

# Physics 225a Problem Set 1

Harry Nelson

due Monday, Oct. 6 in class

- 
1. Go to <http://pdg.lbl.gov> and 'Order PDG products' (on the left bar). Order all books, unless you are completely comfortable with .pdf downloads. In any case, order the booklet in hardcopy.
  2. Draw the Feynman diagrams for, and estimate the order in  $\alpha$  (including powers of  $Z$ ) of the rates for:
    - (a) Bremsstrahlung...  $e^- + Z \rightarrow e^- + \gamma + Z$ , where  $Z$  is an (unshielded) atomic nucleus of charge  $+Z$ .
    - (b) Pair Production...  $\gamma + Z \rightarrow e^+e^-Z$ .
    - (c) Triplet Production...  $\gamma + e^- \rightarrow e^+e^-e^-$ , where the initial  $e^-$  is one of the  $Z$  electrons in an atom of atomic number  $Z$ .

The first two of these processes combine to make what is known as an 'electromagnetic shower,' which has been exploited since 1920 or so to identify high energy electrons; the LHC detectors certainly exploit this phenomenon.

3. What are you most interested in learning about Experimental Particle Physics?
-