

**22.106 Neutron Interactions and Applications
(Spring 2005)**

Problem Set No. 1

Due: Feb. 10, 2005

You are asked to reflect on two historical events of note.

Problem 1

Read Chadwick's 1932 paper in Chadwick, James. "Possible Existence of a Neutron." *Nature* (Feb. 27, 1932): 312 on the possible existence of a neutron, and then answer the following questions briefly and concisely.

- (a) State in no more than two sentences what is the problem Chadwick addressed. In other words, what is the controversy that Chadwick intended to resolve?
- (b) What are the experimental results that Chadwick cited to show that there is an unresolved problem?
- (c) Explain what was meant by the Compton effect (interaction between what and what) brought up by Chadwick in the early part of the paper?
- (d) What was Chadwick resolution to the controversy that he raised? What argument did he use to support his resolution, and was it of an experimental or theoretical nature?
- (e) How did Chadwick arrive at his postulate of the existence of a neutron?
- (f) Was Chadwick very sure of his conclusion? Did he leave the door open for other possible explanations? What exactly was the quantum hypothesis mentioned in the final sentence?
- (g) Write an abstract of Chadwick's paper in not more than 4 normal sentences.

Problem 2

Read the paper by Emilio Segré in Segre, Emilio G. "The Discovery of Nuclear Fission." *Physics Today* (July 1989) on the discovery of nuclear fission, and then answer the following questions briefly and concisely.

- (a) Why was the discovery of fission such a surprise? Describe the problem the various researchers were trying to solve at the time of the discovery.
- (b) State as clearly as you can the precise result on which the discovery was based. What is so special about this result (why didn't other people see it)?
- (c) Give the citation of the paper in which the discovery was announced. Was there any competition?
- (d) Comment on the award of the Nobel Prize for this discovery (do you think others should be acknowledged).
- (e) *Briefly* discuss (in your own words) the implications of this discovery.