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Towards the Understanding of Jet Substructures and Cross Sections in Heavy Ion Collisions Using Soft-Collinear Effective Theory (15' + 5')

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The jet quenching phenomena in heavy ion collisions provide a strong evidence of the modification of parton shower in the quark-gluon plasma (QGP). Jet substructure observables can probe various aspects of the jet formation mechanism. They contain useful information about the QGP and allow us to study the medium properties in great details. Here we present theoretical calculations of jet shapes, jet fragmentation functions and jet cross sections in proton-proton, proton-lead and lead-lead collisions at the LHC using soft-collinear effective theory, with Glauber gluon interactions in the medium. We find that resumming large logarithms in the jet substructure calculation is necessary for precise theoretical predictions. The resummation is performed using renormalization group evolution between characteristic jet scales. We also find that the medium induces power corrections to jet shapes and jet fragmentation functions due to the Landau-Pomeranchuk-Migdal effect. In the end we present the comparison between our calculations with the recent measurements at the LHC with very good agreement. Our calculations help initiate precise jet modification studies in heavy ion collisions.

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