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Beam Energy and Collisions System Dependence of Charge Separation Relative to the Second-, Third- and Fourth-order Event Planes and the Implications for the Search for Chiral Magnetic Effects in STAR

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We present new differential measurements of charge separation relative to the second- (Ψ_2), third- (Ψ_3) and fourth-order (Ψ_4) event planes for Au+Au collisions at $\sqrt{s_{NN}} = 200, 39, 27$ and 19.6 GeV, U+U at $\sqrt{s_{NN}} = 193$ GeV and Cu+Au, Cu+Cu, d+Au and p+Au at $\sqrt{s_{NN}} = 200$ GeV. The measurements are performed with a charge-sensitive correlator $R(\Delta S)$ [1] and the three-particle mixed harmonic correlator $C_{m,n,m+n} = \langle \cos(m\phi_1 + n\phi_2 - (m+n)\phi_3) \rangle$ [2]. These are expected to give different responses to the CME-driven charge separation and non-CME background correlations. The $R(\Delta S)$ measurements are found to be flat relative to Ψ_3 in all systems and Ψ_2 in p(d)+Au systems, consistent with the expectation of random \vec{B} -field orientations relative to these event planes. In contrast, the heavy-ion measurements relative to Ψ_2 show concave-shaped $R(\Delta S)$ distributions, which is consistent with the presence of CME-driven charge separation characterized by an out-of-plane Fourier dipole coefficient a_1 . We will present and discuss $R(\Delta S)$ and $C_{m,n,m+n}$ measurements for a broad range of transverse momenta, pseudorapidity, and centrality intervals and compare it with model predictions [1]. The implication of these measurements for the upcoming isobar collisions at RHIC will also be discussed.

References

- [1] N. Magdy, S. Shi, J. Liao, N. Ajitanand, and R. A. Lacey, arXiv:1710.01717.
 [2] L. Adamczyk et al. (STAR Collaboration), arXiv:1701.06496.

Content type

Experiment

Collaboration

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Centralised submission by Collaboration

Presenter name already specified

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