

Physics 829: Problem Set 4

Due Wednesday, April 29, 2009 at 11:59 PM

Each problem is worth 10 points, unless otherwise stated.

1. Shankar, problem 20.1.1.
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)].