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Search for anomalous chiral effects in heavy-ion collisions with ALICE

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The interplay of the chiral anomaly and the strong magnetic or vortical field created in the off-central heavy-ion collisions can give rise to anomalous chiral effects in the quark–gluon plasma. These include the Chiral Magnetic Effect (CME), the Chiral Magnetic Wave (CMW) and the Chiral Vortical Effect (CVE). The study of these novel phenomena is of fundamental significance since they may reveal the topological structure of vacuum gauge fields, as well as the possible local violation of P and/or CP symmetries in strong interactions.

In this talk, we present comprehensive measurements of anomalous chiral effects in Xe–Xe and Pb–Pb collisions at $\sqrt{s_{NN}} = 5.44$ TeV and 5.02 TeV, respectively, with ALICE. The CME is studied using the charge-dependent two- and three-particle correlators. The Event Shape Engineering (ESE) technique, together with the Monte Carlo Glauber and T_RENTo simulations of the magnetic field are employed to derive an upper limit on the CME signal. The ESE technique is also adopted to quantitatively constrain the strength of the CMW signal, which is examined by the correlation between the charge asymmetry and the elliptic flow. The CVE is studied using several combinations of azimuthal correlations between baryon pairs at different kinematic windows, such as $\Lambda - p$, $\Lambda - \Lambda$ or $p - p$. These measurements provide new insights into the experimental search for anomalous chiral effects in heavy-ion collisions.

Category

Experiment

Collaboration (if applicable)

ALICE

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