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Quark exchange in tetraquark systems

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Tetraquark systems are composed of two quarks and two antiquarks which could be understood as diquark-antidiquark bound states or meson-meson molecules. In the latter case, the antisymmetrisation of the molecular wave function against quark exchange becomes necessary. We discuss the resulting Pauli-blocking effect for the all-charm tetraquark Tcc(6900) as a J/ψ-J/ψ molecule [1] and the light tetraquark a0(500) as a two-pion molecule of the ππ interaction [2,3]. In the case of the heavy-light tetraquark χc1(3872) (formerly X(3872)), we demonstrate that double quark exchange in a J/ψ-ρ or J/ψ-ω molecule leads to an energy-dependent kernel of the Bethe-Salpeter equation for the T-matrix of the two-meson molecule which has a pole at the D-D*threshold that leads to a bound state with the mass of X(3872) [4]. In this way we can explain by a dynamical quark exchange kernel that the X(3872) is a well-defined long-lived resonance close to the D-D* threshold, because it is a quasi-unitary bound state with a very small binding energy. It follows also in accordance with observations that it dominantly decays into a J/ψ and two or three pions under strong CP violation. We speculate about modifications of the X(3872) when it is created in the hot and dense medium of a heavy-ion collision.

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