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Doubly heavy tetraquarks, $qq'\bar{Q}\bar{Q}'$, in a nonrelativistic quark model with a complete set of harmonic oscillator bases

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We improve our previous variational method based nonrelativistic quark model by introducing a complete set of three-dimensional harmonic oscillator bases as the spatial part of the total wave function. After fitting to the masses of the ground state hadrons, we apply our new method to analyzing the doubly heavy tetraquark states $qq'\bar{Q}\bar{Q}'$. In particular, we compare the result for T_{cc} to the result in the recent discovery at LHCb. We also calculate the ground state masses of $T_{sc}(ud\bar{s}\bar{c})$ and $T_{sb}(ud\bar{s}\bar{b})$ with $(I,S)=(0,1),(0,2)$. We find that $T_{bb}(ud\bar{b}\bar{b})$ and $us\bar{b}\bar{b}$, both with $(I,S)=(0,1)$, are stable against the two lowest threshold meson states with binding energies -145 MeV and -42 MeV, respectively. We further find that $T_{cb}(ud\bar{c}\bar{b})$ is near the lowest threshold. The relative positions of the quarks in the tetraquark structure are also discussed.

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