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Gradient tomography in heavy-ion collisions

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Transverse momentum broadening and energy loss of a propagating parton are dictated by the space-time profile of the jet transport coefficient \hat{q} in dense QCD medium. Spatial gradient of \hat{q} perpendicular to the propagation direction can lead to a drift and asymmetry in parton transverse momentum distribution. Such an asymmetry depends on both the spatial position along the transverse gradient and path length of a propagating parton as shown by numerical solutions of the Boltzmann transport in the simplified form of a drift-diffusion equation. In high-energy heavy-ion collisions, this asymmetry with respect to a plane defined by the beam and trigger particle (photon, hadron or jet) with a given orientation relative to the event plane is shown to be closely related to the transverse position of the initial jet production in full event-by-event simulations within the linear Boltzmann transport model. Such a gradient tomography can be used to localize the initial jet production position for more detailed study of jet quenching and properties of the quark-gluon plasma along a given propagation path in heavy-ion collisions

Primary authors: PANG, LongGang (Lawrence Berkeley National Laboratory); Dr HE, Yayun (South China Normal University); WANG, Xin-Nian (Lawrence Berkeley National Lab. (US))

Presenter: Dr HE, Yayun (South China Normal University)

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