Physics 125 First Problem Set

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1. Go to the course web page, `http://hep.ucsb.edu/courses/ph125/`, and from there, go the 'Particle Data Group Order Form' web page. Order the free 'Particle Physics Booklet,' and any of the other 3 free items that you want. Nothing will arrive, unfortunately, until the summer of 2002. Until then, the only option is to use the online particle data group (PDG) website, which has a link available through the course web page.

2. From the course web page, go to the Particle Data Group, and then to the Summary Tables, and look up the lower limit on the mass of the neutral higgs boson H^0 there. Is it the same as that given in the handouts?

3. Find the numerical value of $\beta = v/c$ for an electron with:

   (a) kinetic energy (defined as the difference between the total energy, E, and $m_e c^2$) of 20 eV;

   (b) momentum $p = 5m_e c$.

4. The mass of the sun is $m_s = 1.99\times10^{30}$ kg, and the radius of the sun is $r_s = 6.96\times10^{8}$ m. Evaluate the numerical values of

   (a) the mean spacing between nucleons in the sun

   (b) the mean spacing between nucleons in an object with the same mass as the sun, but that has just barely collapsed into a black hole.

5. Consider two particles, both of mass m, that are bound together by gravity alone. Use the Bohr atom for a quantum mechanical evaluation of the binding energy of the system, and then imagine increasing m until the binding energy cancels out the total initial rest energy of $2mc^2$. Evaluate the numerical value of m.