

Mechanisms of $D\bar{D}$ pair production in $e^+e^- \rightarrow e^+e^-D\bar{D}$ and $AA \rightarrow AAD\bar{D}$ reactions and production of exotic charmonia

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We discuss the production of $D\bar{D}$ pairs in e^+e^- collisions, where D refers to either D^0 or D^+ [1].

The continuum mechanism with the t/u -channel vector-meson D^* exchanges are considered. The results of the calculation depend on the parameter of the off-shell form-factor for the virtual D^* mesons. The $D^*D\gamma$ coupling constants are found from the $D^* \rightarrow D\gamma$ decays.

We find relatively large contribution for the $D^0\bar{D}^0$ channel and much smaller contribution in the D^+D^- channel.

In the second case we consider also the D^\pm exchanges.

We conclude that the bump at $M_{D^0\bar{D}^0} = 3.8\text{-GeV}$ observed by the Belle and BaBar Collaborations has rather continuum origin than it corresponds to the broad resonance $\chi_{c0}(3860)$.

We discuss also production of the $\chi_{c2}(3930)$ resonance which is a candidate for the $\chi_{c2}(2P)$ state.

This state can decay into both $D\bar{D}$ channels, however the branching fractions are not well known at present.

From a comparison of our model results to the BaBar data we find

$$B(\chi_{c2}(3930) \rightarrow D\bar{D}) = 0.58 \pm 0.13$$

using the two-photon width $\Gamma_{\gamma\gamma} = 0.544\text{-keV}$

(obtained for the Buchmüller-Tye potential)

evaluated within the light-front approach (NRQCD limit).

Our finding of

$$\Gamma_{\gamma\gamma} \times B(\chi_{c2}(3930) \rightarrow D\bar{D}) = 0.32 \pm 0.07\text{-keV}$$

is close to the Belle and BaBar results.

Realistic predictions of the differential distributions in several variables and integrated cross-sections are given for the Belle-II kinematics.

We discuss also a possibility to measure $D\bar{D}$ production in ultraperipheral heavy ion collisions.

1) I. Babiarczyk, P. Lebiedowicz, W. Schäfer and A. Szczurek, "Competition of $\chi_c(2P)$ quarkonia and continuum in $e^+e^- \rightarrow e^+e^-D\bar{D}$ ", Phys. Lett. B75 (2026) 140307.

Collaboration

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