

Origin of the mass ordering of v_n from a multi-phase transport

A Multi-Phase Transport (AMPT) model has been shown to describe experimental data well, including the particle spectra and azimuthal anisotropies (v_n) of pions and kaons below p_T of ~ 1.5 GeV/c in heavy ion collisions [1] as well as small system collisions [2]. By following the parton collision history in AMPT, we have found that the opacity in AMPT is relatively small and the parton v_n is primarily produced by the anisotropic escape mechanism [3]. In this study, we investigate the origin and development of the v_n mass ordering of identified hadrons in heavy ion collisions as well as small system collisions at both RHIC and LHC energies [4]. We show that a fraction of the mass ordering arises from kinematics in the quark coalescence hadronization process, while resonance decays tend to reduce the mass ordering. We find that the majority of the mass ordering comes from hadronic rescatterings, although they have little effect on the overall magnitude of charged hadron v_n . These findings are qualitatively the same as those from hybrid models that couple hydrodynamics to a hadron cascade [5-7]. In addition, we find no qualitative difference between heavy ion collisions and small system collisions or between RHIC and LHC energies. Our results from the AMPT study thus demonstrate that the v_n mass ordering may not be a distinctive signature of hydrodynamic collective flow, but can be a quantitative interplay of several physics processes.

[1] Z.W. Lin, Phys. Rev. C 90, 014904 (2014).

[2] A. Bzdak, G.L. Ma, Phys. Rev. Lett. 113, 252301 (2014).

[3] L. He, T. Edmonds, Z.W. Lin, F. Liu, D. Molnar, and F. Wang, Phys. Lett. B753, 506 (2016); Z.W. Lin, L. He, T. Edmonds, F. Liu, D. Molnar, and F. Wang, arXiv:1512.06465 (2015).

[4] H.L. Li, L. He, Z.W. Lin, D. Molnar, F. Wang, and W. Xie, Phys. Rev. C 93(R), 014904 (2016); arXiv:1604.07387v2 (2016).

[5] T. Hirano, U. Heinz, D. Kharzeev, R. Lacey, and Y. Nara, Phys. Rev. C 77, 044909 (2008).

[6] H. Song, S.A. Bass, and U. Heinz, Phys. Rev. C 83, 024912 (2011).

[7] P. Romatschke, Eur. Phys. J. C 75, 429 (2015).

Preferred Track

Collective Dynamics

Collaboration

Not applicable

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