Quark Matter 2018



Contribution ID: 264

Type: Poster

## An Experimental Handle on the Magnetic Field from Spectator Protons in A+A Collisions

Tuesday 15 May 2018 19:10 (30 minutes)

The chiral magnetic effect (CME) and the chiral magnetic wave (CMW) have been predicted to arise from the coupling of domains with quark chirality imbalances in the quark-gluon plasma (QGP) and the strong magnetic field produced by energetic spectator protons. Searches for these quark chirality effects in nucleus-nucleus collisions have been performed at RHIC and the LHC as major scientific goals. For example, the RHIC 2018 run will be devoted to the isobaric collisions of  ${}^{96}$ Ru+ ${}^{96}$ Ru and  ${}^{96}$ Zr+ ${}^{96}$ Zr at  $\sqrt{s_{NN}}$  = 200 GeV, where one may expect an up-to-20% difference in the experimental observables related to the magnetic-field-induced effects.

Current data indicate that the experimental sensitivity to the chirality effects also depends on the beam energy and the colliding system size, presumably owing to variations in the magnetic field and/or the size of the QGP droplets. Therefore, another venue to enhance the experimental sensitivity could be Au+Au collisions at lower beam energies. We will demonstrate with the AMPT simulations that the number of net protons ( $N_{net-p}$ ) at mid-rapidity is anti-correlated with the number of spectator protons, and hence provides an excellent handle on the magnetic field from spectator protons in Au+Au collisions at lower RHIC beam energies. Equipped with the event-shape engineering technique [1], the search for chirality effects by varying  $N_{net-p}$  in Au+Au collisions at lower energies (with  $\sqrt{s_{NN}}$  still higher than 10 GeV) will complement the isobaric collision data. The future RHIC Beam Energy Scan II program will facilitate the application of our method and discern the true contribution due to the quark chirality effects.

[1] F. Wen et al., Chinese Phys C 42(1) (2018) 014001 [arXiv:1608.03205].

## **Content type**

Theory

## Collaboration

## Centralised submission by Collaboration

Presenter name already specified

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Session Classification: Poster Session

Track Classification: Chirality, vorticity and polarisation effects