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Measuring and interpreting charge dependent anisotropic flow as a function of the event charge asymmetry

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Recently, the STAR Collaboration has reported a strong dependence of the elliptic flow of positive and negative pions on the net charge density [1]. This measurement attracted a lot of community attention, as the signal appeared to be of the magnitude and the sign of that predicted by the theory of the Chiral Magnetic Wave [2]. At the same time the interpretation of the results and further detailed study of the effect is rather difficult as the observable itself, the slope of elliptic flow value on the observed charge asymmetry in the STAR TPC acceptance, depends on the tracking efficiency and detector acceptance. In this talk we show how one can first make the observable robust (efficiency independent) and then make it suitable for many differential studies, not possible before. We use this observable, a three-particle correlator, in our model calculations to show the sensitivity of the signal to several background effects, such as local charge conservation, and propose experimental tests for further identification of the effects responsible for the observed signal.

[1] G.~Wang [STAR Collaboration], "Search for Chiral Magnetic Effects in High-Energy Nuclear Collisions," Nucl.\ Phys.\ A904-905 {\bf 2013}, 248c (2013).

[2] Y.~Burnier, D.~E.~Kharzeev, J.~Liao and H.~-U.~Yee, "Chiral magnetic wave at finite baryon density and the electric quadrupole moment of quark-gluon plasma in heavy ion collisions," Phys.\ Rev.\ Lett.\ {\bf 107}, 052303 (2011).

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