Contribution ID: **249**   Type: **Talk**

Tetraquark Interpretation and Production Mechanism of the Belle $Y_b(10750)$-Resonance

Wednesday, 29 July 2020 18:05 (15 minutes)

Recently, the Belle Collaboration has updated the analysis of the cross sections for the processes $e^+e^- \to \Upsilon(nS)\,\pi^+\pi^-$ ($n = 1, 2, 3$) in the e^+e^- center-of-mass energy range from 10.52 to 11.02 GeV. A new structure, called here $Y_b(10750)$, with the mass $M(Y_b) = (10752.7 \pm 5.9^{+0.7}_{-1.1})$ MeV and the Breit-Wigner width $\Gamma(Y_b) = (35.5^{+17.6+3.9}_{-11.3-3.3})$ MeV was observed. We interpret $Y_b(10750)$ as a compact $J^{PC} = 1^{--}$ state with a dominant tetraquark component. The mass eigenstate $Y_b(10750)$ is treated as a linear combination of the diquark-antidiquark and $b\bar{b}$ components due to the mixing via gluonic exchanges shown recently to arise in the limit of large number of quark colors. The mixing angle between Y_b and $\Upsilon(5S)$ can be estimated from the electronic width, recently determined to be $\Gamma_{ee}(Y_b) = (13.7 \pm 1.8)$ eV. The mixing provides a plausible mechanism for $Y_b(10750)$ production in high energy collisions from its $b\bar{b}$ component and we work out the Drell-Yan and prompt production cross sections for $pp \to Y_b(10750) \to \Upsilon(nS)\,\pi^+\pi^-$ at the LHC. The resonant part of the dipion invariant mass spectrum in $Y_b(10750) \to \Upsilon(1S)\,\pi^+\pi^-$ and the corresponding angular distribution of π^+-meson in the dipion rest frame are presented as an example.

Secondary track (number)

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Session Classification: Strong Interactions and Hadron Physics

Track Classification: 06. Strong Interactions and Hadron Physics