PROBLEM SET 5– due Wed. 5-21

Physics 215C- Quantum Mechanics, SPRING 2008

1. Solve the Klein-Gordon equation for a plane wave incident from the left on a potential step $V(x) = 0$ for $x < 0$ and $V(x) = +V_0$ for $x > 0$. Compute the reflection and transmission coefficients. Discuss the three cases (i) $eV_0 < E_p - mc^2$; (ii) $E_p - mc^2 < eV_0 < E_p + mc^2$; and (iii) $eV_0 > E_p + mc^2$. Here $E_p = \sqrt{c^2p^2 + m^2c^4}$. Are there any strange features in your result?

2. Solve the Dirac equation for a plane wave incident from the left on a potential step $V(x) = 0$ for $x < 0$ and $V(x) = +V_0$ for $x > 0$. Compute the reflection and transmission coefficients. Is there still a "Klein paradox" (see preceding problem)?