Isospin splitting of pion elliptic flow in relativistic heavy-ion collisions

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We have studied the effect of the vector-isovector interaction on the elliptic flow difference between π^+ and π^- based on the framework of an extended multiphase transport model, in which the partonic mean-field potentials are obtained from a 3-flavor Nambu-Jona-Lasinio model including isovector couplings, and the hadronization algorithm is improved by considering the coalescence of partons close in phase space [1]. We have found that the time component of the vector-isovector potential leads to a more repulsive (attractive) potential for d (u) quarks in the baryon-rich and d-quark-rich medium, thus enhancing the elliptic flow v_2 of d quarks and π^- while reducing that of u quarks and π^+. The space component of the vector-isovector potential and the hadronic potentials are, however, found to have less important effect on the isospin splitting of v_2. With increasing strength of the vector-isovector coupling, the v_2 difference between $\pi^+$and π^- tends to saturate. As shown in Fig.1, results from our

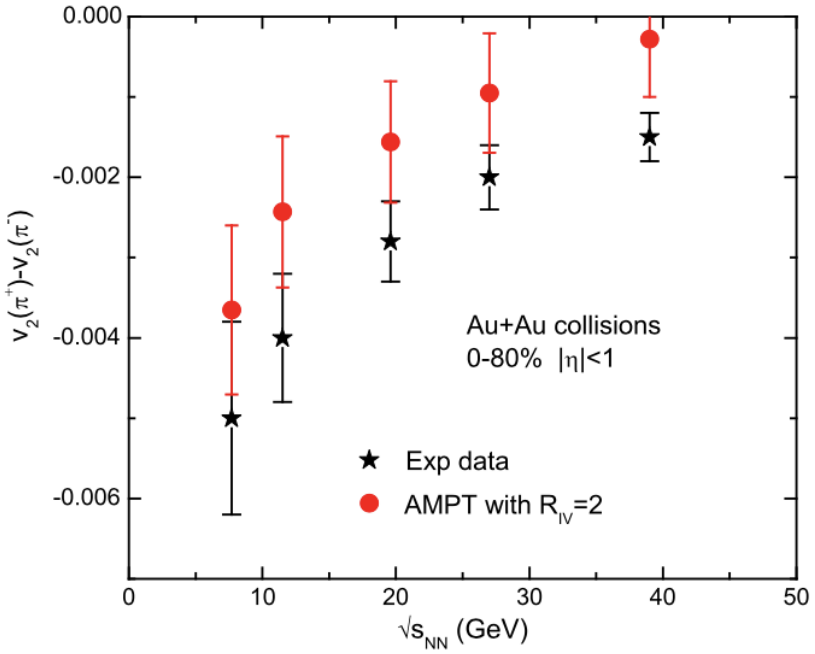

Fig. 1. Comparison of the elliptic flow $\boldsymbol{v_2}$ difference between mid-pseudorapidity ($|\boldsymbol{\eta}| <1$) $\boldsymbol{\pi^+}$and $\boldsymbol{\pi^-}$at different RHIC-BES energies from the extended AMPT model with those measured by the STAR Collaboration [2].

transport approach (solid circles) reproduce the decreasing v_2 splitting with increasing collision energy seen in experiments (solid stars) [2], and the experimentally observed v_2 difference between $\pi^+$and π^- favors a strong vector-isovector coupling, with its coupling strength larger than twice the scalar-isoscalar

coupling strength. In the *d*-quark-rich matter, a stronger vector-isovector coupling disfavors the splitting of *u* and *d* quark chiral phase transition boundary, leads to a critical point at higher temperatures, and results in a larger quark matter symmetry energy [3]. Further studies to understand the observed dependence of the total isospin splitting of pion v_2 on the charge asymmetry [3] and to include the isospin-independent Polyakov-loop potential, which is essential for describing the QCD deconfinement phase transition and the thermodynamic properties of QGP [4], are needed.

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