

# Studying the QCD phase diagram through higher-order fluctuations in RHIC-BES at STAR

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Understanding QCD phase structure is one of ultimate goals of high-energy heavy-ion col-  
liding experiments. At BNL-RHIC, the Beam Energy Scan (BES-I) program was carried out  
from 2010 to 2017. Data sets of Au+Au collisions were collected for various collision energies  
from  $\sqrt{s_{NN}} = 200$  GeV down to 7.7 GeV by the STAR experiment. Recently, the STAR collab-  
oration reported a nonmonotonic beam energy dependence of the fourth-order fluctuations of  
net-proton multiplicity distributions, which could hint a signal from the QCD critical end point  
at  $\sqrt{s_{NN}} \approx 7.7$  GeV.

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In this talk, we will present results on fluctuations of net-particle distributions from the  
BES-I program. Recent progress on the fifth- and sixth-order fluctuations will be reported, and  
will be compared to theoretical calculations. Future prospects for new data from BES-II and  
fixed-target programs will be also discussed.

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