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Future Physics Opportunities in Beam Energy Scan at RHIC

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In the first phase of the beam energy scan program (BES-I) at RHIC, we have collected data from Au+Au collisions at the center of mass energy range from 7.7GeV to 39GeV, corresponding to the baryonic chemical potential of 420MeV to 120MeV, respectively. We have observed the disappearance of the suppression of leading hadrons at large pT, break down of the quark scaling in the identified particle elliptic flow, the net-proton directed flow slope dv_1/dy shows a minimum with negative sign, and a non-monotonical behavior of the net-proton correlation function (the fourth order) at the energy less than 20GeV. All of these observations indicate that the property of the medium at high baryon density is dramatically different from that created at the RHIC top energy where the baryon density is small and partonic interactions are dominant. In this talk I will first review what we have learned in RHIC BES-I. Then I will discuss the opportunities in the future beam energy scan program in order to address key questions regarding the QCD phase structure including the elusive critical point. I will stress that adequate detector upgrades, focused at the large baryon density region, are essential for the physics program.