Chiral kinetic approach to chiral magnetic effect in isobaric collisions

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Based on the chiral kinetic approach using quarks and antiquarks from a multiphase transport model [1] as initial conditions, we have studied the chiral magnetic effect, i.e., the magnetic field induced separation of charged particles in the transverse plane, in non-central isobaric collisions of Zr+Zr and Ru+Ru, which have the same atomic number but different proton numbers [2]. For the observable $\gamma^{OS}-\gamma^{SS}$ related to the difference between the correlations of particles of opposite charges and of same charges, we find a difference between the two collision systems if the magnetic field has a long lifetime of 0.6 fm/c and the observable is evaluated using the initial reaction plane. This signal of the chiral magnetic effect becomes smaller and comparable to the background contributions from elliptic flow if the event plane determined from particle emission angles is used. For the other observable given by the $R(\Delta S)$ correlator related to the distribution of average charge separation in a collision, it depends less on whether the reaction or event plane is used in the analysis, making it a plausible observable for identifying the chiral magnetic effect from its difference in the two isobaric collision systems.

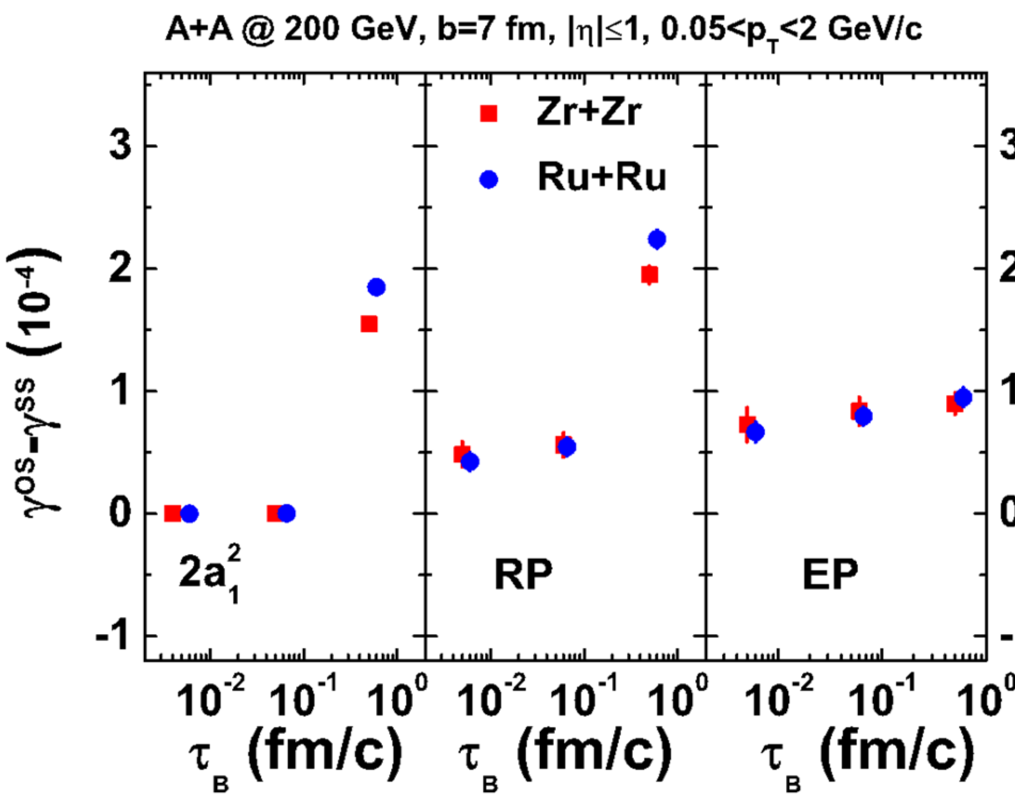

FIG. 1. Magnetic field lifetime dependence of the $\gamma^{OS}-\gamma^{SS}$ correlator of mid-pseudorapidity ($|\eta|\leq 1$) light quarks in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}}=200$ GeV and impact parameter b = 7 fm for transverse momenta in the range $0.05 \leq p_T \leq 2$ GeV/c and using different calculation methods. The error bars denote the statistical errors due to the finite number of events used in the study.

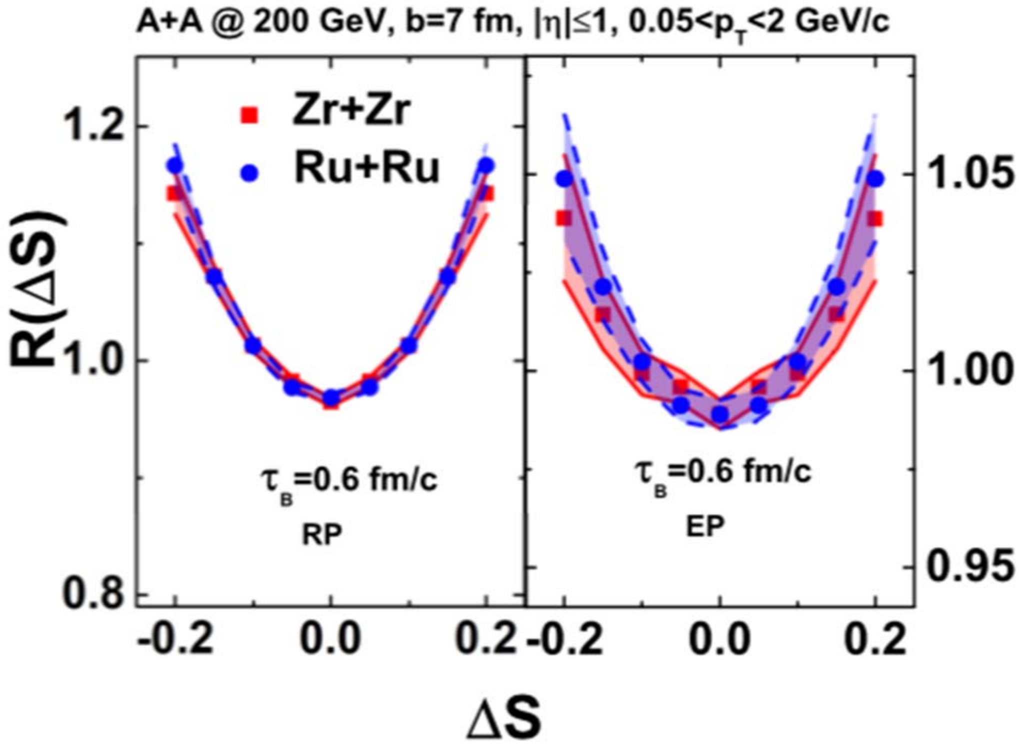

FIG. 2. Same as Fig. 1 for $\boldsymbol{\Delta S}$ dependence of the $\boldsymbol{R}(\Delta\boldsymbol{S})$ correlator.

[1] Z.-W. Lin, C.M. Ko, B.-A. Li, B. Zhang, and S. Pal, Phys. Rev. C **72**, 064901 (2005).
[2] Y. Sun and C.M. Ko, arXiv:1803.06043 [nucl-th].