**Transport model study of deuteron production in relativistic heavy ion collisions**

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The hadronic transport model ART [1] has been extended to include the production and annihilation of deuterons via the reactions *BB*↔*dM* involving baryons and mesons as well as their elastic scattering in the hadronic matter. With initial hadron distributions taken from a blast wave model with parameters such as the initial temperature as well as the transverse flow velocity and anisotropy fitted to reproduce the measured transverse momentum spectra and elliptic flows of protons, the transverse momentum spectrum and elliptic flow of deuterons produced in relativistic heavy ion collisions have been investigated [2]. As shown in Fig. 1, the resulting transverse momentum spectrum of deuterons from the transport model is comparable to, although somewhat softer than, the experimentally measured one.

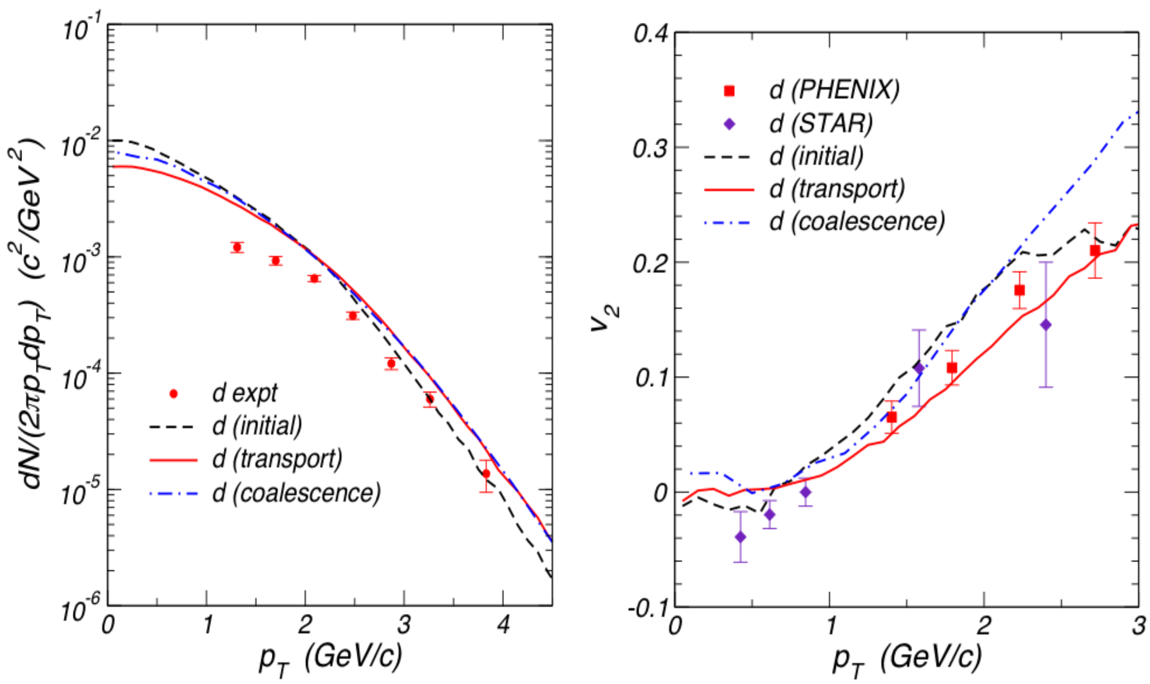


**FIG. 1**. Transverse momentum spectra (left window) and elliptic flow (right window) of protons and deuterons in minimum biased Au+Au collisions at $s_{NN}^{1/2} = 200$ GeV.

The deuteron elliptic flow from the transport model also agrees reasonably with that measured by the PHENIX Collaboration [3] but is found to be positive at small transverse momenta in contrary to the

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negative values observed by the STAR Collaboration [4]. These results have been compared with those from the coalescence model [5] using the freeze-out proton and neutron distributions from the transport model, which are also shown in Fig. 1. While the two give very similar deuteron transverse momentum spectra, the elliptic flows obtained in the two models are different, particularly at high transverse momenta. In addition, the coalescence model is found to give almost exact nucleon number scaling of the elliptic flow, while the elliptic flow from the transport model shows a deviation from this scaling behavior, although it is closer to the measured data. Part of the difference between the results from the two models may be due to the neglect of rescattering of deuterons produced in the coalescence model. Although deuterons are produced from freeze-out nucleons in the coalescence model, they may undergo additional scattering in the hadronic matter, leading to a delayed emission time as results from the transport model have shown. In the transport model, a negative deuteron elliptic flow is possible if the final radial flow velocity is smaller than that reached in the present study. Whether this can still lead to a good description of the measured deuteron transverse momentum spectrum needs to be checked. Further investigations both in theory and experiment are thus required to understand the elliptic flow of deuterons at low transverse momenta and to shed more light on the mechanisms for the production of low transverse momentum hadrons in relativistic heavy ion collisions.


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