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Three-body analysis of the tetraquark $T_{cc}^+(3875)$

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We present a strategy for applying the relativistic three-particle scattering formalism to reactions of non-degenerate mesons of arbitrary angular momenta. For concreteness, we focus on the $DD\pi$ system in the charm $C = 2$ and isospin $I = 0$ sectors, where the T_{cc}^+ tetraquark appears as a pole in the elastic $DD\pi \rightarrow DD\pi$ scattering amplitude. We solve integral equations for a model describing this three-body process and access the DD^* phase shifts at heavier-than-physical pion mass via the LSZ reduction. We compare our results to available lattice data at $J^P = 1^+, 0^-$. Finally, we apply two- and three-body quantization conditions to the same model and discuss the effect of the left-hand cuts associated with one-pion exchanges on the predicted finite-volume energy levels.

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