中国高能核物理网络论坛

HIGH ENERGY NUCLEAR PHYSICS IN CHINA

The 163th HENPIC seminar

Jet energy loss distributions, anisotropy flow, and transverse gradient tomography of jet quenching in heavy-ion collisions

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April 28, 2022, Thursday, 10:30 am (UTC+8)

Zoom meeting ID: 421 173 735

ABSTRACT:

Energy loss and transverse momentum broadening of a propagating parton are twin consequences of jet quenching due to the interaction with the QGP produced in heavy-ion collisions. On one hand, based on the factorization in perturbative QCD, we firstly employ state-of-the-art Bayesian analysis to extract jet energy loss distributions for single inclusive and γ-triggered jets in Pb+Pb collisions with different centrality bins at 2.76 and 5.02 TeV at the LHC. The extracted jet energy loss distributions have a large width with a scaling behavior in $x = \Delta p_T / \langle \Delta p_T \rangle$. The averaged jet energy loss extracted increases with the initial jet p_T that is slightly stronger than a logarithmic form. These results indicate there are a few out-of-cone jet-medium scatterings that are consistent with the LBT simulations and can help constrain uncertainties of jet transport models.

In addition to studying averaged jet energy loss leading to jet suppression, we also investigate the azimuthal anisotropy of jet energy loss which gives rise to jet anisotropy flow. We investigate the colliding energy, centrality, jet transverse momentum dependence of the jet anisotropy, as well as their event-by-event correlation with the flow coefficients of the soft bulk hadrons. An approximate linear correlation between jet and bulk v_2 is found. The jet-induced medium excitation, which is influenced by radial flow, is shown to enhance v_2^{jet} and the enhancement increases with the jet cone size.

On the other hand, the spatial gradient of jet transport coefficient q-hat 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 LBT model. Such a gradient tomography can be used to localize the initial jet production position for a more detailed study of jet quenching.

ABOUT THE SPEAKER:

https://indico.ihep.ac.cn/event/11115/contribution/92/material/1/0.pdf

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Sponsored by Guangdong Major Project of Basic and Applied Basic Research(2020B0301030008)