Contribution ID : **39** Type : **not specified**

What is the right formalism to search for resonances?

Abstract

Hadron decay chains constitute one of the main sources of information on the QCD spectrum. We discuss the differences between several partial wave analysis formalisms used in the literature to build the amplitudes. We match the helicity amplitudes to the covariant tensor basis. Hereby, we pay attention to the analytical properties of the amplitudes and separate singularities of kinematical and dynamical nature. We study the analytical properties of the spin-orbit (LS) formalism, and some of the covariant tensor approaches. In particular, we explicitly build the amplitudes for the $B\to\psi\pi K$ and $B\to D^-\pi\pi$ decays, and show that the energy dependence of the covariant approach is model dependent. We also show that the usual recursive construction of covariant tensors explicitly violates crossing symmetry, which would lead to different resonance parameters extracted from scattering and decay processes.

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