Elliptic flow splitting as a probe of the QCD phase structure at finite baryon chemical potential

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We have studied the effects of both the partonic and the hadronic potential on the elliptic flow splitting of particles and their antiparticles in relativistic heavy-ion collisions [1] carried out in the beam energy scan (BES) program at RHIC [2]. With the evolution of the partonic phase described by an NJL transport model, we have obtained a larger elliptic flow for nucleons and K^- than antinucleons and K^+, respectively, right after hadronization [3]. After the hadronic evolution described by a relativistic transport model that includes the empirically determined hadronic potentials for particles and antiparticles [4], the final elliptic flow is larger for nucleons and K^+ than antinucleons and K^-, respectively. The relative elliptic flow differences from the STAR data can be reproduced if the ratio R_V of the vector coupling constant G_V to the scalar coupling constant G in the NJL model is between 0.5 and 1.1, after taking into account the mean-field potential effects in both the partonic and the hadronic phase as shown in Fig. 1. Our results therefore suggest that studying the elliptic flow splitting of particles and their antiparticles in heavy-ion collisions provides the possibility of studying the QCD phase structure at finite baryon chemical potential, thus helping understand the nature of the strong interaction.

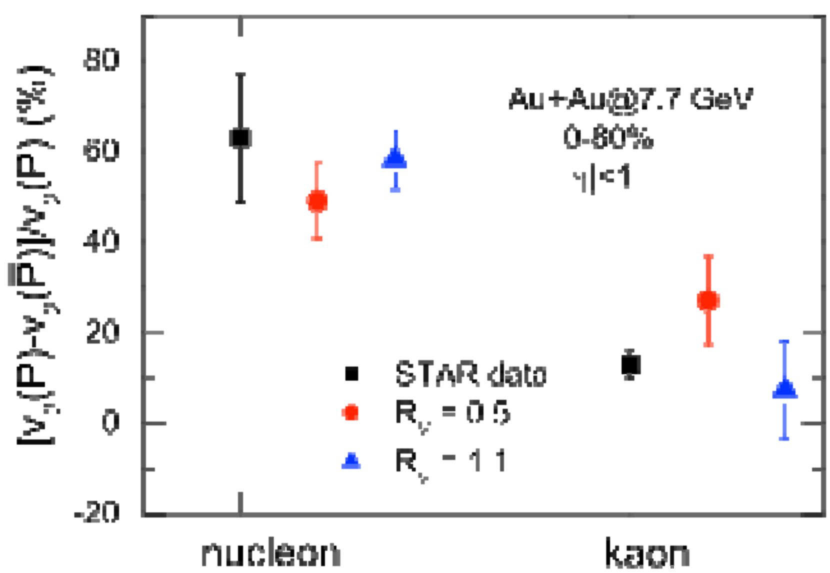

FIG. 1. Relative elliptic flow difference between nucleons and antinucleons as well as kaons and antikaons for different values of $R_V=G_V/G$ in the NJL model compared with the STAR data [5].

[1] J. Xu, T. Song, C.M. Ko, and F. Li, Phys. Rev. Lett. **112**, 012301 (2014).
[2] L. Kumar [STAR Collaboration], J. Phys. G **38**, 124145 (2011).
[3] T. Song, S. Plumari, V. Greco, C.M. Ko, and F. Li, Phys. Lett. B (submitted).
[4] J. Xu, L.W. Chen, C.M. Ko, and Z.W. Lin, Phys. Rev. C **85**, 041901 (2012).
[5] B. Mohanty [STAR Collaboration], J. Phys. G **38**, 124023 (2011).