Beam-energy dependence of transverse momentum and flow correlations in STAR

Niseem Magdy (For the STAR Collaboration)
Department of Physics, University of Illinois at Chicago, Chicago, Illinois 60607, USA

Extraction of the transport properties of the quark-gluon plasma (QGP) is a central objective of the heavy-ion program at the Relativistic Heavy-Ion Collider (RHIC). Measurements that are selectively sensitive to both initial-state effects and final-state viscous attenuation can provide invaluable constraints for temperature (T) and chemical potential (μ_B) dependence of the specific shear viscosity η/s. The transverse momentum correlator $G_2\left(\Delta\eta, \Delta\varphi\right)$ has been shown to be sensitive to η/s [1,2]. Correspondingly, the $\rho(v_2^2, \langle p_T \rangle)$ correlator, that measures the strength of the correlation between an event's mean-transverse momentum [$p_{\rm T}$] and its v_2 magnitude, indicates more sensitivity to the initial-state than to final-state effects [3,4]. A comprehensive set of $G_2\left(\Delta\eta, \Delta\varphi\right)$ and $\rho(v_2^2, \langle p_T \rangle)$ measurements for Au+Au collisions spanning the beam energy range of $\sqrt{s_{\rm NN}}$ = 11.5-200 GeV, will be presented for several centralities and event shape selections. The results, which show characteristic beam-energy-dependent trends, are compared to similar LHC measurements and calculations from several theoretical models [2,4]. The data-model comparisons indicate that the measurements provide significant constraints for the respective influence of initial-state fluctuations, system-size, system-shape, and $\eta/s(\mu_B, T)$.

[1] S. Gavin and M. Abdel-Aziz, Phys. Rev. Lett. 97, 162302 (2006)
[2] N. Magdy, et al., Phys. Rev. C 104, 014907 (2021)
[3] P. Bozek, Phys. Rev. C 93, 044908 (2016).
[4] N. Magdy, et al., Phys. Lett. B 821 (2021) 136625