172(2): Fermion and Antifermion Equations, Chiral Rep.

Fermion

1) ECE Equation in Z Axis

$$\sigma^0 \hat{E} \begin{bmatrix} \psi_1^R & \psi_2^R \\ \psi_1^L & \psi_2^L \end{bmatrix} - c \hat{p}_z \sigma^3 \begin{bmatrix} \psi_1^R & \psi_2^R \\ \psi_1^L & \psi_2^L \end{bmatrix} \sigma^3 = \sigma^1 mc^2 \begin{bmatrix} \psi_1^R & \psi_2^R \\ \psi_1^L & \psi_2^L \end{bmatrix} \quad -(1)$$

$$\hat{E} = i\hbar \frac{\partial}{\partial t}, \quad \hat{p}_z = -i\hbar \frac{\partial}{\partial z} \quad -(2)$$

2) Dirac Equation

$$\left(\gamma^0 \hat{p}_0 - \gamma^i \hat{p}_i - mc \right) \begin{bmatrix} \psi_1^R \\ \psi_2^R \\ \psi_1^L \\ \psi_2^L \end{bmatrix} = 0 \quad -(3)$$

$$\hat{p}_0 = \frac{\hat{E}}{c} \quad -(4)$$

Antifermion

1) ECE Equation in Z Axis

$$\sigma^0 \hat{E} \begin{bmatrix} \psi_1^L & \psi_2^L \\ \psi_1^R & \psi_2^R \end{bmatrix} + c \hat{p}_z \sigma^3 \begin{bmatrix} \psi_1^L & \psi_2^L \\ \psi_1^R & \psi_2^R \end{bmatrix} = \sigma^1 mc^2 \begin{bmatrix} \psi_1^L & \psi_2^L \\ \psi_1^R & \psi_2^R \end{bmatrix} \quad -(5)$$

2) Dirac Equation

$$\left(\gamma^0 \hat{p}_0 + \gamma^i \hat{p}_i - mc \right) \begin{bmatrix} \psi_1^L \\ \psi_2^L \\ \psi_1^R \\ \psi_2^R \end{bmatrix} = 0 \quad -(6)$$