

# Physics 125 Second Problem Set

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1. Use the particle data web site to find the name and mass of the recently observed meson that contains one  $b$  quark and one  $\bar{c}$  quark.
2. A reasonable approximation for typical strong interaction cross sections is to assume that nucleons are, in projection, hard spheres of radius  $1/2$  fermi ( $10^{-15}$  m). If a high energy proton penetrates normal water, how far must it go, on average, before experiencing one interaction? Ignore any consideration of the 'shielding' of nucleons by one another.
3. I said in class that the Poisson probability to see 1 event,  $\mathcal{L}(1)$ , was less than 1, for an arbitrary  $\mu$ . Prove that, and give the smallest upper bound on  $\mathcal{L}(1)$ . Repeat for  $\mathcal{L}(2)$ .
4. For a Poisson distribution with mean  $\mu$ , find the variance, which is  $\langle n^2 \rangle - \langle n \rangle^2$ .