Physics 829: Problem Set 4

Due Wednesday, April 23, 2008 at 11:59 PM

Each problem is worth 10 points, unless otherwise stated.


2. (20pts.) Shankar, 20.2.2.

3. Consider an electron of momentum $p$ traveling in the positive $x$ direction and incident on a potential barrier of height $V$ located at $x = 0$.

   (a). Calculate the reflection and transmission coefficient of the barrier by solving the Dirac equation, under the assumption that $V < E + mc^2$, where $E$ is the incident energy.

   (b). What strange prediction emerges from this calculation if $V > E + mc^2$? Interpret in terms of the Dirac hole theory. [This is known as the “Klein paradox” (Klein, 1929)].