Contribution ID: **85** Type: **Talk**

Two-pole structures as a universal phenomenon dictated by coupled-channel chiral dynamics (remote)

Tuesday, 17 October 2023 12:30 (20 minutes)

In the past two decades, one of the most puzzling phenomena discovered in hadron physics is that a nominal hadronic state can actually correspond to two poles on the complex energy plane. This phenomenon was first noticed for the Λ(1405), then for K1(1270), and to a lesser extent for D*0(2300). In this talk, I show explicitly how the two-pole structures emerge from the underlying universal chiral dynamics describing the coupled-channel interactions between heavy matter particles and pseudo Nambu-Goldstone bosons. In particular, the fact that two poles appear between the two dominant coupled channels can be attributed to the particular form of the leading order chiral potentials of the Weinberg-Tomozawa form. Their lineshapes overlap with each other because the degeneracy of the two coupled channels is only broken by explicit chiral symmetry breaking of higher order. We predict that for light-quark~(pion) masses heavier than their physical values (e.g., about 200 MeV in the Λ(1405) case studied), the lower pole becomes a virtual state, which can be easily verified by future lattice QCD simulations. Furthermore, we anticipate similar two-pole structures in other systems, such as the isopin 1/2 K¯Σc−πΞ′c coupled channel, which await for experimental discoveries.

Parallel Session

Hadron Spectroscopy

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Session Classification: Hadron spectroscopy