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Status of multi-strange dibaryon and hidden strangeness pentaquark searches at the LHC with the ALICE detector

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Quantum chromodynamics (QCD), the fundamental theory of strong interactions, allows the existence of exotic hadrons other than mesons and baryons. An exotic hadron consisting of six quarks is called a dibaryon, and a dibaryon containing strange quarks (multi-strangedibaryon) has not yet been discovered. An exotic hadron consisting of four quarks and an antiquark is called a pentaquark, and the recent discovery of the hidden charm pentaquarks $\mathrm{P}_c(4312)^+$, $\mathrm{P}_c(4440)^+$, and $\mathrm{P}_c(4457)^+$ by LHCb has reopened the question of whether pentaquarks exist in the strange sector.

The recent lattice QCD calculations by HAL QCD showed the attractive potentials between $\Lambda\Lambda$, NΞ, and NΩ. The strangeness enhancement, measured by ALICE as a function of increasing charged particle multiplicity even in pp collisions, further adds to the likelihood of observing strange pentaquark and dibaryon states. A consequence of these attractive potentials and strangeness enhancement is that the H-dibaryon can be a resonance state of $\Lambda\Lambda$, or NΞ, and NΩ may appear as a quasi-bound state, strongly decaying at the collision point. Also, following analogous decay channels for the five quark P_c^+ states into the strange sector, a P_s decaying strongly with daughters ϕp, ΛK, ΛK^*, and $\Sigma^* K$ may appear as a bound state.

In this poster, current status of the searches for H-dibaryon, NΩ-dibaryon, and hidden strangeness pentaquark states via invariant mass reconstruction with Run 2 data will be reported. Moreover, perspectives for LHC Run 3 will also be shown.

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