Massachusetts Institute of Technology

Department of Physics

Course: 8.701 – Introduction to Nuclear and Particle Physics
Term: Fall 2020
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Discussion Problems
from recitation on **September 3rd, 2020**

Problem 1:   Gamma Factor for LEP Electron

At LEP @ CERN, electrons and positrons were accelerated to $100\,\text{GeV}$. How large was γ?

Problem 2:   Splitting the Deuteron

How much energy do we need to split a proton and neutron (deuteron)?

Problem 3:   Photon emission and absorption

An excited particle emits a photon. Under which condition can this photon be reabsorbed?

Problem 4:   Fixed-Target $\bar{p}$ Production

What is the minimal beam energy in a proton on proton fixed target experiment to produce anti-protons?

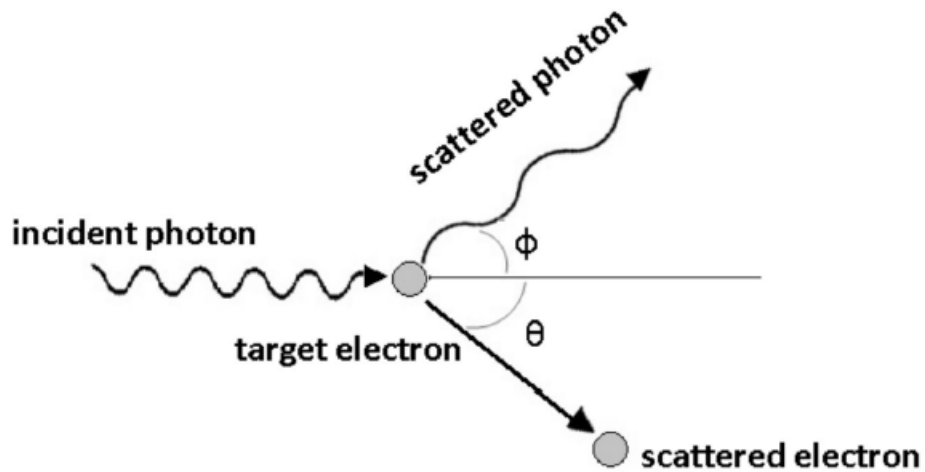## Problem 5:   Pion Decays

Assume the decay of a pion at rest into an electron and positron. How fast are the decau products?

Problem 6:   Fixed-Target Pion Production

What is the minimal beam energy of a proton colliding with a proton at rest to produce a $p + n + \Pi^+$?

Problem 7:   Compton Effect

The energy of a photon is $E = h\nu = \frac{h}{\lambda}$. Calculate the change in the photon's wavelength.

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