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Exposing the dead-cone effect of jet quenching in QCD medium

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When an energetic parton traverses the hot QCD medium, it may suffer multiple scattering and energy losses. The medium-induced gluon radiation for a massive quark will be suppressed relative to that of a light quark due to the dead-cone effect. The development of new declustering techniques of jet evolution makes a direct study of the dead-cone effect in the QCD medium possible for the first time. In this work, we compute the emission angle distribution of the charm-quark initiated splittings in D^0 meson tagged jet and that of the light parton initiated splittings in inclusive jets in p+p and Pb+Pb at 5.02˜TeV by utilizing the declustering techniques of jet evolution. The heavy quark propagation and indued energy loss in the QCD medium are simulated with the SHELL model based on the Langevin equation. When comparing the jet number normalized emission angle distributions of the charm-quark initiated splittings and that of the light parton initiated splittings by directly taking their ratios at the same energy intervals of the initial parton, one can find the charm-quark initiated splittings will be suppressed at smaller emission angle corresponding to the dead-cone effect. The dead-cone effect of the jet quenching can be directly observed. We further investigate the case of the emission angle distributions normalized to the number of splittings in jets and find that the dead-cone effect will broaden the emission angle of the splitting and reduce the possibility of such splitting occurring, leading to the massive parton losing less energy.

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