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Radiative decays of χ_{c1} states in effective field theory approach

The $\chi_{c1}(3872)$ state, discovered by the Belle, BABAR, CDF, D0, and LHCb collaborations and identified with quantum numbers $J^{PC} = 1^{++}$, has been the subject of extensive study due to its intriguing properties. Various theoretical interpretations, including the $\chi_{c1}(2P)$, the molecular $\bar{D}^*D/\bar{D}D^*$, and compact tetraquark states, have been proposed to explain its unique characteristics. However, challenges remain, particularly regarding its mass coincidence with the threshold and isospin violation, which are difficult to reconcile within both the pure $c\bar{c}$ and compact tetraquark models.

The upgrade of the electron energy to 22 GeV at CEBAF offers a valuable opportunity to address these challenges. This enhancement will enable the measurement of the energy dependence of the production rate, allowing for an in-depth exploration of the production mechanisms of the $\chi_{c1}(1P)$ and $\chi_{c1}(3872)$ states in $\gamma^* p$ reactions.

In this study, we analyze the radiative decays of the $\chi_{c1}(1P)$ and $\chi_{c1}(3872)$ states using effective field theory, incorporating triangle loops of D and D^* mesons. Model parameters are determined from the observed branching fraction of the radiative decay mode $\chi_{c1}(1P) \to J/\psi\gamma$. The inclusion of triangle loops in theoretical models has the potential to deepen our understanding of the production mechanisms and to clarify the observed properties of these exotic states.

Primary author(s) : Dr SANGKHAKRIT, Thanat (Suranaree University of Technology)

Co-author(s) : Dr KAEWSNOD, Attaphon (Suranaree University of Technology); Dr SUPANAM, Nopmanee (Srinakharinwirot University); Prof. YAN, Yupeng (Suranaree University of Technology)

Presenter(s) : Dr SANGKHAKRIT, Thanat (Suranaree University of Technology)