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Observation of Strong Directed Flow for ϕ meson in High Baryon Density Region at RHIC

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Directed flow v_1 has been used to probe early dynamics in high-energy nuclear collisions. The vector meson $\phi(s\bar{s})$, with a mass comparable to that of light baryons, exhibits a small interaction cross section with other hadrons. Therefore, the measurement of ϕ-meson directed flow v_1 provides clean access to the early collision dynamics and the production mechanisms of the vector-mesons.

In this talk, we report the measurement of ϕ-meson directed flow (v_1) from Au+Au collisions at center-of-mass energies of 3.0, 3.2, 3.5, 3.9 and 4.5 GeV, using data collected by the STAR experiment as part of the RHIC Beam Energy Scan II program. These energies correspond to the high–baryon-density region (μ_B: 760 - 590 MeV) of the QCD phase diagram. In this region, the observed ϕ-meson v_1 values are all positive and comparable to those of baryons (protons and Λ), while the v_1 values of lighter mesons, such as pions and kaons, are much smaller than those of ϕ mesons. The new results will be compared within the framework of hadronic transport model calculations, and the role of vector meson–baryon coupling in ϕ-meson production will be discussed.

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