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Understanding γ-jet angular correlation and momentum imbalance with QCD resummations.

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γ-jet correlations and their momentum imbalance have been widely regarded as the "Golden probe". Based on our previous studies on dijet, dihadron and hadron-jet angular correlations in $p+p$ and $A+A$ collisions [1,2,3,4], we further employ the systematic Sudakov resummation formalism to study the angular correlation between direct photon and jets as well as their transverse momentum imbalance in both pp and $PbPb$ collisions.

Our results [5] for the γ-jet angular correlation agree nicely with the ATLAS and CMS data. Since the vacuum Sudakov effects are overwhelmingly larger than QGP medium effects, we can naturally explain the negligible difference between pp and $PbPb$ data. Furthermore, based on the resummation improved pQCD approach, our calculation for the distribution of γ-jet transverse momentum imbalance in pp collisions can provide important predictions for this observable, and can be compared with all LHC data once experimental data are unfolded. In addition, using the pp collision as the baseline, we can also apply BDMPS and High-Twist energy loss formalism to $PbPb$ collisions, and thus extract the jet transport coefficient in the LHC regime.

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