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Heavy hadron spectroscopy: exotic hadrons as molecular states near thresholds

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Hadrons have been understood as a quark-gluon composite state bound by the strong interactions, which is one of the interesting phenomena in the low-energy QCD. In the ordinary hadron picture, baryons and mesons are explained as a three-quark state and quark-antiquark state, respectively. In fact, nucleons (protons and neutrons) can be understood as uud and udd baryons. However, accelerator experiments have reported unexpected states called exotic hadrons. Especially, heavy exotic state, such as XYZ, T_{cc} and P_c, being hidden or double charmed states, have attracted a lot of interest in recent years. There have been many discussion about these states as compact multiquarks, hadronic molecules, triangle singularity, etc, while their natures have not been understood yet.

Near the thresholds, the formation of hadronic molecules is expected, where hadron interactions should have an important role to produce an attraction. The pion exchange potential is a key ingredient of hadron interactions, which has a tensor term producing a strong attraction. In this talk, we study some hadronic molecules such as P_c and T_{cc}, and also discuss the role of the interactions to form the exotic states.

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