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Molecular pentaquarks from the effective field theory and phenomenological perspectives

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The last few years have seen the observation of a series of hidden-charm pentaquarks by the LHCb collaboration. The most recent one is the $P^{\Lambda}_{\psi s}(4338)$, which has the quantum numbers of a Λ baryon. Most of these pentaquarks are close to a meson-baryon threshold and have been readily interpreted as bound (or molecular) states. Here we explore what are the consequences of the molecular hypothesis, particularly when constrained by heavy-quark spin symmetry. From effective field theory arguments we argue that, if the $P^{\Lambda}_{\psi s}(4338)$ is to be interpreted as a $\bar{D}\Xi_c$ bound state, this implies the existence of a $\bar{D}_s\Lambda_c$ partner state with a mass close to 4250 MeV [1] (and possibly other partners as well). Besides, we confront the previous predictions with a phenomenological model [2] (based on the saturation of the pentaquark potential by light-meson exchanges) to find what the converging points between these two approaches are.

[1] Mao-Jun Yan, Fang-Zheng Peng, Mario Sánchez Sánchez, Manuel Pavon Valderrama, arxiv:2207.11144
[2] Zi-Ying Yang, Fang-Zheng Peng, Mao-Jun Yan, Mario Sánchez Sánchez, Manuel Pavon Valderrama, arxiv: 2211.08211

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