Physics 225A First Problem Set

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1. Visit the Particle Data Group web site (there is a link on the course web page, and the URL is `pdg.lbl.gov`), and register for them to send you the 'free products,' These are the Review of Particle Physics (RPP), the Particle Physics Booklet, a pocket diary, a plastic cover, and two other documents.

   The RPP is all the Web now; use the Web versions to answer subsequent questions, when appropriate.

2. Nuclear collision lengths (λ_T) are usually reported in gram/centimeters^2; see, for example, the 'Table of Atomic and Nuclear Properties' in the RPP, also linked to the course assignments/outline page. To get the length in centimeters, you divide by the mass density of the material.

   (a) Why use gram/centimeters^2?

   (b) How does it turn out that uranium has a longer λ_T than hydrogen, when measured in those units?

3. What is the quark content, respectively, of the Σ^+ and Σ^- baryons? Are those baryons related by charge conjugation?

4. Is the neutron 'strictly neutral'? Explain your reasoning.

5. We will discuss in class that the masses of the weak gauge bosons, the W and the Z^0, are important and fundamental physical parameters. The error recommended by the PDG on the mass of the W fell by nearly a factor of 2 between 1998 and 1999. What experimental technique led to the error reduction? Look at the 'abstract page' of most recent paper that describes the measurement of the W mass, on the LASL preprint server on the Web (there is a link on the course Web page, and the URL is `xxx.lanl.gov`). The `hep-ex` number is in the 1999 RPP update; it is also very useful to know that if you have the `hep-ex` number, for instance `hep-ex/9909028`, you can just proceed directly to the URL `xxx.lanl.gov/abs/hep-ex/9909028`.

   On the abstract page of the most recent RPP W mass measurement, you can find a link to the *later* papers that have referenced the RPP W mass measurement paper. Indeed, there is a new measurement already. Look carefully at pages 68 and 69 of the paper that describes the new measurement; what do you conclude from Figure 61?