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Clustering behavior of the tetraquark states

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In this presentation, we will discuss our benchmark test calculations of tetraquark states using several different few-body methods. These include the diffusion Monte Carlo (DMC), Gaussian expansion method (GEM), and resonant group method (RGM), within various nonrelativistic quark models such as Silvestre-Brac-Semay models and Salamanca chiral quark models. To investigate resonance states above the two-meson thresholds, we employ the complex scaling method with GEM and RGM. We consider the recently discovered Tcc state as the isospin singlet $cc\bar{q}\bar{q}$ system and use it as a criterion. Our results indicate that the chiral quark models overestimate the coupling between di-meson channels and diquark-antidiquark channels, which allows for a very deep Tcc bound state when complete configurations are included in DMC and GEM. To systematically investigate the doubly heavy tetraquark systems as both bound states and resonances, we only consider the di-meson channels. Our results show that the DMC method can accurately provide the real ground state (two-meson thresholds) of fully tetraquark systems if complete or proper channels are considered.

Primary authors: MENG, Lu (Ruhr University of Bochum); Prof. ZHU, Shi-Lin (Peking University); CHEN, Yan-Ke (Peking University); MA, Yao (Peking University)

Presenter: MENG, Lu (Ruhr University of Bochum)

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