generalized by:

$$mc^2 \rightarrow \left(\frac{\hbar^2}{m}\right)R, \quad -(3)$$

where R is positive valued. Therefore the generally covariant fermion equation is:

$$\left(E - V - c\underline{\sigma}\cdot\hat{\underline{p}}\right)\phi^R = \frac{\hbar^2}{m} R\,\phi^L \quad -(4)$$

$$\left(E - V + c\underline{\sigma}\cdot\hat{\underline{p}}\right)\phi^L = \frac{\hbar^2}{m} R\,\phi^R \quad -(5)$$

Defining the kinetic energy as:

$$\epsilon = E - \frac{\hbar^2}{m} R \quad -(6)$$

then in the notation of UFT 178:

$$(\epsilon - V)\,\phi^R_S = c\underline{\sigma}\cdot\hat{\underline{p}}\,\phi^L_S \quad -(7)$$

$$\left(\epsilon - V + \frac{2\hbar^2 R}{m}\right)\phi^L_S = c\underline{\sigma}\cdot\hat{\underline{p}}\,\phi^R_S \quad -(8)$$

Eqs. (7) and (8) give:

2)

$$(\epsilon - V)\phi_s^R = \frac{mc^2}{2\hbar^2 R}\, \underline{\sigma}\cdot\underline{\hat{p}} \left(\frac{\underline{\sigma}\cdot\underline{\hat{p}}\,\phi_s^R}{1 + \frac{m(\epsilon - V)}{2\hbar^2 R}} \right) \quad -(9)$$

If:

$$\frac{m(\epsilon - V)}{2\hbar^2 R} << 1 \quad -(10)$$

Then:

$$\boxed{(\epsilon - V)\phi_s^R = \frac{mc^2}{2\hbar^2 R}\, \underline{\sigma}\cdot\underline{\hat{p}} \left(\left(1 - \frac{m(\epsilon - V)}{2\hbar^2 R} \right) \underline{\sigma}\cdot\underline{\hat{p}}\,\phi_s^R \right)}$$

$$-(11)$$

In eq. (11), R is defined by the tetrad postulate:

$$D_\mu q^a_\nu = \partial_\mu q^a_\nu + \omega^a_{\mu b} q^b_\nu - \Gamma^\lambda_{\mu\nu} q^a_\lambda \quad -(12)$$

$$= 0.$$

Define:

$$\omega^a_{\mu\nu} = \omega^a_{\mu b} q^b_\nu \quad -(13)$$

$$\Gamma^a_{\mu\nu} = \Gamma^\lambda_{\mu\nu} q^a_\lambda \quad -(14)$$

then

$$\partial_\mu q^a_\nu = \Gamma^a_{\mu\nu} - \omega^a_{\mu\nu} \quad -(15)$$

and

$$\Box q^a_\nu = \partial^\mu (\Gamma^a_{\mu\nu} - \omega^a_{\mu\nu}) \quad -(16)$$

3) The scalar curvature R is defined by:

$$\Box q^a_{\nu} = -R q^a_{\nu} = \partial^\mu \left(\Gamma^a_{\mu\nu} - \omega^a_{\mu\nu} \right) \quad -(17)$$

i.e

$$\boxed{R = q^{\nu}_{a} \partial^\mu \left(\omega^a_{\mu\nu} - \Gamma^a_{\mu\nu} \right)} . \quad -(18)$$

In general, R is a function of distance and of time, and changes under the influence of gravitation.

In the absence of gravitation:

$$R \rightarrow \left(\frac{mc}{\hbar} \right)^2 \quad -(19)$$

In generally covariant unified field theory, R is changed when the fermion interacts with any other field, including another fermion field.

Therefore eq. (11) is:

$$E \phi = \hat{H} \phi \quad -(20)$$

$$\hat{H} = \frac{\hbar^2 R}{m} + V + \frac{mc^2}{2\hbar^2 R} \hat{p}^2 \quad -(21)$$

$$- \frac{m^2 c^2}{4 \hbar^4 R} \underline{\sigma} \cdot \underline{\hat{p}} \left(\frac{(E - V)}{R} \underline{\sigma} \cdot \underline{\hat{p}} \phi \right)$$

$$\phi = \phi^R_S \quad -(22)$$