Probing the interaction of the Ξ hyperon with nucleons using femtoscopy in ALICE

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Content

The interaction between nucleons and double-strange Ξ baryons plays a critical role in determining the equation of state of dense baryonic matter, with implications for the structure of neutron stars. Traditionally, the ΞN interaction has been studied by using hypernuclear spectroscopy. However, the scarce data on Ξ-hypernuclei have so far limited the extraction of precise information on the ΞN interaction, particularly regarding its coupled-channel dynamics.

During the LHC Run 2 data taking, the ALICE Collaboration has provided rich information on the low-energy features of several hyperon-nucleon interactions by using the femtoscopy technique. Among the results, the coupled-channel nature of the p–Λ and p–K^- interactions has been confirmed with the observation of cusp-like structures in the corresponding correlation functions. Moreover, the p–Ξ^- correlation function has been measured in both p–Pb and high-multiplicity pp collisions, providing experimental evidence of the attractive nature of the ΞN strong interaction.

With the start of the LHC Run 3 data taking in 2022, ALICE has begun collecting significantly larger datasets, providing evidence of a pronounced signal at the opening of the Λ–Σ^0 channel in the p–Ξ^- correlation function. This contribution presents new preliminary results on p–Ξ^- correlations measured in pp collisions from the first three years of the LHC Run 3. The measurement will be discussed by comparing the data to the correlation function calculated by using the HAL-QCD potentials. Future prospects for extending these studies to three-body systems with double-strangeness content will also be discussed, highlighting their relevance for both hypernuclei and neutron stars modelling.

Reference

Field of Research: Multi-strange systems / Strangeness in astrophysics and in extreme forms of matter
Experiment / Theory: Experiment
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