

## 22.101 Applied Nuclear Physics

(Fall 2006)

### Problem Set No. 7

Due: Nov. 13, 2006

#### Problem 1

Show that alpha particles and protons having the same initial speed (high speed but nonrelativistic) have approximately the same range in any stopping material. Examine the figu to see which particle should have a slightly longer range. Justify your answer.

#### Problem 2

The range-energy relationship for protons in air at 1 atm. and 15° C, given in Meyerhof as Fig. 3.9 is attached below. From this deduce the energy loss (in Mev cm<sup>2</sup>/gm) curve for the same energy range. Compare your result with Fig. 13.2 in the Lecture Notes as well as analyze your result using the Bethe formula.

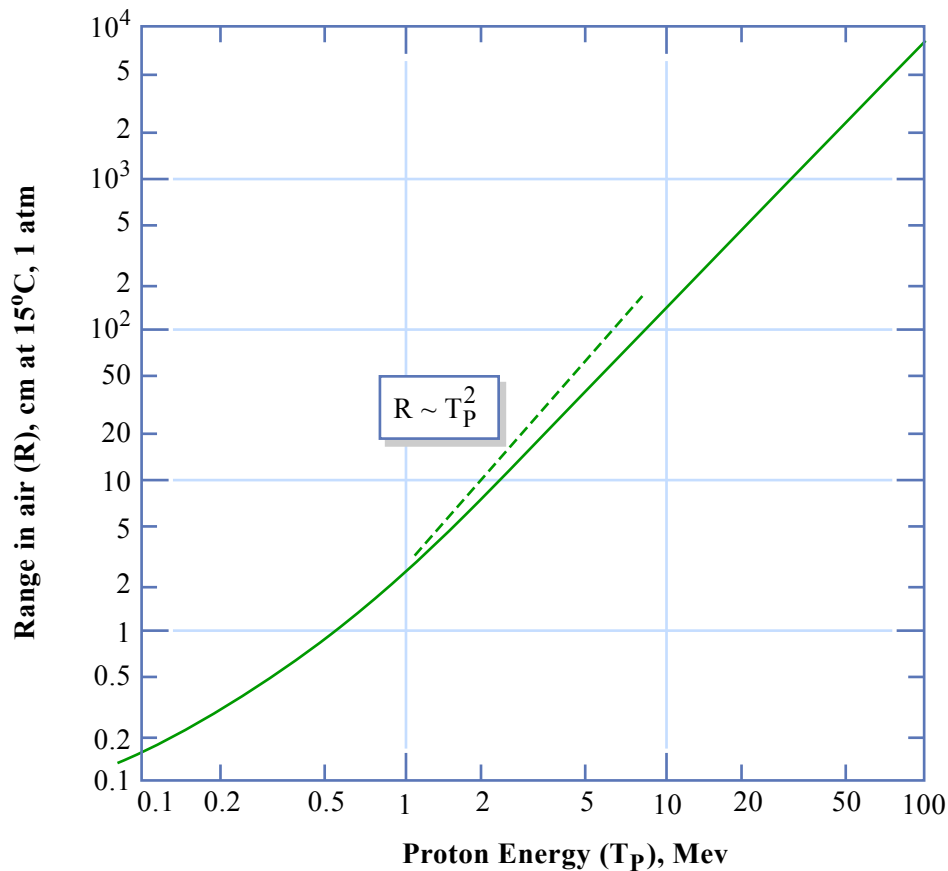


Figure by MIT OCW.

#### Problem 3

Estimate the contributions to the stopping power due to ionization and to radiation for the passage of electrons with energy E in aluminum. Consider E = 0.1, 0.5, 1, 2, and 4 Mev.

Express your results in a sketch (in units of Mev/mm and Mev cm<sup>2</sup>/gm) and compare with those given in the Lec14. Discuss the significance of your results and the comparison.

**Problem 4**

Consider neutron elastic scattering where the target nucleus can be taken to be at rest.

- (a) Derive the Q-equation and show that Eq.(15.7) is a solution.
- (b) Show that in CMCS the magnitudes of the neutron and target nucleus velocities remain unchanged after the scattering.
- (c) Derive Eq.(15.15) using Fig. 15.2(c).