

$P_c(4312)$, $P_c(4380)$, and $P_c(4457)$ as double triangle cusps

Content

Understanding the nature of the hidden charm pentaquark(like) signals in the LHCb data for $\Lambda_b^0 \rightarrow J/\psi p K^-$ is a central problem of hadron spectroscopy. We propose a scenario completely different from previous ones such as hadron molecules and compact pentaquarks. We identify relevant double triangle mechanisms with leading or lower-order singularities. The associated anomalous threshold cusps at the $\Sigma_c^{(*)} \bar{D}^{(*)}$ threshold are significantly more singular than the ordinary ones. Then we demonstrate that the double triangle amplitudes reproduce the peak structures of $P_c(4312)^+$, $P_c(4380)^+$, and $P_c(4457)^+$ in the LHCb data, through an interference with other common mechanisms. Only the $P_c(4440)^+$ peak is due to a resonance with width and strength significantly smaller than previously estimated. P_c^+ signals are expected in other processes and the proposed model (partly) explains the current data such as: the GlueX J/ψ photoproduction data with no P_c^+ signals; the LHCb $\Lambda_b^0 \rightarrow J/\psi p \pi^-$ data with a possible signal only from $P_c(4440)^+$. The double triangle singularity is now a possible option to interpret resonancelike structures near thresholds in general. This presentation is based on arXiv:2103.06817 which has been accepted for publication in Physical Review D as a Letter.

Summary

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