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Fully-heavy tetraquarks in the relativistic diquark-antidiquark picture

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Masses of the ground and excited states of the fully-heavy tetraquarks, composed of charm c and bottom b quarks and antiquarks, are calculated in the diquark-antidiquark picture in the framework of the relativistic quark model based on the quasipotential approach and quantum chromodynamics. The quasipotentials of the quark-quark and diquark-antidiquark interactions are constructed similarly to the previous consideration of mesons and baryons. Relativistic effects are consistently taken into account. A tetraquark is considered as a bound state of a diquark and an antidiquark. It is assumed that the diquark and antidiquark interact in the tetraquark as a whole, and the internal structure of the diquarks is taken into account. Most of the investigated states of tetraquarks are found above the thresholds of decays to two heavy quarkonia. This is a result of the consideration of the diquark not to be a pointlike object. Therefore, such tetraquarks can be observed only as broad resonances decaying dominantly to quarkonia. The narrow state $X(6900)$ recently discovered in the $di-J/\psi$ production spectrum by the LHCb, CMS and ATLAS Collaborations corresponds to an excited state of the fully-charmed tetraquark. Other recently discovered exotic charmed resonances $X(6200)$, $X(6400)$, $X(6600)$, $X(7200)$, $X(7300)$ can also be interpreted as the different excitations of the fully-charmed tetraquark.

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