
Xiao-Hau Liu

Jülich Center for Hadron Physics

Generating a resonance-like structure in the reaction $B_c \rightarrow B_s \pi \pi$

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Abstract

Hadron spectroscopy, in particular, due to the appearance of the so-called XYZ particles, is experiencing a renaissance in recent years. Concerning the underlying structures of those XYZ states, besides the genuine resonances interpretations, some non-resonance interpretations which connect the kinematic singularities of rescattering amplitudes with the resonance-like peaks were also proposed in literatures, such as the triangle singularity mechanism. Before claiming that a resonance-like peak corresponds to a genuine particle, it is also necessary to exclude or confirm the possibility of the non-resonance interpretation. We investigate the process $B_c^+ \rightarrow B_s^0 \pi^+ \pi^0$ via \bar{K}^* rescattering. The kinematic conditions for triangle singularities are perfectly satisfied in the rescattering diagrams. A resonance-like structure around the \bar{K} threshold, which we denote as $X(5777)$, is predicted to be present in the invariant mass distribution of $B_s^0 \pi^+$. Because the relative weak \bar{K} ($I=1$) interaction does not support the existence of a dynamically generated hadronic molecule, the $X(5777)$ can be identified as a pure kinematical effect due to the triangle singularity. Its observation may help to establish a non-resonance interpretation for some XYZ particles.