Ratios of heavy baryons to heavy mesons in relativistic nucleus-nucleus collisions

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We have studied heavy baryon/meson ratios $\Lambda_c/D_0$ and $\Lambda_b/B_0$ in relativistic heavy ion collisions in the quark coalescence model [1]. For heavy baryons, we include production from coalescence of heavy quarks with free light quarks as well as with bounded light diquarks [2] that might exist in the strongly coupled quark-gluon plasma produced in these collisions. As shown in Fig. 1 and Fig. 2, the resulting $\Lambda_c/D_0$ and $\Lambda_b/B_0$ ratios, including the contribution from decays of heavy hadron resonances and also that due to fragmentation of heavy quarks that are left in the system after coalescence, in central Au+Au collisions at $s_{NN}^{1/2} = 200$ GeV are about a factor of five and ten, respectively, larger than those given by the thermal model, and about a factor of ten and twelve, respectively, larger than corresponding ratios in the PYTHIA model for pp collisions. These ratios are reduced by a factor of about 1.6 if there are no diquarks in the quark-gluon plasma. The momentum dependence of the heavy baryon/meson ratios is found to be sensitive to the heavy quark mass, with the $\Lambda_b/B_0$ ratio being much flatter than the $\Lambda_c/D_0$ ratio, which peaks at the transverse momentum $p_T \sim 0.8$ GeV but the peak shifts to $p_T \sim 2$ GeV in the absence of diquarks.

FIG. 1. Spectra of (a) $\Lambda_c$ and (b) $D_0$ as well as (c) the ratio $\Lambda_c/D_0$. Solid lines are for the three-quark model and dashed lines are for the diquark model. Results from the PYTHIA model are shown by filled circles.
FIG. 2. Same as Fig.1 for (a) $\Lambda_b$ and (b) $B^0$ spectra, and (c) the $\Lambda_b/B^0$ ratio.