Hadronic potential effects in elliptic flow in heavy ion collisions

J. Xu, L.W. Chen,[1] C.M. Ko, and Z.W. Lin[2]

[1]*Department of Physics, Shanghai Jiao Tong University, Shanghai 200240, China*

[2]*Department of Physics, East Carolina University, C-209 Howell Science Complex, Greenville, North Carolina 27858*

We have studied the elliptic flows of p, K^+, π^+ and their antiparticles in heavy ion collisions at energies of $\sqrt{s_{NN}}$ = 7.7, 11.5 and 39 GeV, where a baryon-rich hot dense matter is produced, by extending the string melting AMPT model [1] to include their mean-field potentials in the hadronic stage [2]. Because of the more attractive potentials for proton than antiproton [3], the attractive K^- and repulsive K^+ potentials [3], and the slightly attractive π^+ and repulsive π^- potentials in the baryon- and neutron-rich matter [4] formed in these collisions, smaller elliptic flows are obtained for antiproton, K^-, and π^+ than for proton, K^+, and π^-. Also, the difference between the elliptic flows of particles and their antiparticles is found to decrease with increasing collision energy as a result of the decreasing baryon chemical potential of hadronic matter as shown in Fig. 1. Although our results are qualitatively consistent with the experimental observations from the STAR Collaboration at RHIC [5], they somewhat underestimated the relative elliptic flow difference between proton and antiproton as well as that between π^- and π^+, and overestimated that between K^+ and K^-. Studies including different quark and antiquark potentials in the baryon-rich quark gluon plasma are being carried out to investigate their effects on the quark and antiquark elliptic flow before hadronziation in order to understand more quantitatively the different

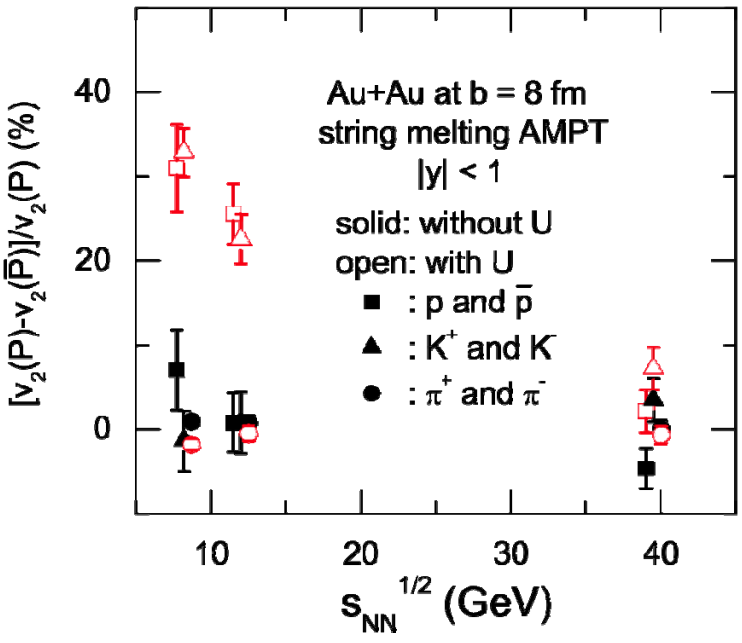

FIG. 1. Relative elliptic flow difference between proton and antiproton, K^+ and K^-, and π^+ and π^- with and without hadronic potentials U at three different energies from the string melting AMPT model. Results for different species are slightly shifted in energy to facilitate the presentation.

elliptic flows between particles and their antiparticles observed in relativistic heavy ion collisions.

[1] Z.W. Lin, C.M. Ko, B.A. Li, B. Zhang, and S. Pal, Phys. Rev. C **72**, 064901 (2005).
[2] J. Xu, L.W. Chen, C.M. Ko, and Z.W. Lin, Phys. Rev. C (in press).
[3] C.M. Ko and G.Q. Li, J. Phys. G **22**, 1673 (1996).
[4] N. Kaiser and W. Weise, Phys. Lett. B **512**, 283 (2001).
[5] B. Mohanty for the STAR Collaboration, arXiv:1106.5902 [nucl-ex].