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Chiral magnetic effect in isobar collisions

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The quark-gluon matter produced in relativistic heavy-ion collisions may contain local domains in which P and CP symmetries are not preserved. When coupled with an external magnetic field, such P- and CP-odd domains will generate electric currents along the magnetic field — a phenomenon called the chiral magnetic effect (CME). Recently, the STAR Collaboration at RHIC and the ALICE Collaboration at the LHC released data of charge-dependent azimuthal-angle correlators with features consistent with the CME expectation. However, the experimental observable is contaminated with significant background contributions from elliptic-flow-driven effects, which makes the interpretation of the data ambiguous. In this Letter, we show that the collisions of isobaric nuclei, $^{96}_{44}$Ru + $^{96}_{44}$Ru and $^{96}_{40}$Zr + $^{96}_{40}$Zr, provide an ideal tool to disentangle the CME signal from the background effects. Our simulation demonstrates that the two collision types at 200 GeV have more than 10% difference in the CME signal
and less than 2% difference in the elliptic-flow-driven backgrounds for the centrality range of 20-60\%.

Preferred Track

Collective Dynamics

Collaboration

Not applicable

Primary author: Prof. HUANG, Xu-Guang (Fudan University)

Presenter: Prof. HUANG, Xu-Guang (Fudan University)

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