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 **October 8th, 2020**

Problem 1:   Hadron production

An impressive way to display the structure of leptons and quarks, we define R as the ratio of cross section to hadrons over the cross section to muons. a) Discuss what can be learned from this ratio. b) How would the result change if we define the ratio using the cross section to electrons. Evaluate

- a) One can read the number of quarks, i.e. flavor and color from the ratio. When studied as a function of energy, on can also find the masses of the quarks. b) There is a second diagram in the elastic case, and this means that the kinematic factors do not cancel , as they do for the muons.

Problem 2:   Vacuum polarization with quarks and gluons

Draw diagrams of vaccum polarization including quarks and gluons. Discuss the differences between QED and QCD vacuum polarization.

- See lecture 5.5.

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