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Study QCD Phase Diagram in High-Energy Nuclear Collisions

Exploring the QCD phase structure of hot and dense nuclear matter is one of the main goals of the RHIC Beam Energy Scan (BES) program. Started in 2010, the first RHIC BES program covered the center of mass collision energy of $\sqrt{s} = 7.7, 11.5, 14.5, 19.6, 27, 39, 54.4, 62.2$ and 200GeV corresponding to the chemical potential range $\mu \approx 420 - 20\text{MeV}$. I summarize the properties of the medium created in ultra-relativistic heavy-ion collisions into three Cs: (i) Collectivity that represents the collective motion of the system including anisotropic flows; (ii) Chirality describes the results that are connected to Chiral properties, such as the recently hotly debated CME, CVE results; and (iii) Criticality covers the observations that may be linked to the illusive QCD critical point. For example, the end point of the first-order phase boundary. In this talk, I will focus on the results from the first phase BES at RHIC, especially on results that are related to Collectivity and Criticality. In addition, I will discuss the upgrades at STAR experiment and the physics for the second beam energy scan program at RHIC.

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