

## 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  $\Lambda_b \rightarrow J/\psi p K^-$  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  $\Lambda_b \rightarrow \Lambda_c \bar{D}_1^{(*)0} K^-$  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>

**Primary authors:** SWANSON, Eric (University of Pittsburgh); BURNS, Timothy

**Presenter:** BURNS, Timothy

**Track Classification:** Hadron-hadron interactions