

Nuclear and Particle Physics - Problem Set 6

Problem 1)

Using all the references you can find (PDG, our book, lecture notes and white board captures), answer the following question (be as specific and detailed as possible).

- a) List all truly **fundamental** particles that have already been discovered. How many are there?
- b) How many **more** are there if you also count antiparticles? (careful!)
- c) List at least 3 baryons and 3 mesons that are stable against strong decay. Write down their quark content. (Just list the constituent quarks/antiquarks).
- d) What particles does the negative muon (μ^-) decay into? Why can't it decay into just 2 particles?
- e) Why is the Weak Interaction so much weaker than the electromagnetic one, at least in everyday life?
- f) Which of the 4 fundamental interactions do neutrinos experience?
- g) Do W^+ bosons obey the Pauli principle? Why or why not?
- h) List at least one basic decay mode of the charmed quark c . (Write down the decay sequence in terms of fundamental particles only).
- i) List at least 3 "unsolved mysteries" (experimental facts or theoretical requirements that are not explained or predicted by the Standard Model).
- j) Which Standard Model particle has neither spin $\frac{1}{2}$ nor spin 1?