

ISOMORPHISM CONNECTING THE FREE FIELD DIRAC EQUATION AND MAXWELL'S EQUATIONS

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S u m m a r y

It is known that if one considers the state spinor $\psi(x)$ as a field operator satisfying the Dirac equation in interaction with a Maxwell field, then it satisfies [1]

$$(i\gamma \frac{\partial}{\partial x} - m)\langle 0|\psi(x)|p\rangle = -\bar{\Sigma}_1^{(0)}(m^2)\langle 0|\psi^{(0)}(x)|p\rangle,$$

where the right-hand side comes from higher order interactions in the current operator $j^\mu(x) = \langle \bar{\psi}(x)|\gamma^\mu\psi(x)\rangle$. In the above equation, the theoretical mass of an electron should be infinite to compensate with the mass renormalization part $\bar{\Sigma}_1^{(0)}(m^2)$. In the present paper, in discussing the connection between the free field Maxwell's equations and the free field Dirac equation, we assume the bare mass of a lepton to be finite. The isomorphism connecting an extended Dirac equation [2, 3] with the free Maxwell's equation is also discussed.