Charmed hadron chemistry in relativistic heavy-ion collisions

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We have developed a comprehensive coalescence-fragmentation approach for studying heavy quark hadronization in heavy-ion collisions [1]. Both *s* and *p*-wave charmed hadron states, which are sufficient to cover all major charmed hadron states reported in PDG, have been included in our coalescence model. We have found that the inclusion of *p*-wave states enhances the total coalescence probability of charm quarks. It is also necessary for a full 3-dimensional calculation to normalize the charm-QGP coalescence probability at zero momentum using reasonable in-medium sizes for charmed hadrons. In our new coalescence model, a strict 4- momentum conservation has been implemented by first

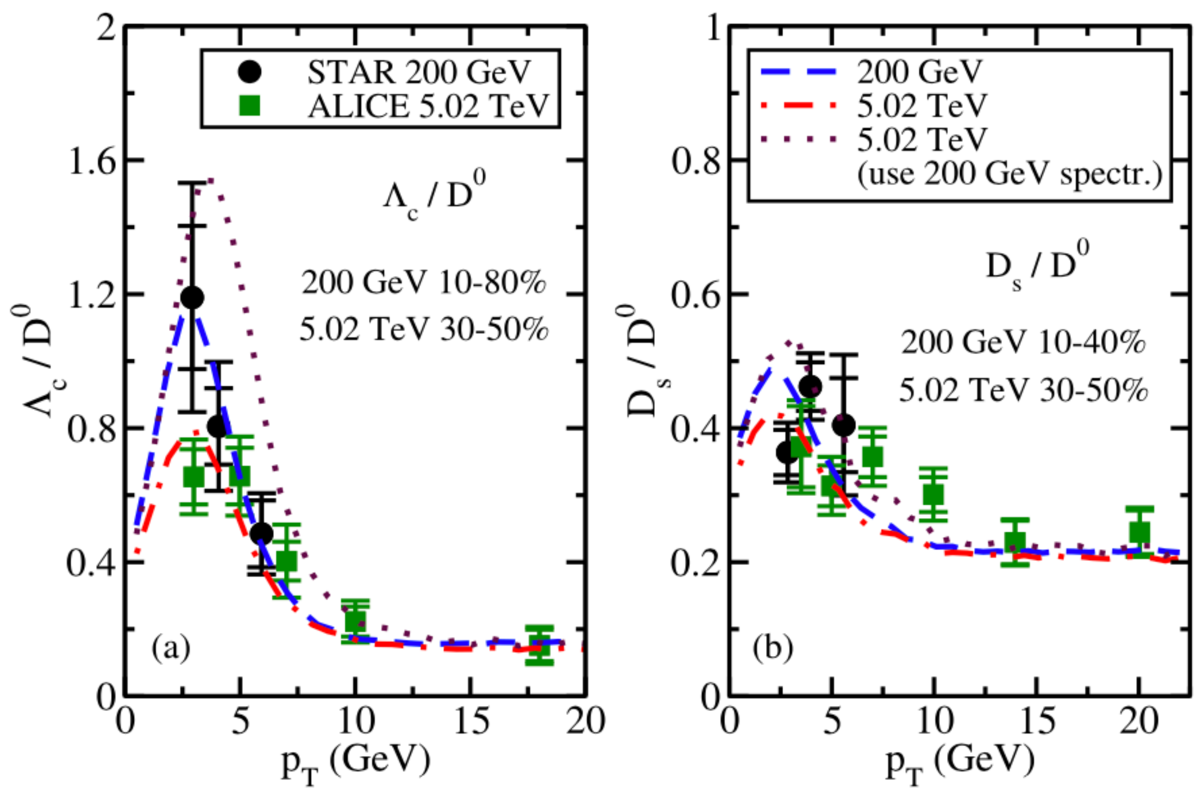

Fig. 1. Λ_c/D^0 and D_s/D^0 ratios in 200 GeV Au-Au collisions at RHIC [2] and 5.02 TeV Pb-Pb collisions at the LHC [3].

forming the off-shell excited hadron states and then letting them decay into the ground state charmed hadrons, which guarantees the boost invariance of the coalescence probabilities for producing charmed hadrons and the thermal limit of their energy spectra. By combining our new hadronization approach with the up-to-date FONLL+EPPS16 initial spectra of charm quarks and their nuclear modification through the advanced Langevin-hydrodynamics model, our state-of-the-art calculation has provided a simultaneous description of the p_T-integrated and differential Λ_c/D^0 and D_s/D^0ratios at both RHIC and the LHC as shown in Fig. 1. We have also found that the interplay between the QGP flow and the charm quark transverse momentum spectrum is essential for describing the final charmed hadron chemistry in heavy-ion collisions, especially the puzzling observation of a larger Λ_c/D^0 ratio at RHIC than at the LHC. Our study has further suggested that the sizes of charmed hadrons should be larger in medium than in vacuum, which is qualitatively consistent with the findings in Ref. [4] and may be further tested by hadronic model calculations in the future.

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