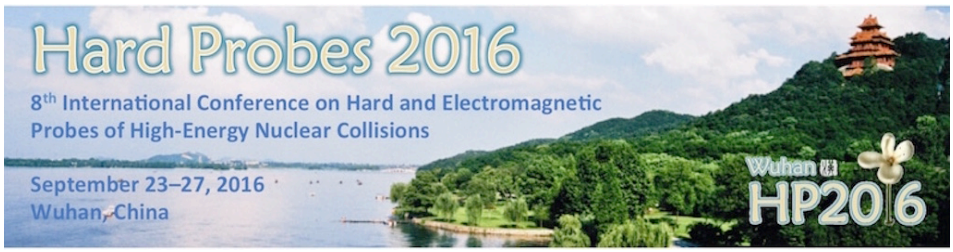

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Productions of η, ρ^0 and ϕ at large transverse momentum in Heavy ion Collisions with NLO pQCD

Sunday 25 September 2016 09:50 (20 minutes)

The transverse momentum spectrum of η meson in relativistic heavy-ion collisions is studied at the next-to-leading-order (NLO) within the perturbative QCD, where the jet quenching effect in the QGP is incorporated with the effectively medium-modified η fragmentation functions using the higher-twist approach. We show that the theoretical simulations could give nice descriptions of PHENIX data on η meson in both $\mathrm{p}+\mathrm{p}$ and central $\mathrm{Au}+\mathrm{Au}$ collisions at the RHIC, and also provide numerical predictions of η spectra in central $\mathrm{Pb}+\mathrm{Pb}$ collisions with $\sqrt{s_{NN}} = 2.76$˜TeV at the LHC. The ratios of η/π^0 in $\mathrm{p}+\mathrm{p}$ and in central $\mathrm{Au}+\mathrm{Au}$ collisions at 200˜GeV are found to overlap in a wide p_T region, which matches well the measured ratio η/π^0 by PHENIX. We demonstrate that, at the asymptotic region when $p_T \to \infty$ the ratios of η/π^0 in both $\mathrm{Au}+\mathrm{Au}$ and $\mathrm{p}+\mathrm{p}$ are almost determined only by quark jets fragmentation and thus approach to the one in e^+e^- scattering; in addition, the almost identical gluon (quark) contribution fractions to η and to π result in a rather moderate variation of η/π^0 distribution at intermediate and high p_T region in $\mathrm{A}+\mathrm{A}$ relative to that in $\mathrm{p}+\mathrm{p}$; while a slightly higher η/π^0 at small p_T in $\mathrm{Au}+\mathrm{Au}$ can be observed due to larger suppression of gluon contribution fraction to π^0 as compared to the one to η. The theoretical prediction for η/π^0 at the LHC has also been presented.

Also, we present our further studies on vector mesons such as ρ^0 and ϕ within the same framework. The theoretical predictions based on pQCD are thus firstly given which math well with the experimental measurements. It paved the way to the uniformly understanding of the strong suppression of single hadron productions at large transverse momentum which is a convincing evidence of the jet quenching effect.

Summary

The transverse momentum spectrum of η meson in relativistic heavy-ion collisions is studied at the next-to-leading-order (NLO) within the perturbative QCD, where the jet quenching effect in the QGP is incorporated with the effectively medium-modified η fragmentation functions using the higher-twist approach. We show that the theoretical simulations could give nice descriptions of PHENIX data on η meson in both $\mathrm{p}+\mathrm{p}$ and central $\mathrm{Au}+\mathrm{Au}$ collisions at the RHIC, and also provide numerical predictions of η spectra in central $\mathrm{Pb}+\mathrm{Pb}$ collisions with $\sqrt{s_{NN}} = 2.76$˜TeV at the LHC. The ratios of η/π^0 in $\mathrm{p}+\mathrm{p}$ and in central $\mathrm{Au}+\mathrm{Au}$ collisions at 200˜GeV are found to overlap in a wide p_T region, which matches well the measured ratio η/π^0 by PHENIX. We demonstrate that, at the asymptotic region when $p_T \to \infty$ the ratios of η/π^0 in both $\mathrm{Au}+\mathrm{Au}$ and $\mathrm{p}+\mathrm{p}$ are almost determined only by quark jets fragmentation and thus approach to the one in e^+e^- scattering; in addition, the almost identical gluon (quark) contribution fractions to η and to π result in a rather moderate variation of η/π^0 distribution at intermediate and high p_T region in $\mathrm{A}+\mathrm{A}$ relative to that in $\mathrm{p}+\mathrm{p}$; while a slightly higher η/π^0 at small p_T in $\mathrm{Au}+\mathrm{Au}$ can be observed due to larger suppression of gluon contribution fraction to π^0 as compared to the one to η. The theoretical prediction for η/π^0 at the LHC has also been presented.

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