Femtoscopy of Protons, Light Nuclei, and Strange hadrons in Au+Au Collisions at the STAR experiment

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Two-particle correlations at small relative momenta contain information about the space-time characteristics of the particle emitting source and final-state interaction effects. Light nuclei, such as deuteron (d), triton (t), and helium (^{3}He, ^{4}He), are loosely bound objects that are expected to be formed at the late stage of relativistic heavy-ion collisions. The measurement of two-particle correlations for various light nuclei combinations provides a unique tool to obtain detailed information about the spatial and temporal evolution of the particle emitting source as well as the isospin dependence of strong interaction. This analysis can be further applied to investigate the production mechanism of light nuclei in heavy-ion collisions, such as coalescence vs. thermal production.

For the case of strange particles, such as kaons and hyperons, the correlation functions are sensitive to the early stage of the collision evolution and provide different information about particle-emitting sources compared to pions. Information on the final state interactions amongst the particles under study can also be extracted from the measurement. Further, one could investigate hyperon-nucleon interactions which is little known.

In this talk, we will present measurements of proton, light nuclei, and strange particle with charged and neutral kaons as well as Ξ hyperons correlation functions in Au+Au collisions at the BES program and top RHIC energy. The experimental results will be compared with theory predictions to extract the size of emitting source and the properties of final state interactions. The collision energy and centrality dependence of the source size will be studied. Also, the implications for the production mechanism of light nuclei will be discussed.