APCTP SEMINAR

Study of excited open-heavy flavor mesons using HQET

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ZOOM Webinar

According to latest Review of Particle Physics (RPP) by Particle Data Group (PDG) [1], the spin-parity of excited open-charm mesons D(2550), D_J^* (2600), D^* (2640), D(2740), D_3^* (2750),D_J (3000),D_J^* (3000),D_2^* (3000),D_s1 (2536),D_s1^* (2860),D_s3^* (2860) and D_sJ (3040) are not yet confirmed from the known experimental measurements. It is crucial to assign the spin-parity of hadrons which facilitate the determination of properties such as decay width, branching fraction, isospin mass splitting, polarization amplitude, etc. Theoretically, there is much possible interpretation of these open-charm mesons [2]. Here we apply the heavy quark effective theory (HQET) in the leading order approximation [3] to calculate the strong decay of experimentally seen open-charm mesons. The ratio of the branching fraction measurement of strong decay modes can help to classify the decaying meson [4]. Experimental information in the bottom sector is limited. Due to large non-resonant continuum contributions, however, experimentally the broad resonance states are difficult to identify. We shall calculate the masses and strong decay behavior of excited bottom mesons in the framework of HQET. The flavor symmetry of heavy quark explore the flavor independent parameters Δ_F^((c))= Δ_F^((b)) and λ_F^((c))= λ_F^((b)) to calculate the masses of excited open-bottom mesons (see Ref. [5], for instance). This study may raise many possibilities in the decisions of the experimentally missing open-bottom mesons. Additionally, our spin-parity assignment of experimentally observed open-charm mesons may allow us to construct the Regge trajectories in (M^2,J) and (M^2,n_r) planes [4], where J is the total-spin, n_r is the radial principal quantum number, and M^2 is the square of the meson mass. That can estimate the masses of experimentally missing states lying on these Regge lines. Their ratio of the strong decay rates may guide future experimental studies to find them in fundamental decay modes.

References:

[1] P.A. Zyla et al., (Particle Data Group), Prog. Theor. Exp. Phys. 2020, 083C01 (2020).
[2] H.X. Chen et al., Rep. Prog. Phys. 80, 076201 (2017).
[3] A. V. Manohar and M. B. Wise, Heavy Quark Physics (Cambridge University Press (2000)).
[4] K. Gandhi and A.K. Rai, Eur. Phys. J. A 57, 23 (2021).
[5] P. Colangelo et al. Phys. Rev. D 86, 054024 (2012).

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