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## A Novel Approach to Search for CME from STAR and the Future Prospect

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In this talk I will present the recent results of CME searches from the STAR collaboration using a novel event shape selection method and give a personal prospect on the future of the CME experimental searches. In high-energy heavy-ion collisions, the chiral magnetic effect (CME) may arise from the interplay between domains of chirality imbalanced quarks in the quark-gluon plasma and the strong magnetic field ( $\vec{B}$ ) generated by spectator protons. The CME is predicted to induce an electric charge separation along the  $\vec{B}$  direction, manifestly violating local

*calP* and

*calCP* symmetries. We use the  $\Delta\gamma^{112}$  correlator based on pairs of same- and opposite-sign charged hadrons to detect such a charge separation along the  $\vec{B}$  direction. To remove the background induced by elliptic flow ( $v_2$ ), we use a novel event shape selection (ESS) approach that classifies events based on their shapes which allows us to determine  $\Delta\gamma_{\text{ESS}}^{112}$  at the zero- $v_2$  limit. Furthermore, we use the spectator information to reconstruct the  $\vec{B}$  direction, thereby minimizing nonflow backgrounds. We report the measurements of  $\Delta\gamma^{112}$  and a background indicator  $\Delta\gamma^{132}$  in Au+Au collisions from the RHIC Beam Energy Scan phase II and at the top RHIC energy. After background suppression,  $\Delta\gamma_{\text{ESS}}^{132}$  is consistent with zero, and  $\Delta\gamma_{\text{ESS}}^{112}$  is reduced from inclusive  $\Delta\gamma^{112}$  by more than five-fold. The measured  $\Delta\gamma_{\text{ESS}}^{112}$  value in the 20\%-50\% centrality range is finite with an over  $3\sigma$  significance at each of center-of-mass energies 11.5, 14.6, and 19.6 GeV, whereas the corresponding values at other beam energies are consistent with zero within uncertainties. The STAR results present intriguing scenarios for the RHIC BES regime and more theoretical insights are needed. I will comment on future prospect related to experimental CME searches.

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