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The $X(3872)$ Puzzle: Insights from Effective Field Theories

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The (in)famous $X(3872)$ was the first exotic particle discovered in 2003, compatible with a tetraquark interpretation. More than twenty years have passed since then, yet its internal dynamic remain an open question. Currently, the most established models describe the $X(3872)$ either as a compact tetraquark, where quarks interact via color forces, or as a $\bar{D}^0 D^0$ mesonic molecule, given that its mass is incredibly close to the di-meson threshold. The study of the internal dynamics of exotic particles provides a fundamental probe for understanding QCD in its confinement regime. In this talk, we will explore how the language of non-relativistic effective field theories can be applied to study the nature of the $X(3872)$, drawing inspiration from well-established approaches used to describe low-energy proton-neutron interactions. Finally, we will discuss our findings in light of the results produced by LHCb and in anticipation of upcoming analyses.

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