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Studying chiral partner resonances K^* and K_1 to investigate chiral symmetry restoration with ALICE

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In the relativistic heavy-ion collisions at the LHC, the quark-gluon plasma (QGP) is produced during the deconfinement phase transition, when the system reaches a specific temperature (T_{ch}) and energy density. Lattice QCD calculations indicate that chiral symmetry (CS) restoration occurs around T_{ch} as well ($\sim$ 156 MeV). CS restoration can be investigated using parity partner resonances, particles that have the same quantum numbers except parity, such as $\mathrm{K}^*(892)^0$ and $\mathrm{K}_1(1270)$. In the vacuum these resonances exhibit different masses, decay lengths, and production yields. However, at a temperature near those associated with CS restoration, these discrepancies are expected to diminish, resulting in a K_1 to K^* production ratio higher than the one predicted by the statistical hadronization model.
The ALICE Collaboration has already measured K^* production spectra using LHC Run 2 data, evaluating the K^*/K yield ratios in pp, p-Pb and Pb-Pb collisions, providing an experimental evidence that $\mathrm{K}^*(892)^0$ decay products undergo rescattering during the hadronic phase of the QGP evolution. However, the reconstruction of the K_1 resonance has not been achieved.

Thanks to its excellent tracking and particle identification capabilities, the ALICE Collaboration has measured a comprehensive set of mesonic and baryonic resonances. In this contribution, recent results on resonance production in pp, p–Pb, Xe–Xe and Pb–Pb collisions at various centre-of-mass energies, including new feasibility studies on $\mathrm{K}^*(892)^0$ using LHC Run 3 data, will be presented and compared to state-of-the-art models. Furthermore, the feasibility study of the K_1 measurement with ALICE and plans for investigating CS restoration will be discussed.

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