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Multijet topology in high-energy nuclear collisions: Jet broadening

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This work presents the first theoretical investigation of the medium modification of jet broadening as an event-shape observable in multijet final states due to jet quenching in high-energy nuclear collisions. The partonic spectrum of *pp* collisions with next-to-leading order (NLO) accuracy at $\sqrt{s_{\rm NN}} = 5.02$ TeV is provided by the POWHEG+PYTHIA8 event generator, and the linear Boltzmann transport (LBT) model is utilized to investigate the energy loss of fast partons as they traverse through the hot and dense QCD medium. Jet broadening distributions in multijet final states for both *pp* and Pb+Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV are calculated. We observe an enhancement at the small jet broadening region while a suppression at the large jet broadening region in Pb+Pb collisions relative to that in *pp*. This suggests that medium modifications with parton energy loss in the QGP lead to a more concentrated energy flow in all observed multijet events in Pb+Pb reactions. We also demonstrate that the intertwining of two effects, the jet number reduction and the restructured contribution, results in the novel behavior of nuclear modification of the jet broadening observable in Pb+Pb collisions.

Primary authors: 康, 锦文 (华中师范大学); Mr 王, 磊; DAI, Wei (China University of Geosciences); WANG, Sa (China Three Gorges University); ZHANG, Ben-Wei (Central China Normal University)

Presenter: 康, 锦文 (华中师范大学)

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