Probing Deuteron Production via Fluctuations Measured in 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 , (b) Coalescence model. Though both scenarios are able to explain the experimental data quite well, a complete understanding of production mechanism of light nuclei is still missing. Light nuclei are formed and survive the 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 moments of event-by-event number distributions, which carry subtle details of distribution has been used extensively for the search of QCD critical point. Higher order moments of deuteron number fluctuations are also recently suggested to shed light into their production mechanism.

In this context, we have studied the higher fluctuations of event-by-event Deuteron number distributions measured in the STAR experiment for Beam Energy Scan Phase - I (BES-I) program at the Relativistic Heavy Ion Collider (RHIC) facility at BNL. We will present results on the centrality and collision energy dependence of cumulants and their ratios of Deuteron distributions for Au on Au collisions at $\sqrt{s_{NN}} = 7.7$, 11.5 and 19.6 GeV. Using Time Projection Chamber (TPC) and Time-of-Flight (ToF) detectors, Deuterons are measured in the kinematic region: $|y| <$0.5(mid-rapidity) and transverse momentum range 0.6$<$ $p_T(GeV/c)$ $<$4.0. A comparison of these results with calculations from a thermal Hadron Resonance Gas (HRG) model model will be shown. Physics implications of the results in the understanding of light nuclei formation mechanism and QCD phase structure will be discussed.