Physics 570 Homework 2

Due September 26, 2018

Problem 1 (20 points)

Problem 1.6 of Thomson

Problem 2 (10 points)

Problem 2.12 of Thomson

Problem 3 (40 points)

Problem 13.4 of Thomson

Problem 4 (30 points)

Of the following processes, state which are allowed or forbidden according to the Standard Model (in a reaction A + B → C + D, assume that the beam energy is above the threshold for producing the particles in the final state). If they are allowed, state which interaction is primarily responsible (strong, electromagnetic, or weak). If they are forbidden, give the reason why.

a) $\Lambda \to \Sigma^- + \pi^+$

b) $\pi^\circ \to \gamma + \gamma$

c) $\gamma + e^- \to e^-$

d) $p + \bar{p} \to \Lambda + \bar{\Lambda}$

e) $n \to p + e^-$

f) $\bar{\nu}_e + p \to e^+ + n$

g) $\Lambda \to \pi^+ + e^-$

h) $e^+ + e^- \to \nu_\mu + \bar{\nu}_\mu$

i) $K^- + p \to K^+ + \Xi^-$

j) $\pi^- + p \to \pi^\circ + \Lambda$

Some properties of the particles:

Λ: baryon, quarks content: uds, mass: 1115.7 MeV

Σ^-: baryon, quarks content: dds, mass: 1197.4 MeV

p: baryon, quarks content: uud, mass: 938.3 MeV

n: baryon, quarks content: udd, mass: 939.6 MeV

Ξ^-: baryon, quarks content: dss, mass: 1321.3 MeV

K^+: meson, quarks content: $u\bar{s}$, mass: 493.7 MeV

π^+: meson, quarks content: $u\bar{d}$, mass: 139.6 MeV

π°: meson, quarks content: $u\bar{u}(d\bar{d})$, mass: 135.0 MeV