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On chiral extrapolations of charmed meson masses and coupled-channel reaction dynamics

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We perform an analysis of QCD lattice data on charmed meson masses. The quark-mass dependence of the data set is used to gain information on the size of counter terms of the chiral Lagrangian formulated with open-charm states with $J^P = 0^-$ and $J^P = 1^-$ quantum numbers. Of particular interest are those counter terms that are active in the exotic flavour sextet channel. A chiral expansion scheme where physical masses enter the extrapolation formulae is developed and applied to the lattice data set. Good convergence properties are demonstrated and an accurate reproduction of the lattice data based on ensembles of PACS-CS, MILC, HPQCD, ETMC and HSC with pion and kaon masses smaller than 600 MeV is achieved. It is argued that a unique set of low-energy parameters is obtainable only if additional information from HSC on some scattering observables is included in our global fits. The elastic and inelastic s-wave πD and ηD scattering as considered by HSC is reproduced faithfully. Based on such low-energy parameters we predict 15 phase shifts and in-elasticities at physical quark masses but also for an additional HSC ensemble at smaller pion mass. In addition we find a clear signal for a member of the exotic flavour sextet states in the ηD channel, below the $\bar{K} D_s$ threshold. For the isospin violating strong decay width of the $D_{s0}(2317)$ we obtain the range (104 – 116) keV.

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