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Measurements of p-Ξ^- Correlation Functions in Au+Au Collisions from STAR Beam Energy Scan II

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Two-particle femtoscopy provides a powerful tool for studying the spatial-temporal characteristics of particle emission source and final-state interactions in high-energy nuclear collisions. The particle emission source size R, and interaction parameters, such as the scattering length f_0 and effective range d_0, are key to understanding the freeze-out dynamics in such collisions. In particular, as a hyperon-nucleon (S = -2) pair, the proton-Ξ^-(p=uud, Ξ^-=dss) system offers an important chance to study the hyperon-nucleon interactions, which serve as basic inputs for constructing the equation of state and understanding the inner structure of neutron stars.

In this talk, we present measurements of p-Ξ^- correlation functions in Au+Au collisions over a broad energy range, from $\sqrt{s_{\rm NN}} = 3.0$ to 27 GeV, using data from STAR's Beam Energy Scan II. The correlation functions are analyzed within the Lednicky-Lyuboshitz formalism, allowing us to extract the Y-N interaction parameters - f_0 and d_0, and emission source size R. The inferred f_0, d_0 will be compared with recent calculations from Lattice QCD and effective theory models. The energy and centrality dependence of the correlation functions are further compared with simulations from the UrQMD hadronic transport model combined with the CRAB afterburner accounting for strong and Coulomb interactions.

[1] First Observation of an Attractive Interaction between a Proton and a Cascade Baryon, Phys. Rev. L 123, 112002 (2019)

[2] Femtoscopic study of coupled-channels NΞ^- and $\Lambda\Lambda$ interactions, Phys. Rev. C 105, 014915 (2022)

The collision energies for which results are presented in this talk:
$\sqrt{s_{\rm NN}} = 3.0,\ 3.2,\ 3.5,\ 3.9,\ 7.7,\ 14.6, 19.6,\ 27$ GeV

Authors: AN, Jing (Central China Normal University); STAR COLLABORATION

Presenter: AN, Jing (Central China Normal University)

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