Investigating Potential Evidence of a Chiral Magnetic Effect Signal in Au+Au Collisions at $\sqrt{s_{\mathrm{NN}}} = 200$ GeV at the Relativistic Heavy Ion Collider

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Topological fluctuations of the vacuum gluon field in quantum chromodynamics can induce a chirality imbalance of quarks via quark-gluon interactions. Such a chirality imbalance, under a strong magnetic field, can result in an electric current, a phenomenon called the chiral magnetic effect (CME). We analyze the CME-sensitive charge-dependent azimuthal correlator, $\Delta\gamma$, with respect to the spectator and participant planes, proxied by the harmonic planes reconstructed from spectator neutrons measured by the zero-degree calorimeters (ZDC) and charged tracks measured by the time projection chamber (TPC) in the STAR experiment. The combination of these measurements eliminates the elliptic flow (v_2)-induced background in the extracted CME-sensitive signal [1]. We remove remaining nonflow contamination by decomposing the measured two-particle elliptic anisotropy into flow and nonflow and by estimating the genuine three-particle correlation contribution using the HIJING and Pythia models, similar to methods employed in recent isobar post-blind analysis [2,3]. We also analyze the TPC and ZDC measurements of $\Delta\gamma$, inclusive as well as differentially in pair invariant mass, using the event-shape engineering method with elliptic anisotropy $\vec{q}_2$ vector computed in a phase space different from that of particles of interest to avoid autocorrelations. We report measurement suggestive of a possible CME signal in Au+Au collisions at nucleon-nucleon center-of-mass energy of $\sqrt{s_{\mathrm{NN}}} = 200$ GeV at BNL's Relativistic Heavy Ion Collider.

[1] STAR Collaboration, Phys. Rev. Lett. 128 (2022) 092301, *"Search for the Chiral Magnetic Effect via Charge-Dependent Azimuthal Correlations Relative to Spectator and Participant Planes in Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV"*
[2] STAR Collaboration, Phys. Rev. Res. 6 (2024) L032005, *"Upper limit on the chiral magnetic effect in isobar collisions at the Relativistic Heavy-Ion Collider"*
[3] STAR Collaboration, Phys. Rev. C 110 (2024) 014905, *"Estimate of background baseline and upper limit on the chiral magnetic effect in isobar collisions at sNN=200 GeV at the BNL Relativistic Heavy Ion Collider"*