Search for CME in U+U and Au+Au collisions in STAR with different approaches of handling backgrounds

PAs(alphabetically): Subikash Choudhury, Yu Hu (Fudan), Prithwish Tribedy (BNL), Jie Zhao (Purdue)
(for the STAR collaboration)

Abstract

We present two approaches to handle the dominant elliptic flow (v_2) background in the observable, $\Delta\gamma_{112}$ (charge separation across second-order event plane), sensitive to the chiral magnetic effect (CME).

In the first approach, we present the $\Delta\gamma_{112}$ and $\Delta\gamma_{123}$ measurements in U+U and Au+Au collisions. While hydrodynamic simulations including resonance decays and local charge conservation predict that $\Delta\gamma_{112}$ scaled by $N_{\rm part}/v_2$ will be similar in U+U and Au+Au collisions, the projected B-field exhibits a distinct difference between the two systems and with varying $N_{\rm part}$. Therefore, U+U and Au+Au collisions provide a two-system configuration to contrast signal and background expectations for the CME. The charge separation across third-order event plane $\Delta\gamma_{123}$ scaled by $N_{\rm part}/v_3$ provides necessary system dependence only from backgrounds. Although some features of our data appear to hint CME interpretation driven by B-field, the background expectations capture most of the observed trends at 200 GeV. We repeat our measurements with the recent high statistics Au+Au collisions data at 27 GeV to see if such a trend persists at lower collision energies. The newly installed forward event plane detector helps to suppress non-flow correlations.

In the second approach, we handle the v_2 background by measuring $\Delta\gamma_{112}$ with respect to the planes of spectators $\Psi_{\rm ZDC}$ and elliptic anisotropy Ψ_2. These measurements contain different amounts of contributions from CME signal (along B-field, due to spectators) and v_2 background (determined by the participant geometry). With the two $\Delta\gamma_{112}$ measurements, the possible CME signal and the background contribution can be determined. Applying this method, we have previously reported the measurements of possible CME signal fraction in 200 GeV Au+Au collisions, revealing dominant background contribution. Here, we report our findings in U+U collisions where the spectator-participant plane correlations are expected to differ from those in Au+Au collisions.