

Homework 5

Due on Wednesday November 12, 3:00 pm

21 + 6 (bonus) = 27 points

Problem 1 (4 points)

Who was the first to detect muons? When? (1 point)

How did they know that the newly detected particles were neither electrons nor protons? (1 point)

What did they think they had discovered? (1 point)

What are muon lifetime and mass? (1 point)

Problem 2 (1 points)

Why is the τ -lepton lifetime so different from the muon lifetime? (1 point)

Problem 3 (4 points)

Who suggested the existence of neutrino? Why? (1 point)

Who discovered the neutrino? When did it happen and why did it take so long? (1 point)

Why do low energy neutrinos have a so small interaction cross section? (1 point)

How do we know that neutrinos occur in three different kinds: e.g., how was it proven that the muon-kind neutrino is different from the electron-kind neutrino? (1 point)

Problem 4 (1 point)

What was so strange about the strange particles that even gave them this name? (1 point)

Problem 5 (1 point)

What are the two distinct methods that can be used in searching for resonances in π^+p -system? (1 point)

Problem 6 (5 points)

Give the quark composition of Δ^{++} and Ω^- particles. (1 point)

What are their spins? (1 point)

What are their lifetimes? (1 point)

Why are the lifetimes so different? (2 points)

Problem 7 (2 points)

What were the first three quarks introduced by Gell-Mann and Zweig? (1 point)

List their charges, spins? (1 point)

Why did one have to introduce a new quantum number "color"? (1 point)

Problem 8 (3 points)

What was the first discovered particle that would have c-quarks in it? Who discovered it? (1 point)

What was the first discovered particle that would have b-quarks in it? Who discovered it? (1 point)

How was the t-quark discovered? (1 point)

Bonus Problem 8 (6 bonus points)

Assuming that the up and down quarks have masses of about 340 MeV and the strange quark's mass is 510 MeV, estimate the magnetic moment of Σ^0 -baryon.