

SET 7–DUE 4 MARCH

“The nonmathematician is seized by a mysterious shuddering when he hears of ‘four-dimensional’ things, by a feeling not unlike that awakened by thoughts of the occult. And yet there is no more commonplace statement, that the world in which we live is a four-dimensional space-time continuum.”—A. Einstein

The midterm exam is Monday March 9 7-830 PM in Duane G-125

- 1) [20 points] Jackson 11.20 In part (b), at the end, I had to make a graph and look for its maximum to get an answer of about 5 degrees.
- 2) [20 points] A particle originally at rest and with initial rest energy  $m_1 = m + \Delta E$  emits a photon and decays to a particle of rest energy  $m$ . What is the energy of the photon? Check explicitly the limiting cases  $m \gg \Delta E$ , and  $m = 0$ . ( $c = 1$  here) Analogs of these cases are the decay of the 2P state of hydrogen to the 1S state, and the decay  $\pi^0 \rightarrow \gamma\gamma$ .
- 3) A beam of light of frequency  $\omega$  travelling in the  $x - y$  plane (at an angle  $\theta_0$  with respect to the  $x$  axis) is reflected from a mirror moving with velocity  $v$  in the  $x$  direction. Calculate  
(a) [10 points] the frequency of the reflected beam and b) [10 points] the angle of reflection (in the frame where the incident angle is  $\theta_0$ ).