Multiple scattering and p_T-broadening at RHIC energies

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Abstract

In ultrarelativistic heavy-ion collisions, in the 2 GeV $< p_T <$ 6 GeV transverse-momentum region, the soft and semi-hard multiple scattering of the incoming nucleons results in the broadening of the expected hadronic (e.g. pion) p_T spectra. Thus, higher transverse-momentum regions are populated than in proton-proton (pp) collisions. In a perturbative QCD based calculation we include the intrinsic transverse momentum (k_T) of the partons in the nucleon (determined from pp collisions), augmented by the extra broadening obtained via a systematic analysis of pA collisions in the energy range $17 < s^{1/2} < 39$ A GeV. The original polynomial spectra are modified, and an exponential spectrum appears in the region 2 GeV $< p_T <$ 4 GeV. At present RHIC energies ($\sqrt{s} = 56,\ 130$ A GeV), the slope of the spectra coincides with that of fluid-dynamical descriptions, but it lacks any thermal origin. We determine and discuss the size of the modifications originating in multiple scattering, which lead to this state of affairs.