

Exercises, part 9

Thursday 2003-12-11 - Thursday 2004-01-08 16:00

1. Recent CDF paper on heavy quark state

10 points

Read the paper

D. Acosta et al., (CDF collaboration), ‘Observation of the Narrow State $\mathbf{X(3872)} \rightarrow \mathbf{J/\Psi} \pi^+ \pi^-$ in $\bar{p}p$ Collisions at $\sqrt{s} = 1.96 \text{ TeV}$ ’, Fermilab-PUB-03/393-E, subm. to Phys. Rev. Lett.

i) Please answer the following questions:

- a) What is the expected mass spectrum of $c\bar{c}$ bound states ? (diagram)
- b) Which of those $c\bar{c}$ bound states have already been found ? What are the measured masses ?
- c) How can $c\bar{c}$ states be created in decays of light B mesons ?
- d) What is the Belle experiment ?
- e) Are there other hadronic particles suspected to be either a meson-meson molecule or a meson-baryon bound state ?
- f) Why is $S/\sqrt{S+B}$ the ‘significance’ ?
- g) Estimate the CDF detector resolution for the mass measurement of the $\mathbf{X(3872)}$. Is the statement, that the observed width is consistent with the experimental resolution, correct ?
- h) Could one also use the $\mathbf{J/\Psi} \rightarrow e^+e^-$ decay mode to study the $\mathbf{X(3872)}$ decay ?

ii) Ask yourself two questions related to the paper!