First-order event plane correlated directed and triangular flow from fixed-target energies at RHIC-STAR

Sharang Rav Sharma (for the STAR collaboration)

Indian Institute of Science Education and Research (IISER) Tirupati

Relativistic heavy-ion collisions produce a deconfined state of quarks and gluons known as the Quark Gluon Plasma (QGP). Lattice QCD calculations have demonstrated that the transition between the QGP and the hadronic matter is a smooth crossover at vanishing baryon chemical potential (μ_B) and high temperature (T). However, various QCD effective models have suggested that the transition between the QGP and the hadronic matter is a first-order phase transition at large μ_B and low T.

Anisotropic flow parameters (v_n) are important observables as they provide insight into the collective hydrodynamic expansion and transport properties of the medium produced in relativistic heavy-ion collisions. Among these parameters, directed flow (v_1) describes the collective sideward motion of produced particles in heavy-ion collisions. It is an important probe to study the in-medium dynamics as it is sensitive to the equation of state (EoS) of the produced medium. Minimum in the slope of directed flow (dv_1/dy) as a function of collision energy has been proposed as a signature of the first-order phase transition between hadronic matter and QGP. Triangular flow (v_3) typically arises from the initial state fluctuations and is expected to be uncorrelated to the reaction plane. However recent measurements at lower collision energies show a correlation between v_3 and the first-order event plane angle (Ψ_1).

In this presentation, we will report the first measurements of v_1 and v_3 for π, K, p, d, and t in Au+Au collisions at $\sqrt{s_{NN}}$ = 3.2, 3.5, 3.9, and 4.5 GeV in fixed-target mode from the second phase of the beam energy scan (BES-II) program at RHIC-STAR. The rapidity, centrality, and collision energy dependence of v_1 and v_3 will be presented, and their physics implications will be discussed.