Contribution ID: **36** Type: **contributed parallel talk**

Insights into the T_{cc}^{+} tetraquark in a constituent quark model picture

Thursday 20 July 2023 15:40 (20 minutes)

The LHCb collaboration announced in 2021 the discovery of a new tetraquark-like state, named T_{cc}^{+}. The T_{cc}^{+} is reminiscent of the $X(3872)$, which is a candidate for a loosely-bound $D\bar{D}^{*}$+h.c. molecule; however, we are now dealing with an open-charmed state which radically changes its nature and makes it explicitly exotic. In this talk, the recently discovered T_{cc}^{+} is evaluated as a DD^{*} molecular structure in the $J^{P}=1^{+}$ sector [1]. A coupled-channel calculation in the charged basis, considering the $D^{0}D^{*+}$, $D^{+}D^{*0}$ and $D^{*0}D^{*+}$ channels, is carried out in the framework of a constituent quark model that has successfully described other molecular candidates in the charmonium spectrum such as the $X(3872)$. The T_{cc}^{+} is found to be a $D^{0}D^{*+}$ molecule (87%) with a binding energy of 387 keV/c^{2} and a width of 81 keV, in agreement with the experimental measurements. The quark content of the state forces the inclusion of exchange diagrams to handle indistinguishable quarks between the D mesons, which are found to be essential for binding the molecule. The $D^{0}D^{0}\pi^{+}$ line shape, scattering lengths and effective ranges of the molecule are also analysed and found to be in agreement with the LHCb analysis. We search for further partners of the T_{cc}^{+} in other charm and bottom sectors, finding different candidates. In particular, in the charm sector we find a shallow $J^{P}=1^{+}$ $D^{+}D^{*0}$ molecule (83%), called $T_{cc}^{\prime}$, just 1.8 MeV above the T_{cc}^{+} state. In the bottom sector, we find an isoscalar and an isovector $J^{P}=1^{+}$ bottom partners, which are BB^{*} molecules lying 21.9 MeV/c^{2} ($I=0$) and 10.5 MeV/c^{2} ($I=1$), respectively, below the $B^{0}B^{*+}$ threshold.

[1] P.G.Ortega, J.Segovia, D.R.Entem and F.Fernandez, “Nature of the doubly-charmed tetraquark Tcc+ in a constituent quark model”, Phys. Lett. B 841 (2023), 137918 [arXiv:2211.06118 [hep-ph]].

Consent

I consent to recording/broadcasting my presentation.

Primary author: GARCÍA ORTEGA, Pablo (Universidad de Salamanca)

Co-authors: Dr SEGOVIA, Jorge (U. Pablo de Olavide); Prof. R. ENTEM, David (University of Salamanc); Prof. FERNÁNDEZ, Francisco (University of Salamanca)

Presenter: GARCÍA ORTEGA, Pablo (Universidad de Salamanca)

Session Classification: Parallel A

Track Classification: exotics