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Mechanisms of production of exotic $X(3872)$ in proton-proton collisions and its structure

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We calculate the total cross section and transverse momentum distributions for the production of the enigmatic $\chi_{c1}(3872)$ (or X(3872)) (see [1]) assuming different scenarios: $c\bar{c}$ state and $D^{0*}\bar{D}^0 + D^0\bar{D}^{0*}$ molecule. The derivative of the $c\bar{c}$ wave function needed in the first scenario is taken from a potential $c\bar{c}$ model calculations. Compared to earlier calculations of molecular state we include not only single parton scattering (SPS) but also double parton scattering (DPS) contributions. The latter one seems to give smaller contribution than the SPS one. The upper limit for the DPS production of $\chi_{c1}(3872)$ is much below the CMS data. We compare results of our calculations with existing experimental data of CMS, ATLAS and LHCb collaborations. Reasonable cross sections can be obtained in either $c\bar{c}$ or molecular $D\bar{D}^*$ scenarios for $X(3872)$, provided one takes into account both directly produced D^0, $\bar{D}^0$, as well as D^0, $\bar{D}^0$ from the decay of D^*. However, arguments related to the lifetime of D^* suggest that the latter component is not active. With these reservations, also a hybrid scenario is not excluded.

[1] A. Cisek, W. Sch\"afer and A. Szczurek, Structure and production mechanism of the enigmatic $X(3872)$ in high-energy hadronic reactions', Eur. Phys. Jour. {\bf C882}, (2022) 1062.

Collaboration

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