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Production of P_c states in Lambda_b decays

We develop a model for the production of the P_c states observed at LHCb in $\Lambda_b \to J/\psi p K^-$ decays. With fewer parameters than other approaches, we obtain excellent fits to the $J/\psi p$ invariant mass spectrum, capturing both the prominent peaks, and broader features over the full range of invariant mass. A distinguishing feature of our model is that whereas $P_c(4312)$, $P_c(4380)$ and $P_c(4440)$ are resonances with $\Sigma_c^{(*)}\bar{D}^{(*)}$ constituents, the nature of $P_c(4457)$ is quite different, and can be understood either as a $\Sigma_c\bar{D}^{(*)}$ threshold cusp, a $\Lambda_c(2595)\bar{D}$ enhancement due to the triangle singularity, or a $\Lambda_c(2595)\bar{D}$ resonance. We propose experimental measurements that can discriminate among these possibilities. Unlike in other models, our production mechanism respects isospin symmetry and the empirical dominance of colour-enhanced processes in weak decays, and additionally gives a natural explanation for the overall shape of the data. Our model is consistent with experimental constraints from photoproduction and $\Lambda_b \to \Lambda_c \bar{D}^{(*)0} K^-$ decays and it does not imply the existence of partner states whose apparent absence in experiments is unexplained in other models.
https://arxiv.org/abs/2112.11527
https://arxiv.org/abs/2207.00511
https://arxiv.org/abs/2208.05106

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