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Axial charmonium production in $e^-e^+ \to \gamma^* \to H' + H''$ at $\sqrt{s} = 10.6$ GeV at B-factories

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We have studied the production of ground and excited axial charmonia in processes, $e^-e^+ \to h_c(nP) + \eta_c(n'S)$, and $e^-e^+ \to \chi_{c1}(nP) + h_c(n'P)$ [1] for $n, n' = 1, 2$, through leading order (LO) tree-level diagrams $\sim O(\alpha_{em}\alpha_s)$, which proceed through exchange of a virtual photon and an internal gluon line connecting two quark lines in the triangle quark loop part of the diagram at center of mass energy, $\sqrt{s} = 10.6 GeV$. We employ the framework of 4×4 Bethe-Salpeter equation, and calculate their cross sections [1], which are compared with recent NRQCD and Relativistic quark model calculations. For both the above processes, we have drawn plots of total cross sections versus $\sqrt{s}$ for $n, n' = 1, 2$, as well as plots of differential cross section versus $cos\Theta$ at different center of mass energies. These studies might be of interest for future experiments at B-factories, since h_c, η_c, and χ_{c1}, h_c production might provide opportunities for observing h_c with higher statistics in future. Also our cross sections may provide guidance for future experiments at B-factories.

Reference:

[1] M.Narang, S.Bhatnagar, Few-Body Syst. 64, 82 (2023).

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