

DNP15-2015-020152

Abstract for an Invited Paper  
for the DNP15 Meeting of  
the American Physical Society

### **The RHIC Beam Energy Scan: Present Challenges and Coming Opportunities**

KRISHNA RAJAGOPAL, Massachusetts Institute of Technology

The RHIC Beam Energy Scan is mapping the phase diagram of QCD, creating and probing quark-gluon plasma “doped” to varying degrees with an excess of quarks over antiquarks. Recent data from the first phase of the scan challenge us to understand intriguing non-monotonic collision energy dependence (and therefore doping dependence) of various observables. They hint at a reduction in the QGP pressure, long anticipated in collisions that form QGP at temperatures not far above the crossover region. As the collision energy is lowered, possible signs of the turning off of effects driven by the chiral anomaly, signaling the approximate restoration of chiral symmetry, have been seen. And, there are tantalizing indications of a substantial drop and a subsequent substantial rise in a fluctuation observable that is particularly sensitive to critical fluctuations and that has been predicted to do exactly that the doping increases if a critical point on the phase diagram is approached. Each of these points to opportunities for discovery in the second phase of the scan (BES-II), coming in 2019-20, with much higher statistics data at the low energies where the most tantalizing effects reside. Today, though, the ball is squarely in the theorists’ court: the data demand a concerted, multifaceted, theoretical response, building a quantitative framework for modeling the salient features of lower energy heavy ion collisions. If we respond well to this present challenge, BES-II can turn today’s trends and features into discoveries, conclusions, and new understanding.