Charm Production from Proton-Proton Collisions

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Using a hadronic model based on the SU(4) flavor-invariant Lagrangian with empirical masses and coupling constants, we have studied charmed hadron production from proton-proton reactions through the reactions pp → p $\overline{D}^{0}\Lambda_c^{+}$ and pp → p $\overline{D}^{*0}\Lambda_c^{+}$ [1]. These reactions involve exchange of pion, rho meson, D and D*, and their cross sections can be expressed in terms of the cross sections for the off-shell processes Mp → $\overline{D}^{*0}\Lambda_c^{+}$ and Mp → $\overline{D}^{0}\Lambda_c^{+}$, where M denotes one of the above exchanged off-shell mesons. With cutoff parameters in form factors adjusted to fit the cross section for strange hadron production in proton-proton reactions, the resulting cross section for charmed hadron production from proton-proton reactions at center-of-mass energy of 11.5 GeV is about 0.1 μb, comparable to the measured inclusive cross section [2] as shown in Fig. 1. The predicted cross section decreases to about 1 nb at 40 MeV above threshold. Our results will be useful for the experiments to be carried out at future accelerator at the German Heavy Ion Research Center [3].

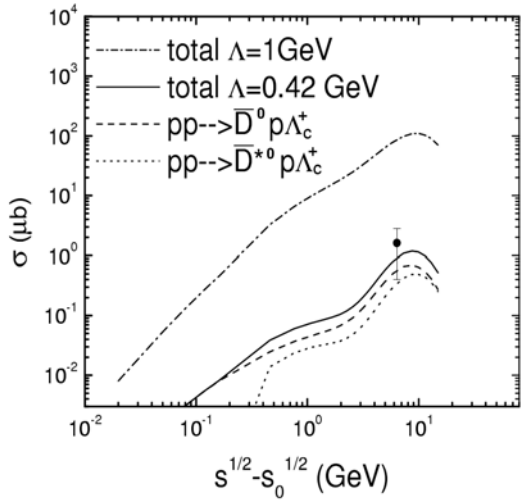

Figure 1. Cross sections for charmed hadron production in proton-proton reactions. Dashed and dotted lines are results obtained with empirical cutoff parameter Λ=0.42 GeV for pp → p $\overline{D}^{0}\Lambda_c^{+}$ and pp → p $\overline{D}^{*0}\Lambda_c^{+}$, respectively, while the total cross section is shown by the solid line. The threshold energy refers to that of the reaction pp → p$D^{0}\Lambda_c^{+}$. Experimental data [2] are shown by the filled circle. The dash-dotted line is the total cross section obtained with Λ=1.0 GeV.

[1] W. Liu, C.M. Ko, and S.H. Lee, Nucl. Phys. **A728**, 457 (2003).
[2] N.S. Amaglobei *et al.*, SVD Collaboration, Phys. At. Nucl. **64**, 891 (2001).
[3] See http://www.gsi.de/GSI-future.