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Search for the QCD Critical Point and Strange Di-baryon in High Energy Nuclear Collisions

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Understanding the properties of quark matter and its phase structure is crucial for advancing our knowledge of the universe's evolution and the composition of visible matter. Over the past two decades, numerous experimental observations have provided evidence for the existence of strongly interacting quark-gluon plasma (sQGP) in relativistic heavy-ion collisions. As a result, exploring the QCD phase structure at high baryon densities—such as mapping the first-order phase transition boundary and locating the QCD critical point—has become a primary objective in heavy-ion collision research. Between 2010 and 2021, the first and second phase of the Beam Energy Scan (BES-I) at RHIC wrere completed, with the STAR experiment collecting data from Au+Au collisions at energies ranging from 200 GeV to 3 GeV (Collider and Fixed-target mode). In this talk, I will present the latest experimental progress in searching for the QCD critical point and strange dibaryon in heavy-ion collisions at RHIC. I will also discuss new facilities designed for exploring the high baryon density region and outline future research plans.

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