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Final-state Interactions in Three-body hadronic heavy meson decays

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Three-body decays of heavy-flavoured hadrons into light particles are sequential processes, dominated by intermediate resonant states that requires a full amplitude analysis to be determined. These decays are a natural source of information about two-body scattering amplitudes, as an alternative to the early scattering data. However,
the determination of the two-body amplitudes requires the understanding of the role of final-state interactions (FSI) and strong phases from the primary weak vertex. This is also a crucial step to understand the massive localized CP violation observed in $B^+ \to h_1^- h_2^+ h_3^+$ $(h_i \equiv \pi, K)$
decays from LHCb.
The gigantic samples of B and D decays collected by the LHCb, BES-III and, in the near future, Belle II experiments motivated theoretical efforts in the past decade towards building models that are based on more solid grounds. These models improve essentially the description of FSI by using coupled-channels formalism and imposing two-body unitarity, in the framework of dispersion relations and chiral perturbation theory. Most models are based on the quasi-two-body (2+1) approximation, in which interactions with the third particle are neglected. Three-body FSI, however, may play significant role, especially in D decays as for the $D^+ \to K^-\pi^+ + \pi^+$ decay.
In this talk an overview of these models will be presented. In particular, two important results will be discussed, namely $D^+ \to K^-K^+K^+$ and $B^+ \to K^-K^+K^+$.
In the first case, the focus
is on the determination of the K^-K^+ scattering amplitudes, whilst in the second decay, the focus is on the underlying mechanisms of the CP asymmetries pattern observed in the Dalitz plot.

Primary author: Dr MAGALHAES, Patricia (University of Bristol)

Presenter: Dr MAGALHAES, Patricia (University of Bristol)

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