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Measurement of $D^{\pm}$ meson production and total charm production yield at midrapidity in Au+Au collisions at $\sqrt{s_N N}$ = 200 GeV with the STAR experiment

We present the STAR measurement of $D^{\pm}$ meson production at midrapidity (|y| < 1) in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. $D^{\pm}$ mesons were reconstructed from the three-body decay channel $D^{\pm}$ -> $K\ \pm^{\pm}$ utilizing STAR's Heavy Flavor Tracker for topological reconstruction. The $D^{\pm}$ invariant spectra at midrapidity were obtained in various centrality classes covering a transverse momentum (p_T) range of 0.5 < p_T < 10.0 GeV/c. The measured nuclear modification factor of $D^{\pm}$ mesons reveals a significant suppression at high p_T in central and mid-central Au+Au collisions with respect to p+p collisions. The p_T dependent (D^+ + D^-)/(D^0 + $\overline{D^0}$) yield ratios are found to be consistent in different centrality classes, and PYTHIA calculations reproduce the observed ratios. For the first time, we extracted the total charm production yield at midrapidity combining the major ground states (D^0, $D^{\pm}$, D^s and $_c$) in Au+Au collisions. The total charm cross-section per nucleon-nucleon collision at midrapidity in mid-central Au+Au collisions is found to be 112.4 ± 5.7 ± 22.9 μb, consistent with the total cross-section measured in p+p collisions at the same collision energy. This demonstrates that charm quark production follows the number-of-binary collisions scaling in heavy-ion collisions at RHIC and charm quarks are predominantly produced through the initial hard scatterings.

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