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Flavor hierarchy of jet energy correlators inside quark-gluon plasma

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Outline of my talk

WJX, Cao, Qin and Wang *Phys. Rev. Lett.* 134 (2025) 5, 052301

□ Introduction to the jet EEC



- □ The EEC spectra of heavy and light flavor jet in pp and AA
- □ Interplay of jet-medium interaction on jet EEC
- □ Summary

Introduction to jet EEC



Jet EEC proposed in PRL 130 (2023) 5, 051901

$$\frac{\mathrm{d}\sigma_{\mathrm{EEC}}}{\mathrm{d}R_L} = \int \mathrm{d}\sigma(\Delta R_{ij}) \frac{p_{\mathrm{T},i} \, p_{\mathrm{T},j}}{p_{\mathrm{T},j\mathrm{et}}^2} \,\delta(\Delta R_{ij} - R_L)$$
$$\Delta R_{ij} = \sqrt{\Delta \phi_{ij}^2 + \Delta \eta_{ij}^2}$$

• Jet EEC presents a clear transition between perturbative region and non-perturbative region.



EEC as probe of QGP properties



• Medium-modified jet EECs present remarkable opportunity to probe jet-medium interaction mechanism and QGP properties.

Flavor hierarchy of jet EEC in pp

Pythia 8



θ



Flavor (mass) dependence:

- Σ(charged jet) > Σ(D jet) > Σ(B jet)
- $\theta^{\text{peak}}(\text{charged jet}) < \theta^{\text{peak}}(\text{D jet}) < \theta^{\text{peak}}(\text{B jet})$

Flavor hierarchy of jet EEC in pp

Pythia 8



$\langle \boldsymbol{\theta} \rangle$	Charged jet	D jet	<i>B</i> jet
20 < $p_{\mathrm{T}}^{\mathrm{jet}}$ < 40 GeV	0.207	0.214	0.263
40 < $p_{\rm T}^{\rm jet}$ < 60 GeV	0.167	0.18	0.233
60 < $p_{\rm T}^{\rm jet}$ < 80 GeV	0.144	0.162	0.214

Flavor (mass) dependence:

- Σ(charged jet) > Σ(D jet) > Σ(B jet)
- θ^{peak}(charged jet) < θ^{peak}(D jet) < θ^{peak}(B jet)

Jet energy dependence:

• Higher $p_{\rm T}$ jet peaks at smaller angle.

LBT model: jet-medium interaction



• Inelastic collisions:

$$\Gamma_a^{\text{inel}}(E_a, T, t) = \int dz dk_{\perp}^2 \frac{1}{1 + \delta^{ag}} \frac{dN_g^a}{dz dk_{\perp}^2 dt}$$

• Describe jet partons, radiated gluons, recoil partons and "negative" partons within the same transport framework.

Flavor hierarchy of jet EEC in central PbPb



Flavor (mass) hierarchy in the nuclear modification of jet EEC:

- For charged jets, the EEC spectra gets a strong suppression at intermediate angle, and gets enhanced at small and large angles.
- For heavy-meson-tagged jets, both suppression and enhancement become weaker.

Effect of jet-medium interaction on jet EEC



- S: shower partons from PythiaR: medium-induced radiated gluonsM: medium response
- Jet energy loss is responsible for the suppression of jet EEC at intermediate angles.
- Medium response provides the most significant contribution to the enhancement of jet EEC at large angles.

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Effect of selection bias on jet EEC



Jet trigger bias can explain the enhancement of inclusive jet EEC

☆ High energy jets tend to radiate more gluons, which facilitates the enhancement of EEC at small angle.

Summary

Xing, Cao, Qin and Wang, Phys. Rev. Lett. 134 (2025) 5, 052301

- □ We have performed a complete realistic simulation on the medium modification of heavy and light flavor jets in heavy-ion collisions.
- □ A clear flavor hierarchy is observed for jet EEC in both vacuum and QGP due to mass effect.
- The medium modification of inclusive jet EEC exhibits rich structure: suppression at intermediate angles, and enhancement at small and large angles, which can be explained by the interplay of mass effect, energy loss, mediuminduced radiation and medium response.



LBT model: jet-medium interaction



He, Luo, Wang, Zhu, PRC 2015; Cao, Luo, GYQ, Wang, PRC 2016, PLB 2018; etc.

Medium response and medium-induced radiation to jet EEC



Flavor (mass) hierarchy in quark-jet EEC:

 Σ(light jet) > Σ(charm jet) > Σ(bottom jet), this hierarchy maintains in the contribution from medium response and medium-induced radiation.

