Assignment sheet: Week 3 (Jan 27)

After the third week of class you should be able to answer each of the following questions thoroughly, and with confidence. You should have this sheet completed by: Tuesday, Feb 3

1. What is the property that “causes” the electromagnetic (E/M) force?
2. Which particles have this property, and therefore participate in the E/M force?
3. What particle is the force carrier for the E/M force?
4. What are the rules that describe how the E/M force works?
5. Using your answers to the previous three questions, write a sentence or two describing the process that occurs when two electrons are repelled by each other, or when an electron and a proton are attracted to each other.
6. What is the property that “causes” the strong force?
7. Which particles have this property, and therefore participate in the strong force?
8. What particle is the force carrier for the strong force?
9. What are the rules that describe how the strong force works?
10. How many quarks are there, total? Identify them, grouping them together into their proper families.
11. Which quarks bundle together to make a proton? A neutron?
12. How many leptons are there? Identify them, grouping them together into their proper families.
13. How many force carrier particles are there? Group them according to which force they carry.
14. What process does the weak force govern?
15. Why is all stable matter made of the lowest mass quarks (the up and down quarks) and the lowest mass lepton (the electron — the electron neutrino doesn’t count!)?
16. Which force or interaction can not yet be described by the Standard Model of particle physics?
17. According to string theory, an electron is not a particle. What is it instead?
18. How are superstring theories different than other string theories?
19. Identify at least two different considerations that give rise to different string theories.
20. Define by way of description each of the following types or groups of particles:
   quark hadron baryon meson lepton electron muon tau neutrino proton neutron photon gluon fermion boson