

Elliptic flow of light nuclei

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Using the coalescence model based on the nucleon phase-space distribution function from a blast-wave model, we have studied the transverse momentum spectra and elliptic flows of light nuclei in relativistic heavy-ion collisions [1]. Assuming that the spatial distribution of nucleons in the system is independent of their momenta and fitting the parameters to the experimental measured proton transverse momentum spectrum and elliptic flow by the STAR collaboration at RHIC, we have obtained a good description of the measured transverse momentum spectra of deuteron (antideuteron) and triton (helium-3) as shown in the top window of Fig.1 but have failed to reproduce the measured elliptic flows of these nuclei, particularly at large transverse momenta. We have attributed this failure of the coalescence model to the neglect of possible preference of nucleons of large transverse momenta to be more spread in space if their momenta are along the reaction plane than perpendicular to it. Allowing a nucleon phase-space distribution that includes such space-momentum correlations in the blast-wave model indeed leads to a good description of the elliptic flows of deuteron (anti-deuteron) and triton (helium-3) as shown in the bottom window of Fig. 1. Our study thus indicates that the elliptic flows of light nuclei are sensitive to the space- momentum correlations of nucleons at kinetic freeze-out and are thus a possible probe of the nucleon emission source in relativistic heavy ion collisions.

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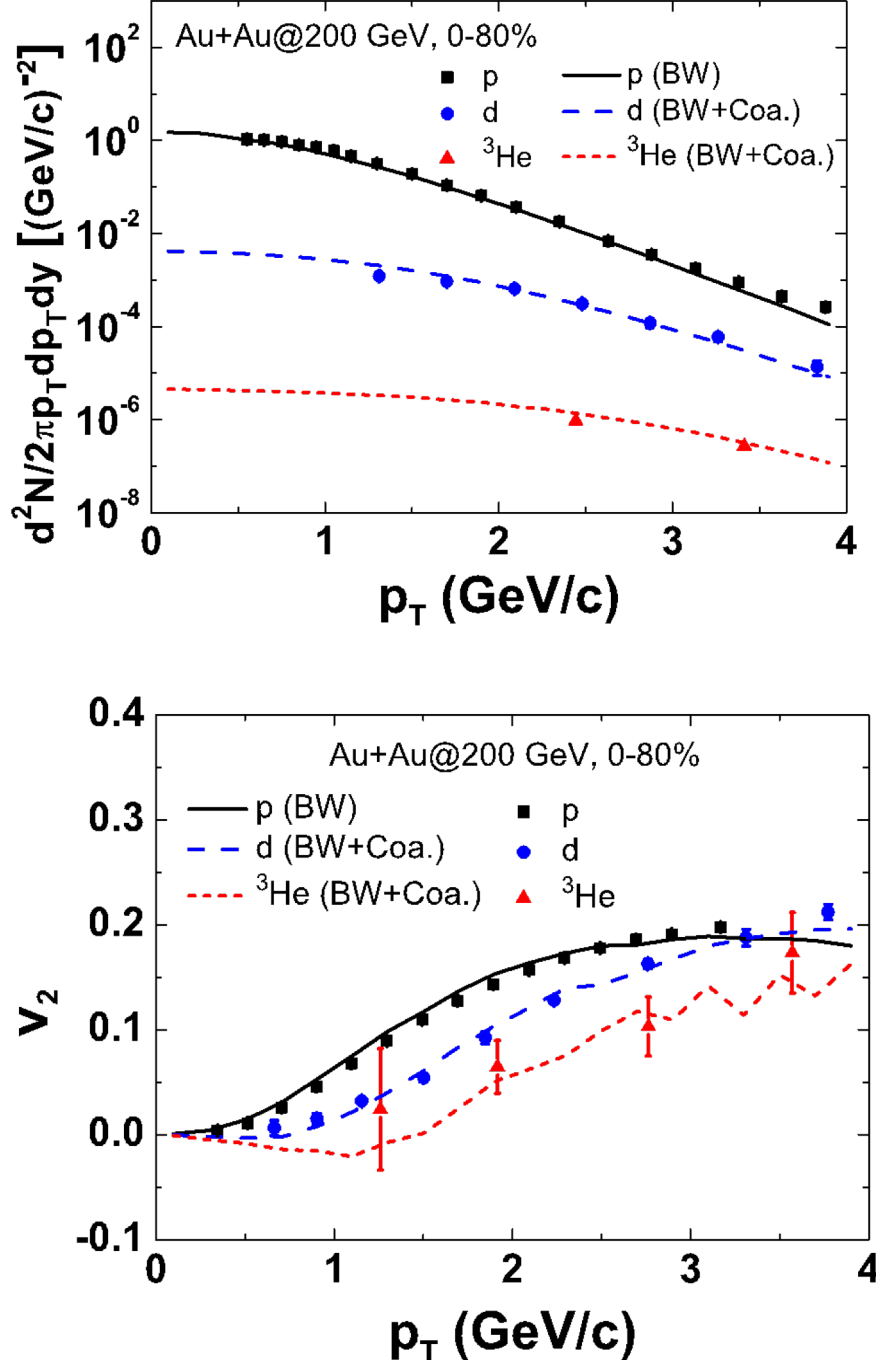


FIG. 1. Transverse momentum spectra (top) and elliptic flows (bottom) of midrapidity proton (black solid line), deuteron (anti-deuteron) (blue long-dashed line), and triton (helium-3) (red short-dashed line) from the coalescence model based on a blast-wave model with space-momentum correlation for Au+ Au collisions at $\sqrt{s_{NN}} = 200$ GeV and centrality of 0- 80%. Data for transverse momentum spectra are from Refs.[2] for proton, Ref. [3] for deuteron (anti-deuteron), and Ref. [4] for triton (helium-3), while those for elliptic flows are from Ref.[5] for proton and Ref. [6] for deuteron (anti-deuteron) and triton (helium-3).