Measurements of azimuthal correlations with spectator and participant planes to search for the chiral magnetic effect in STAR

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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 and charged tracks measured by the time projection chamber in the STAR experiment. The combination of these measurements eliminates the elliptic flow ($v2$)-induced background in the extracted CME-sensitive signal. 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. We report results from such an analysis in Au+Au collisions at nucleon-nucleon center-of-mass energy of $\sqrt{s_{NN}}$ = 200 GeV from STAR at BNL's Relativistic Heavy Ion Collider. We discuss the implications of our results pertaining to the search for the CME.