

Search for the Chiral Magnetic Effect with Isobar Collisions at $\sqrt{s_{NN}}=200$ GeV by the STAR Collaboration at RHIC

The chiral magnetic effect (CME) is predicted to occur as a consequence of a local violation of P and CP symmetries of the strong interaction amidst a strong electromagnetic field generated in relativistic heavy-ion collisions. Experimental manifestation of the CME involves a separation of positively and negatively charged hadrons along the direction of the magnetic field. Previous measurements of the CME-sensitive charge-separation observables remain inconclusive because of large background contributions. In order to better control the influence of signal and backgrounds, the STAR Collaboration performed a blind analysis of a large data sample of approximately 3.8 billion isobar collisions of Ru+Ru and Zr+Zr at $\sqrt{s}=200$ GeV. Prior to the blind analysis, the CME signatures are predefined as a significant excess of the CME-sensitive observables in Ru+Ru collisions over those in Zr+Zr collisions, owing to a larger magnetic field in the former. A precision down to 0.4% is achieved, as anticipated, in the relative magnitudes of the pertinent observables between the two isobar systems. Observed differences in the multiplicity and flow harmonics at the matching centrality indicate that the magnitude of the CME background is different between the two species. No CME signature that satisfies the predefined criteria has been observed in isobar collisions in this blind analysis.