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The all-charm tetraquark and its contribution to two photon processes.

Over the past two decades a plethora of new exotic states containing heavy quarks have been discovered above open heavy-flavor thresholds.
For these states, which cannot be interpreted as quark anti-quark bound states, a number of different explanations have been put forward in terms of tetraquark states based on QCD diquarks, QCD hybrids, hadronic molecules, among others. In the past couple of years, LHCb has reported the first observation of exotic states, in particular the X(6900), comprised of only heavy quarks decaying into $J/\Psi\ J/\Psi$. Very recently, several more states have been reported by the CMS and ATLAS collaborations in the di-J/Ψ and $J/\Psi\ \Psi(2S)$ spectra, which have been interpreted as all-charm tetraquarks. In this work, we review non-relativistic potential models for the all-charm tetraquark states, as diquark anti-diquark bound states, and explore how well these describe the structures obtained from the various experiments. Within such models, the most plausible explanation for $X(6900)$ is either as a scalar (0^{++}) meson or as a tensor (2^{++}) meson. Subsequently, we calculate the two-photon decay widths of these states within the potential model for both 0^{++} and 2^{++} quantum number assignments. The resulting two-photon decay widths allow to predict the light-by-light scattering cross sections and check if any excess, in comparison to the Standard Model prediction, seen in ongoing ATLAS experiments can be attributed to such exotic states.

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