Partonic mean-field effects on matter and antimatter elliptic flow

T. Song, S. Plumari,[1] V Greco,[1] C. M. Ko, and F. Li
[1]*Dipartimento di Fisica e Astronomia, Universit?di Catania, Via S. Sofia 64, 95125 Catania, Italy*

We have studied [1] the effect of partonic mean fields on the elliptic flows of quarks and antiquarks in a brayon-rich quark matter by using a transport model based on the NJL model [2]. For the scalar mean field, which is attractive for both quarks and antiquarks, it leads to a similar reduction of the quark and antiquark elliptic flow as first found in Ref.[3]. The vector mean field, on the other hand, has very different effects on quarks and antiquarks in the baryon-rich quark matter as it is repulsive for quarks and attractive for antiquarks. Using the quark coalescence model, we have further studied the elliptic flows of p, Λ, and K^+ and their antiparticles produced from the baryon-rich quark matter and found that the differences between particle and antiparticle elliptic flows are appreciable as a result of the different quark and antiquark elliptic flows. The magnitude of the relative integrated elliptic flow difference between particles and their antiparticles depends on the strength of the vector coupling, and this is shown in Fig.1. For the small vector coupling of g_v/G=1/6, the elliptic flow differences between p and anti-p, Λ and anti-Λ, and K^+ and K^- are about 49, 48, and 9%, respectively, which are about a factor of 1.5, 2.5, and 1/3 of corresponding values due to the effect of hadronic potentials given in Ref.[4]. If the effects of partonic and hadronic mean-field potentials were additive, then the final relative elliptic flow differences between p and anti-p, Λ and anti-Λ, and K^+ and K^- would be close to those measured in the BES experiments at RHIC [5,6]. Although a more quantitative study is needed before a definitive

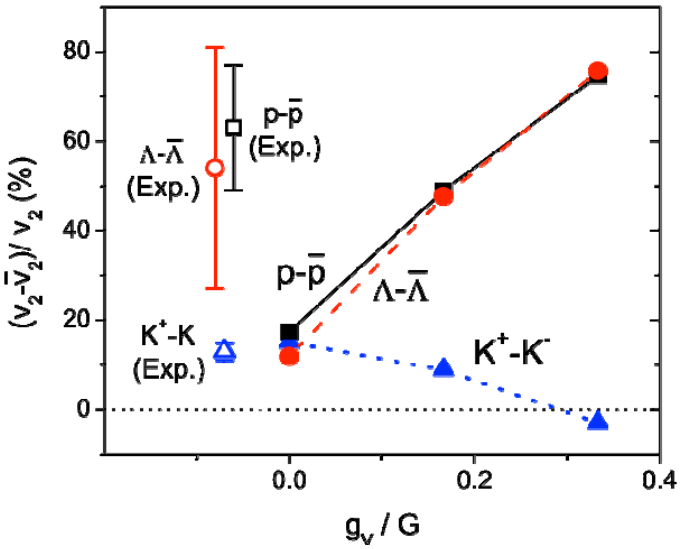

FIG. 1. Relative differences between integrated elliptic flows of mid-rapidity (|y|<1) p and anti-p (solid squares), Λ and anti-Λ (solid circles), and K^+ and K^- (solid triangles) at hadronization for several values of the isoscalar vector coupling.

determination of the strength of vector interactions in the baryon-rich QGP can be achieved, the upper bound inferred from the present study for the value of the vector coupling already has an important implication on the equation of state of baryon-rich quark-gluon plasma.

[1] T. Song, S. Plumari, V. Greco, C.M. Ko, and F. Li, Phys. Lett. B (submitted).
[2] Y. Nambu and G. Jona-Lasinio, Phys. Rev. **122**, 345 (1961); **124**, 246 (1961).
[3] S. Plumari, V. Baran, M. Di Toro, G. Feini, and V. Greco, Phys. Lett. B **689**, 18 (2010).
[4] J. Xu, L.W. Chen, C.M. Ko, and Z.W. Lin, Phys. Rev. C **85**, 041901 (2012).
[5] L. Kumar [STAR Collaboration], J. Phys. G **38**, 124145 (2011).
[6] B. Mohanty [STAR Collaboration], J. Phys. G **38**, 124023 (2011).