Measurements of Deuteron Fluctuation and Correlation in BES-I of the STAR experiment at RHIC.

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Synthesis mechanism of loosely bound objects such as deuterons and other light nuclei created in high-energy nuclear collisions is primarily discussed in two scenarios: (a) statistical thermal model and (b) coalescence model. Though both scenarios are able to explain the experimental data fairly well, a complete understanding of production mechanism of light nuclei is still missing. Light nuclei are formed and survive during evolution of matter, despite the fact that typical energy scales in such collisions exceed the binding energy of these objects by orders of magnitude. Higher-order cumulants of deuteron number distribution are recently proposed to shed light on the synthesis mechanism of light nuclei created in such collisions and could potentially distinguish between statistical thermal and coalescence production scenarios. In addition, as deuteron carries two baryon numbers, it is also expected to carry the signals of QCD phase transition and the critical point (CP).

We report measurement of cumulants (up to 4^{th} order) of deuteron number (event-by-event) distributions and proton-deuteron correlations in BES-I energies in the STAR experiment. Deuterons are selected at mid-rapidity ($|y| < 0.5$) and within transverse momentum $0.8 < p_T$ (GeV/c) < 4.0, using Time Projection Chamber (TPC) and Time-of-Flight detectors. I will present results on collision energy and centrality dependence of deuteron number cumulants, proton-deuteron correlations, and their ratios for collision energies $\sqrt{s_{NN}}$ = 7.7–200 GeV. Comparison with various model calculations will also be presented.