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Non-spectator Contributions to Lifetime of Λ_b

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Abstract: In this work, we study the contributions of non-spectator effects to the lifetimes of Λ_b and B-mesons comparatively. Based on the well-established theoretical framework about the effective weak Lagrangian, we derive the formulation of the non-spectator effects at the quark level. Especially, for Λ_b we have considered two pictures: the three-valence-quark picture and the quark-diquark picture. In the two pictures, the interference contributions to the total width are different, in this work, we investigate the interference effects in detail. As a preliminary estimate on the lifetimes, we evaluate the hadronic matrix elements appearing in the final formulas of the lifetimes by means of a simple phenomenological model for both pictures. Our results show that the contributions of the non-spectator effects can reduce the ratio of lifetime of Λ_b to that of B-mesons by 5 $\sim$7 %. It is noted that in the quark-diquark picture the ratio can be further reduced if excited states of the diquark system are taken into account. We conclude that the measured ratio $\tau(\Lambda_b)/\tau(B^0) \cong 0.79$ [The Data Group, Phys. Rev. D66 (2002) 010001] can be partly understood by the non-spectator effects, although the problem on the discrepancy between theoretical prediction and experimental measurement is not fully solved.

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