K_1/K^* enhancement in heavy-ion collisions and the restoration of chiral symmetry

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We have extended the recent study of K_1/K^* enhancement as a signature of chiral symmetry restoration in heavy ion collisions at the CERN Large Hadron Collider via the kinetic approach [1] to include the effects due to non-unity hadron fugacity during the evolution of produced hadronic matter and the temperature-dependent K_1 mass [2]. It is found that including non-unity pion and kaon fugacity (middle window of Fig. 1) reduces slightly the K_1/K^* enhancement found in previous study due to chiral symmetry restoration but adding temperature-dependent K_1 mass (left window of Fig. 1) leads to a substantial further reduction of the K_1/K^*enhancement. However, the final K_1/K^* ratio still shows a factor of 2.4 and 1.3 enhancement, respectively, in peripheral and midcentral collisions compared to the case without chiral symmetry restoration as shown in right window of Fig. 1, confirming its use as a good signature for chiral symmetry restoration in the hot dense matter produced in relativistic heavy ion collisions.

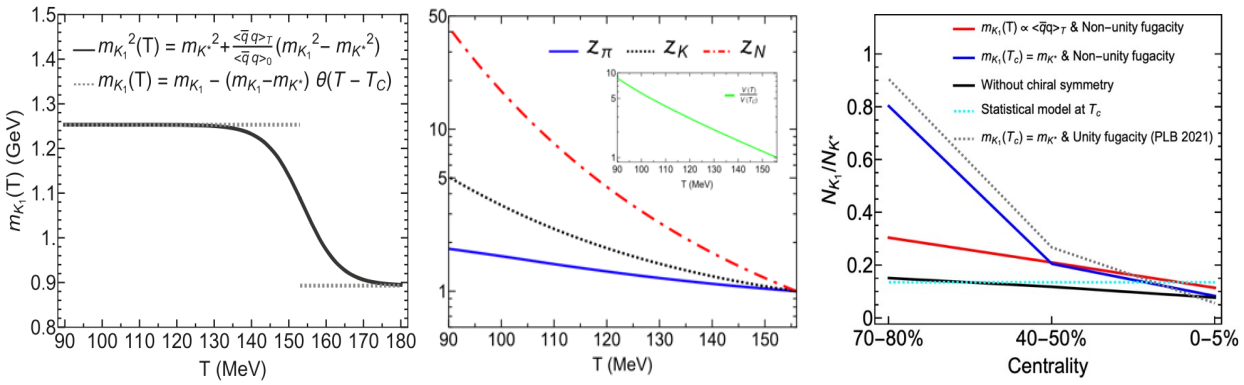

FIG. 1. (Left window) Temperature dependence of $\boldsymbol{K_1}$mass. Solid line is from the QCD sum rule calculations of Ref. [3], while dotted line is the one assumed in Ref. [1] with $\boldsymbol{T_C = 156}$ MeV. (Middle window) Temperature dependence of the pion (solid line), kaon (dotted line), and nucleon (dash-dotted line) fugacity as well as the volume ratio of hadronic matter (solid line in the inset). (Right window) The $\boldsymbol{K_1/K^*}$ yield ratio in Pb-Pb collisions at $\sqrt{\boldsymbol{s_{NN}}}$= 5.02 TeV at three centralities of 0–5%, 40–50%, and 70–80% for various scenarios of K_1 mass and hadronic matter property.

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