

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.811

Fall Term 2003

PROBLEM SET 4

Due: November 4, 2003.

Problem 1

Halzen and Martin, exercise 15.2

Problem 2

Show that the Yukawa Lagrangian (Halzen and Martin 15.31) is $SU(2)_L \times U(1)_Y$ invariant.

Problem 3

Halzen and Martin, exercise 15.6

Problem 4

Make a back-of-the-envelope estimate for a lifetime limit of the proton, using the fact that you are rather unlikely to die from radiation damage during the time period that you are taking 8.811. A unit of radiation dosage is 1 rad = 100 ergs/gram. Assume that the dominant decay mode of the proton is $p \rightarrow e^+ \pi^0$. The annual permissible radiation dose to humans is 5 rad.

Problem 5 (bonus)

How many elephants were on parade down Vassar St.?