

Local Parity Violation or Local Charge Conservation/Flow? A Reaction-Plane-Dependent Balance Function Study

STAR has recently reported charge-dependent azimuthal correlations that are sensitive to the charge separation effect in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV [1]. Qualitatively, these results agree with some of the theoretical predictions for local parity violation in heavy-ion collisions. However, a study using reaction-plane-dependent balance functions shows an alternative origin of this signal. The balance function, which measures the

correlation between oppositely charged pairs, is sensitive to the mechanisms of charge formation and the subsequent relative diffusion of the balancing charges. The reaction-plane dependent balance function measurements can be related to STAR's charge-dependent azimuthal correlations. We report reaction-plane-dependent balance functions for Au+Au collisions at $\sqrt{s_{NN}} = 200, 62.4, 39, 11.5,$ and 7.7 GeV using the STAR detector. The model of Schlichting and Pratt [2] incorporating local charge conservation and elliptic flow reproduces most of the three-particle azimuthal correlation results at 200 GeV. The experimental charge-dependent azimuthal charge correlations observed at 200 GeV can be explained in terms of local charge conservation and elliptic flow.

[1] B. I. Abelev et al. [STAR Collaboration], Phys. Rev. Lett. 103, 251601 (2009) and B.

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[2] S. Schlichting and S. Pratt, Phys. Rev. C 83, 014913 (2011)

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