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Systematic searches for the chiral magnetic effect and chiral vortical effect using identified particles at RHIC/STAR

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QCD allows for chirality imbalance as a consequence of the vacuum transition[1]. When coupled with the strong magnetic field produced in heavy-ion collisions, the chirality imbalance in local domains can lead to electric charge separation along the magnetic field direction, manifested as the chiral magnetic effect (CME). Recently, an analogous effect, the chiral vortical effect (CVE)[2] was also theorized, in which the vorticity of the collision system replaces the magnetic field, and a baryonic charge separation appears instead of the electric charge separation. This would result in a distinct hierarchy in the particle dependent correlation magnitudes: $proton - K_s^0$ (no CME/CVE), $proton - \pi^\pm$ (CME only), $proton - \Lambda$ (dominated by CVE), and $proton - proton$ (both CME and CVE). In order to explore this physics, we report correlation measurements for these identified particle pairs in Au+Au at 200GeV with the STAR detector. The physics backgrounds due to collective flow[3] and resonance decays are evaluated.

In addition, the measurements to search for the chiral magnetic effect and the chiral magnetic wave will also be presented for Au+Au at 14.5 GeV, which completes the Phase I of the Beam Energy Scan at RHIC.

[1] D.E. Kharzeev, L.D. McLerran, H.J. Warringa, Nucl. Phys. A 803 (2008) 227.

[2] D.E. Kharzeev, D.T. Son, Phys. Rev. Lett. 106 (2011) 062301.

[3] A. Bzdak, V. Koch, J. Liao Lect. Notes Phys. 871 (2013) 503, L. Adamczyk et al. (STAR Collaboration), Phys. Rev. Lett. 113(2014), 052302

On behalf of collaboration:

STAR

Primary author: WEN, Liwen

Presenter: WEN, Liwen

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