Estimate of Background Baseline and Upper Limit on the Chiral Magnetic Effect in Isobar Collisions at $\sqrt{s_{\rm NN}} = 200$ GeV from STAR

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Abstract

We have reported the isobar ($^{96}_{44}$Ru + $^{96}_{44}$Ru, $^{96}_{40}$Zr + $^{96}_{40}$Zr) results from a blind analysis on the search for the chiral magnetic effect (CME) [1]. The Ru+Ru to Zr+Zr ratio of the CME-sensitive charge-dependent azimuthal correlator ($\Delta\gamma$), normalized by elliptic anisotropy (v_2), is observed to be close to but systematically larger than the inverse multiplicity ($1/N$) ratio. The background baseline ~~for~~ of the isobar ratio $Y = \frac{(\Delta\gamma/v_2)^{\rm Ru}}{(\Delta\gamma/v_2)^{\rm Zr}}$ is naively ~~expected~~ anticipated to be $\frac{(1/N)^{\rm Ru}}{(1/N)^{\rm Zr}}$~~,~~ ~~however,~~ . However, genuine two- and three-particle correlations ~~are expected to alter it. We estimate the contributions from those correlations to~~ have the potential to alter this baseline. We calculate the influence of these correlations on Y ~~, utilizing the STAR isobar data as well as~~ by incorporating data from STAR isobar experiments and HIJING simulations. ~~Including those~~ By accounting for these contributions, we ~~arrive at a final background baseline~~ establish a comprehensive background reference for Y. The background baseline is found to be consistent with the isobar data, and an upper limit of $\sim 10\%$ at 95% confidence level is extracted on the CME signal fraction in the $\Delta\gamma$ measurement in isobar collisions at 200 GeV [2].

[1] STAR Collaboration, Phys. Rev. C **105**, 014901 (2022)

[2] STAR Collaboration, arXiv:2308.16846

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