

Recent highlights on collective properties of the nuclear matter from the STAR experiment at RHIC

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The study of flow harmonics provides valuable insights into the dynamics and properties of the Quark-Gluon Plasma (QGP) medium produced in heavy-ion collisions. The directed flow (v_1) slope (dv_1/dy) of protons at mid-rapidity is expected to be sensitive to the first-order phase transition. The number of constituent quark (NCQ) scaling of elliptic flow (v_2) can be regarded as a signature of the formation of QGP. Triangular flow (v_3) typically originates from fluctuations and is expected to provide constraints on the initial state geometry and fluctuations.

In this talk, we focus on the results of collective flow from Au+Au collisions at the top RHIC energy ($\sqrt{s_{NN}} = 200$ GeV), the Beam Energy Scan (BES) program ($\sqrt{s_{NN}} = 3.0$ to 27 GeV). Additionally, we will present results from the data collected for the deformed nuclei, such as Isobars (Ru+Ru and Zr+Zr) and U+U collisions. The transverse momentum (p_T), rapidity (y), and centrality dependence of v_1 and v_2 will be presented. Furthermore, the beam energy dependence of the v_1 and v_3 slopes and the p_T -integrated v_2 will be examined. The experimental results will be compared with model calculations to better understand the underlying physics mechanisms in heavy-ion collisions.

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