



High Energy Physics - Phenomenology

Quasi-bound states in the continuum: a dynamical coupled-channel calculation of axial-vector charmed mesons

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Masses and widths of the charmed axial-vector mesons $D_{1(2420)}$, $D_{1(2430)}$, $D_{s1(2536)}$, and $D_{s1(2460)}$ are calculated nonperturbatively in the Resonance-Spectrum-Expansion model, by coupling various open and closed meson-meson channels to the bare $J^P=1^+ \bar{q}c$ ($q=u,d$) and $\bar{s}c$ states. The coupling to two-meson channels dynamically mixes and lifts the mass degeneracy of the spectroscopic 3P_1 and 1P_1 states, as an alternative to the usual spin-orbit splitting. Of the two resulting S -matrix poles in either case, one stays very close to the energy of the bare state, as a quasi-bound state in the continuum, whereas the other shifts considerably. This is in agreement with the experimental observation that the $D_{1(2420)}$ and $D_{s1(2536)}$ have much smaller widths than one would naively expect. The whole pattern of masses and widths of the axial-vector charmed mesons can thus be quite well reproduced with only two free parameters, one of which being already strongly constrained by previous model calculations. Finally, predictions for pole positions of radially excited axial-vector charmed mesons are presented.

Comments: REVTex4, 4 pages, 3 figures, 2 tables. V2: 6 pages, 3 figures, 6 tables; paper expanded, Appendix and more tables added, excited states also calculated, errors and typos corrected; version accepted for publication in Phys. Rev. D

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