Results from a modified R_{Ψ_2} observable in isobar collisions at STAR

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The $R_{\Psi_2}(\Delta S)$ observable, which quantifies fluctuations of charge separation (ΔS) perpendicular to the reaction plane relative to those parallel [1], has been used to search for the chiral magnetic effect (CME) in isobar ($^{96}_{44}$Ru + $^{96}_{44}$Ru and $^{96}_{40}$Zr + $^{96}_{40}$Zr) collisions with nucleon-nucleon center-of-mass energy of $\sqrt{s_{\rm NN}}$ = 200 GeV by STAR [2]. The collection of tracks in each event measured by the STAR Time Projection Chamber is divided into two subevents according to the particle pseudorapidity, where one is used to reconstruct an event plane as the proxy for the reaction plane and the other subevent is used to calculate ΔS, and vice versa. The ΔS is normalized by the width of the charge-shuffled ΔS distribution, parallel to the event plane, and the ΔS values from the two subevents are averaged. The Ru+Ru/Zr+Zr ratio of the squared inverse width of the $R_{\Psi_2}(\Delta S)$ distribution, $1/\sigma^2_{R_{\Psi_2}}$, is consistent with unity, indicating no evidence for the pre-defined CME signal [2].

In this talk, we present a modified definition of $R_{\Psi_2}(\Delta S)$, where the ΔS values perpendicular and parallel to the event plane are normalized by the respective charge-shuffled widths, and the ΔS from the two subevents are not averaged but kept separate in the analysis [3]. We demonstrate that the ΔS averaging introduces an autocorrelation, between ΔS and the event plane, rendering difficulty in its interpretation. We report preliminary results on the modified $R_{\Psi_2}(\Delta S)$ observable. We discuss connections between the modified $R_{\Psi_2}(\Delta S)$ to the $\Delta\gamma$ observable, and discuss our results in the context of the CME search.

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[3] Y. Feng, J. Zhao, H.-j. Xu and F. Wang, Phys. Rev. C **103**, 034912 (2021).