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Dijet, dihadron and hadron-jet correlations in resummation improved pQCD approach

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Dijet, dihadron and hadron-jet angular correlations as well as dijet transverse momentum asymmetry have been reckoned as important probes of the transverse momentum broadening effects in relativistic nuclear collisions [1,2]. Dijets become de-correlated due to the vacuum soft gluon radiation associated with the Sudakov logarithms and the medium-induced transverse momentum broadening.

We first employ the systematic Sudakov resummation formalism to describe the dihadron and hadron-jet angular correlation data in pp and central AA collisions [1]. For a quark jet at RHIC top energy, a global χ^2 analysis of dihadron and hadron-jet angular correlation data renders the best fit for the medium-induced broadening $\langle p_\perp^2 \rangle$ and the so-called jet transport coefficient $\hat{q}$ in central AA collisions.

Then we develop a systematic theoretical approach to dijet asymmetries in pp collisions based on pQCD expansion and Sudakov resummation formalism [2]. We find that the NLO pQCD calculation is indispensable to describe experimental data, while the resummation formalism is vital near the end points where the pQCD expansion fails to converge due to appearance of large Sudakov logarithms. Utilizing our resummation-improved pQCD approach, we extract jet transport coefficient for quark-gluon plasma in $PbPb$ collisions at 2.76A~TeV.

We can also use this method to study the properites of cold nuclear matter and other related topics [3].

Further experimental and theoretical efforts along the direction of this work shall significantly advance the quantitative understanding of transverse momentum broadening and help us acquire precise knowledge of jet quenching parameter in heavy-ion collisions.

[1] L. Chen, G. Y. Qin, S. Y. Wei, B. W. Xiao and H. Z. Zhang, Phys. Lett. B 773, 672 (2017).
[2] L. Chen, G. Y. Qin, S. Y. Wei, B. W. Xiao and H. Z. Zhang, arXiv:1612.04202 [hep-ph].
[3] L. Chen, G. Y. Qin, S. Y. Wei, B. W. Xiao and H. Z. Zhang, in preparing.

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