



Spicy Gluons 2026



Jet Suppression in O+O Collisions across Energy Scales

South China University of Technology

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Spicy Gluons 2026

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In collaboration with: Y. Dang (SDU), Q. Wang (CCNU), Y. He (SCUT),

S. Cao (SEU), X.-N. Wang (CCNU)

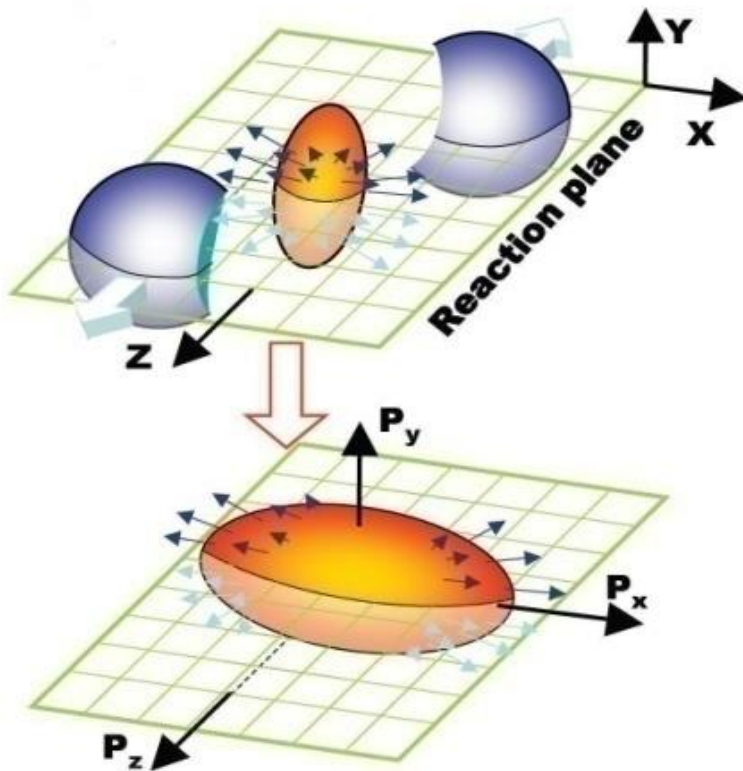
Spicy Gluons 2026

- Introduction
- LBT model
- Jet Suppression
- Summary

Properties of QGP in A+A Collisions

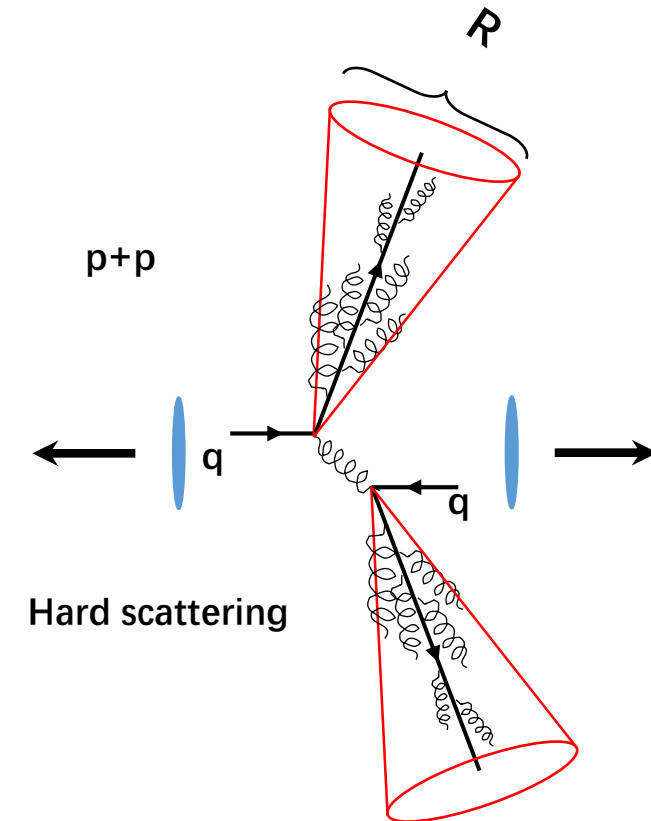
- **“Soft” probes:** light-flavour particle spectra and flow at low p_T (hydrodynamic description)

1. Elliptic flow (v_2)



- **“Hard” probes:** high p_T particles

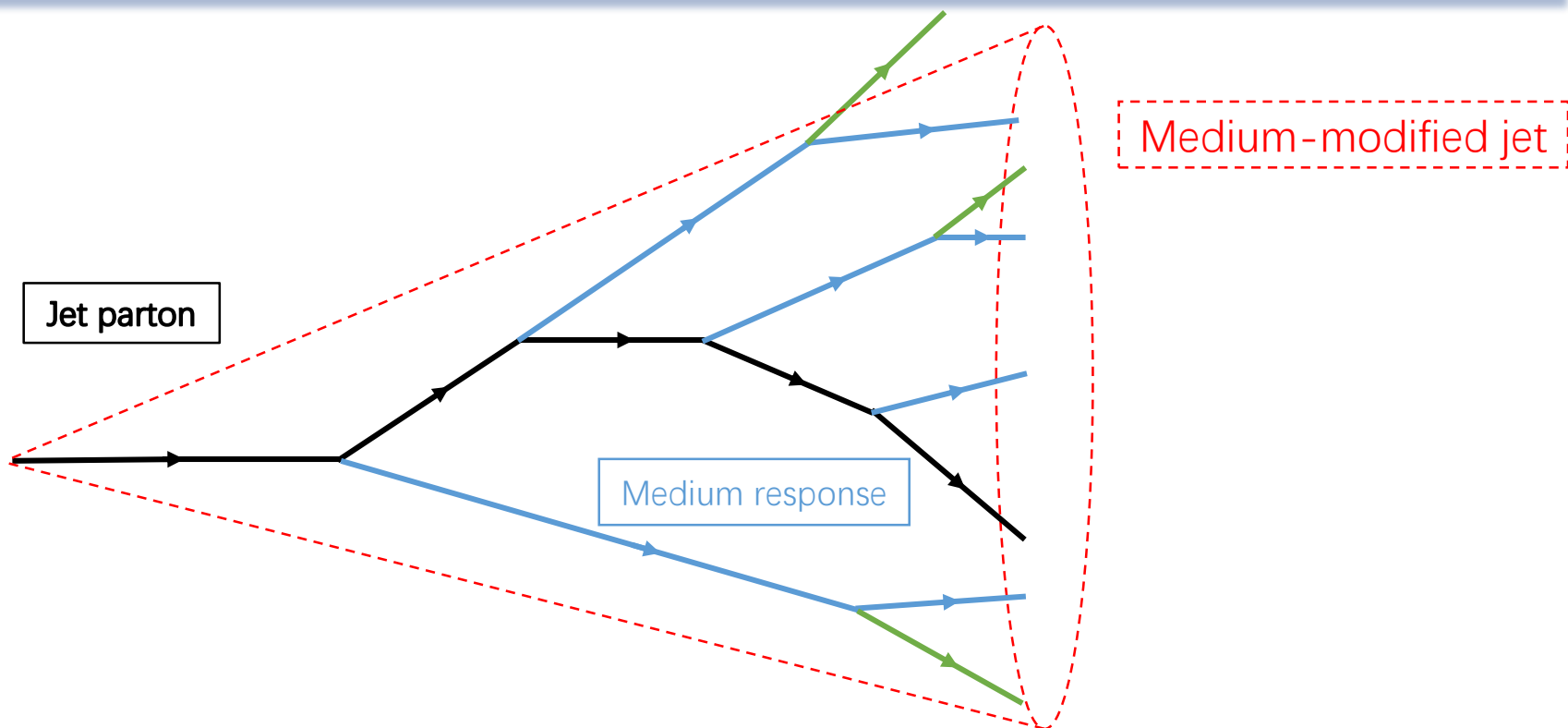
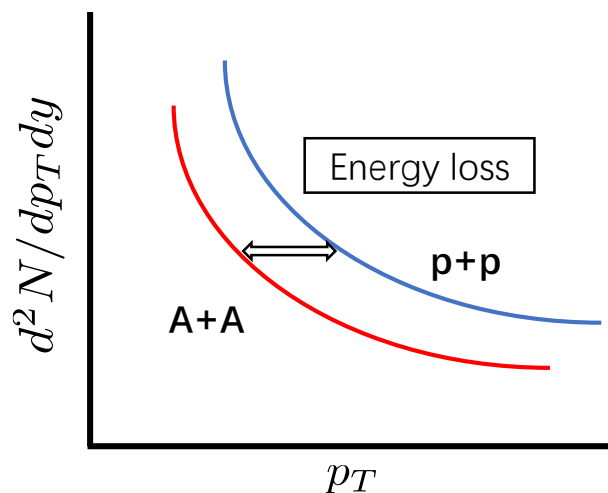
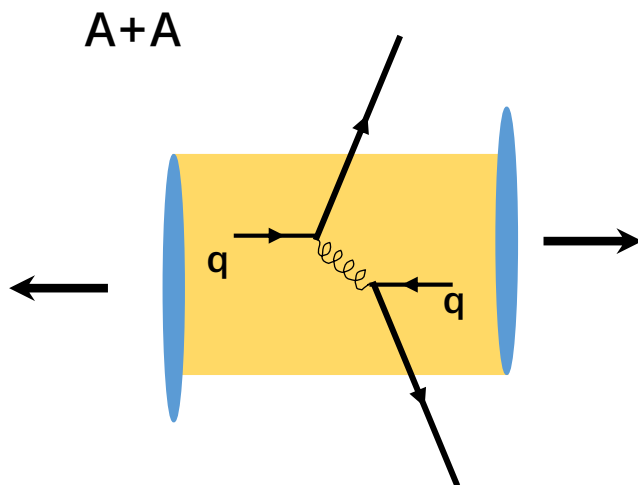
1. Jets



2. Heavy flavours
3. Quarkonia

Properties of QGP in A+A Collisions

● Jets quenching:



Nuclear modification factor (R_{AA}):

$$R_{AA} = \frac{1}{N_{coll}} \frac{d^2 N_{AA}(p_T)/dp_T dy}{d^2 N_{pp}(p_T)/dp_T dy}$$

- charged hadrons
- Inclusive jets

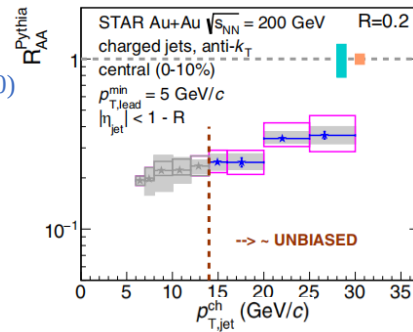
Gold standard
of jet quenching

Jet Quenching Across Systems: Energy vs. Size

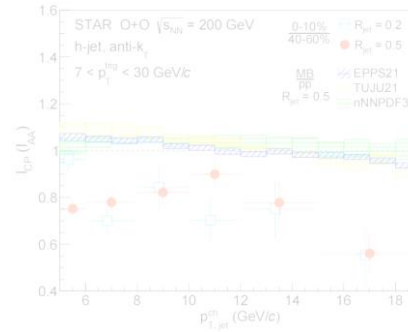
System size

Au + Au @ 200 GeV
STAR, Phys. Rev. C **102** 054913 (2020)

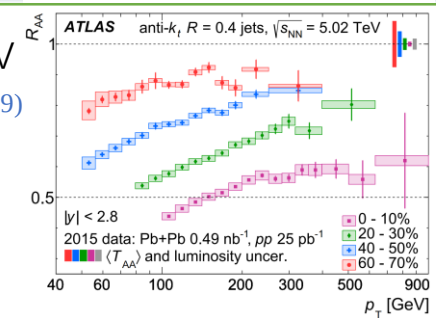
➤ Jet quenching: observed



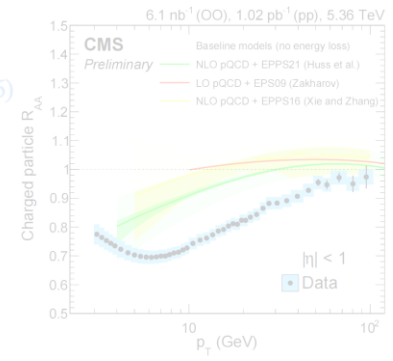
O + O @ 200 GeV
STAR, arXiv:2604.13935v1



Pb + Pb @ 5020 GeV
ATLAS, Phys. Lett. B **790**, 108 (2019)

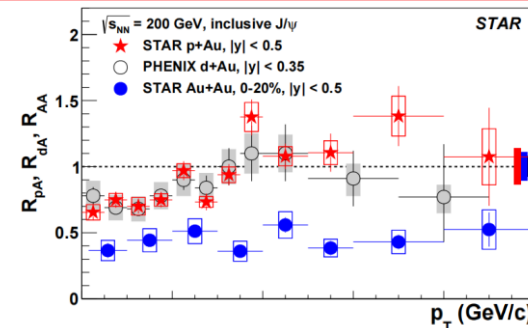


O + O @ 5360 GeV
CMS, Phys. Rev. L. **136**, 162301 (2026)

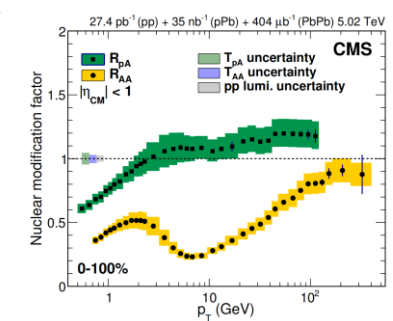


p + Au @ 200 GeV
STAR, arXiv:2110.09666v2

➤ Jet quenching: Not observed



p + Pb @ 5020 GeV
CMS, JHEP **04** (2017) 039



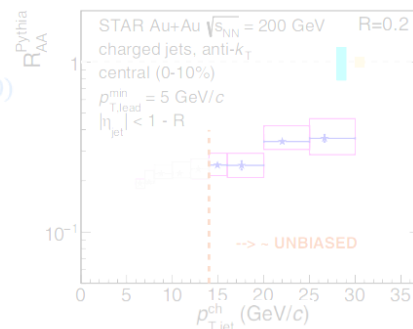
Collision energy $\sqrt{s_{NN}}$

Jet Quenching Across Systems: Energy vs. Size

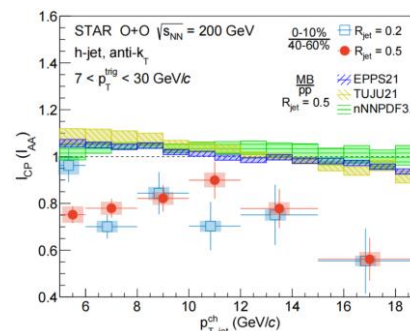
System size

➤ Jet quenching: observed

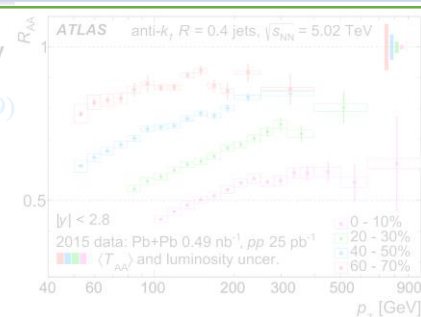
Au + Au @ 200 GeV
STAR, Phys. Rev. C **102** 054913 (2020)



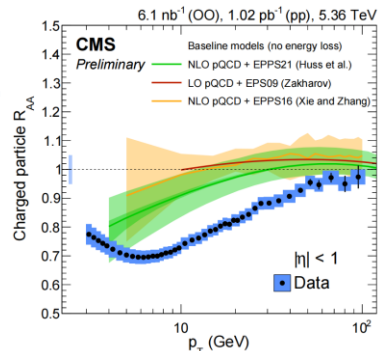
O + O @ 200 GeV
STAR, arXiv:2604.13935v1



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ATLAS, Phys. Lett. B **790**, 108 (2019)

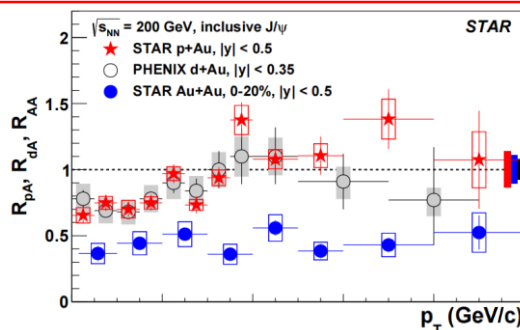


O + O @ 5360 GeV
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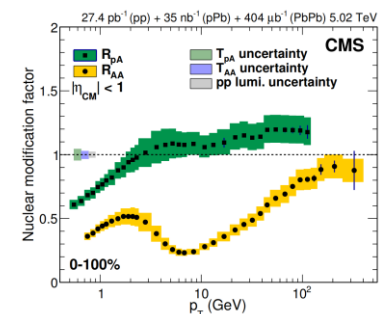


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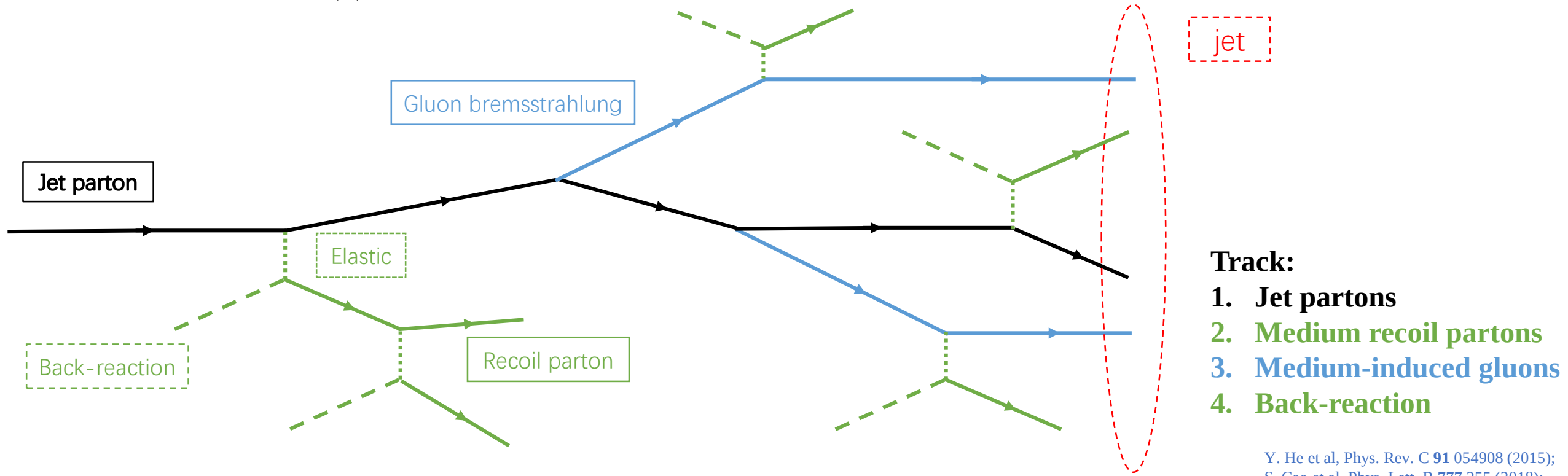
Collision energy $\sqrt{s_{NN}}$

Linear Boltzmann Transport (LBT) Model

● The LBT model

- Solve the linear Boltzmann transport equation:

$$p_a \cdot \partial f_a = \frac{\gamma_b}{2} \int \sum_{bcd} \prod_{i=b,c,d} \frac{d^3 p_i}{2E_i (2\pi)^3} (f_c f_d - f_a f_b) |M_{ab \rightarrow cd}|^2 S_2(\hat{s}, \hat{t}, \hat{u}) (2\pi)^4 \delta^4(p_a + p_b - p_c - p_d) + \text{inelastic}$$



Track:

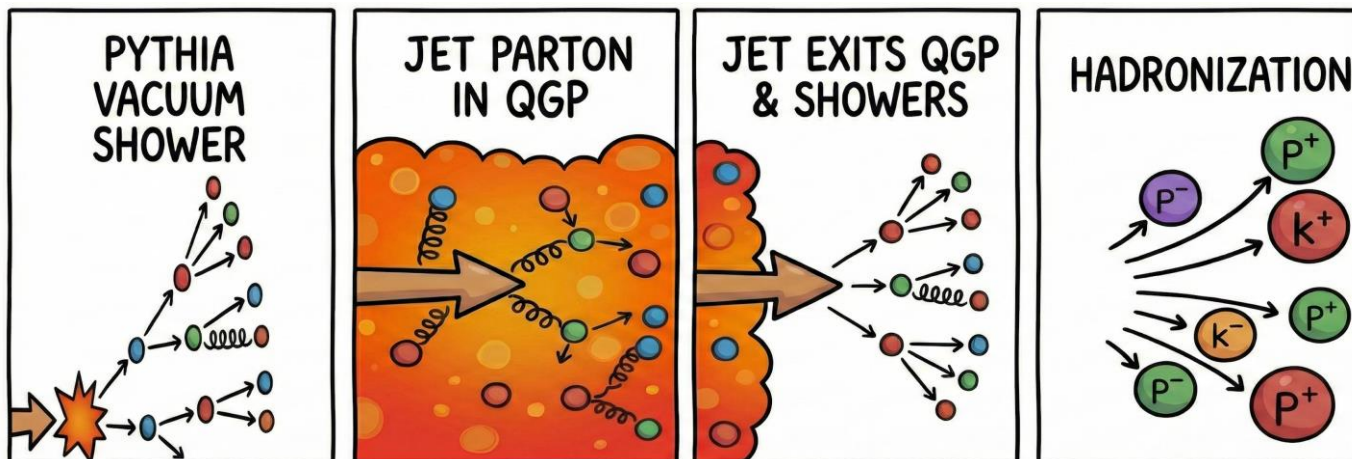
1. **Jet partons**
2. **Medium recoil partons**
3. **Medium-induced gluons**
4. **Back-reaction**

Y. He et al, Phys. Rev. C **91** 054908 (2015);
 S. Cao et al, Phys. Lett. B **777** 255 (2018);
 Y. He et al, Phys. Rev. C **99** 054911 (2019);
 T. Luo et al, Phys. Rev. C **109** 034919 (2024);
 Y. Dang et al, arXiv:2602.10395.

● CLVisc 3+1D hydro bulk evolution

Linear Boltzmann Transport (LBT) Model

● Energy scale:



[Y. C. Dang, JAO 2026.](#)

$$Q > Q_m$$

$$Q \sim Q_m$$

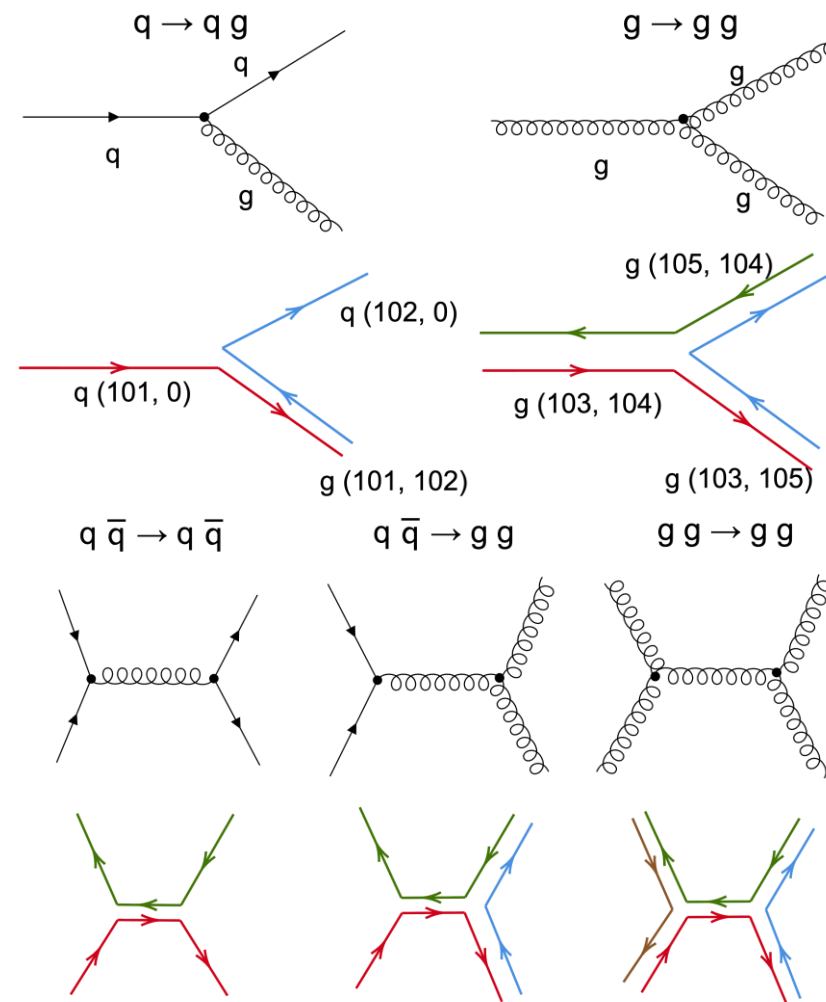
$$Q > Q_h$$

$$Q \sim Q_h$$

➤ Previous setting: $Q_m = Q_h = 0.5 \text{ GeV}$

➤ Now : $Q_m > Q_h$

● Color flow:

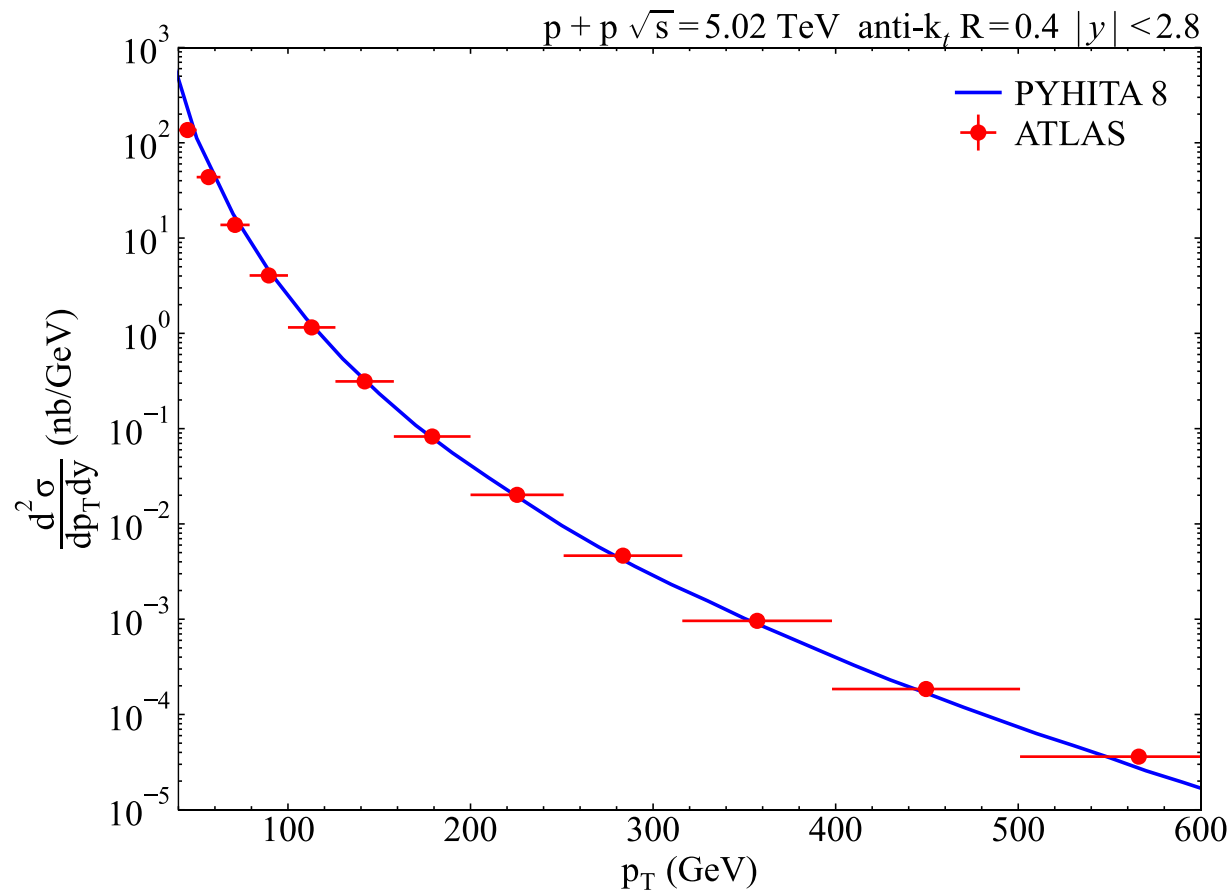


➤ large- N_c color scheme in Pythia 8

[Y. Dang, et. Al., arXiv:2602.10395](#)

p_T distribution of pp collision within PYTHIA 8

Inclusive Jets



$$R_{AA} = \frac{1}{N_{coll}} \frac{d^2 N_{AA}(p_T)/dp_T dy}{d^2 N_{pp}(p_T)/dp_T dy}$$

- PYTHIA 8 can well describe the experimental data
- Power-law spectrum in the high p_T region:
The p_T -dependent contributions from the parton distribution functions (PDFs) and hadron fragmentation functions.

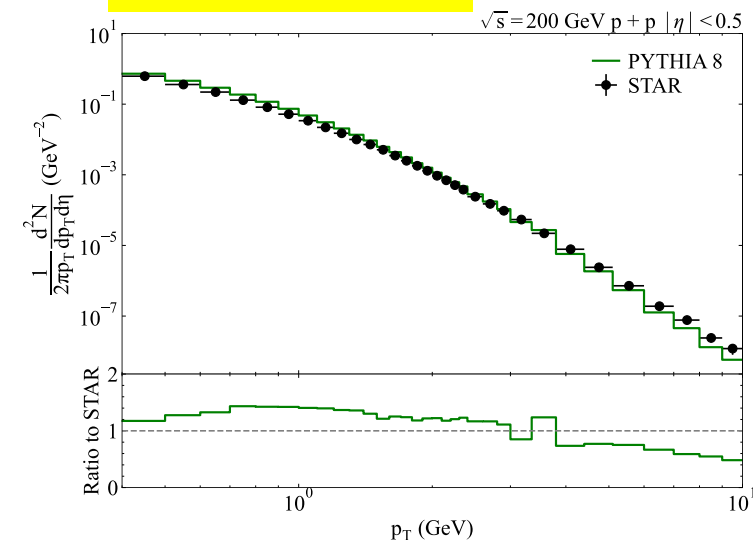
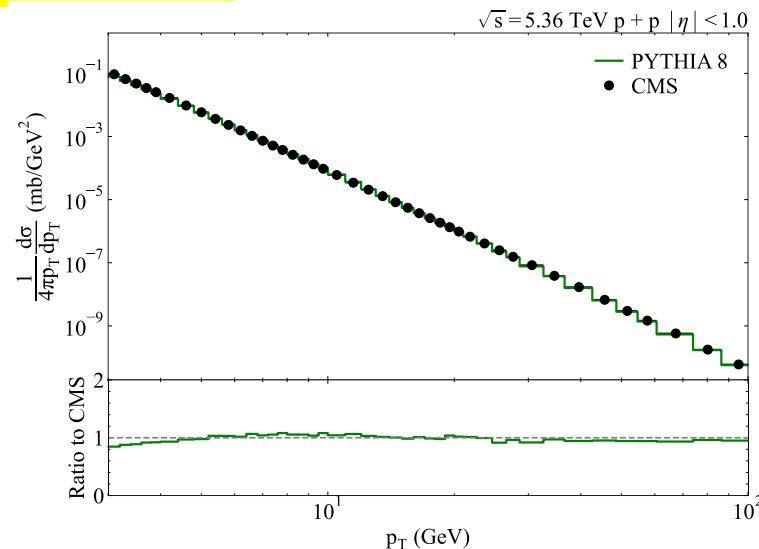
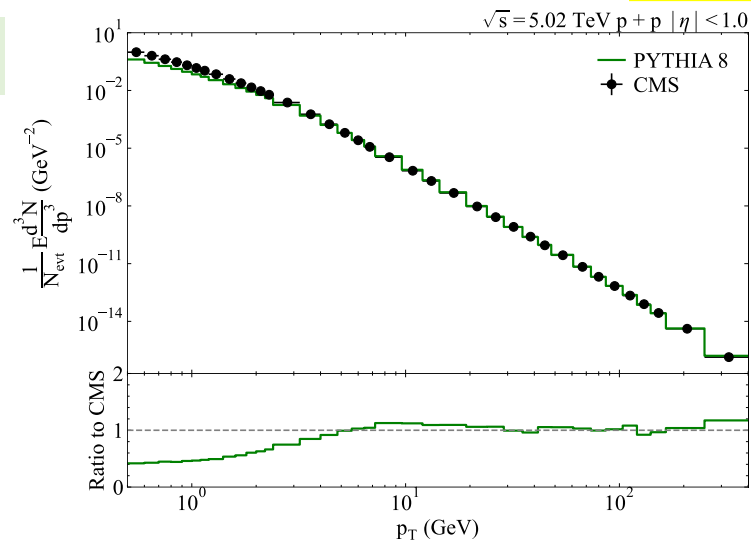
$$\frac{d\sigma}{dp_T} \propto \frac{1}{p_T^n} \quad n \approx 4-6$$

p_T distribution of pp collision within PYTHIA 8

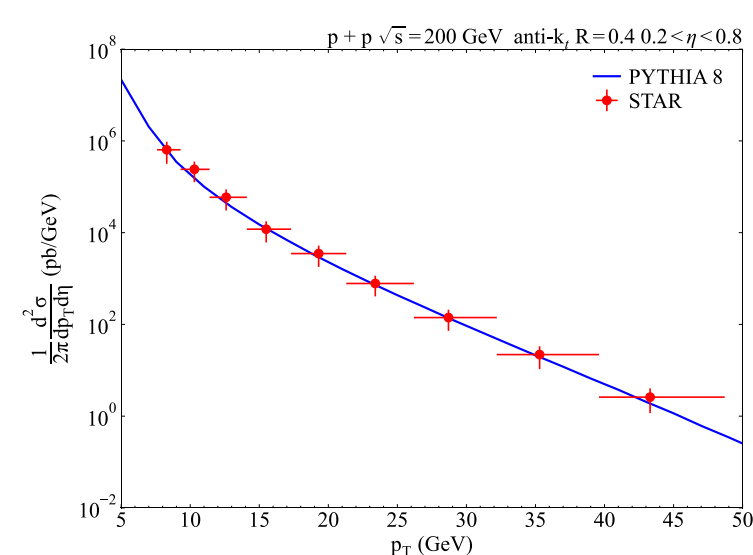
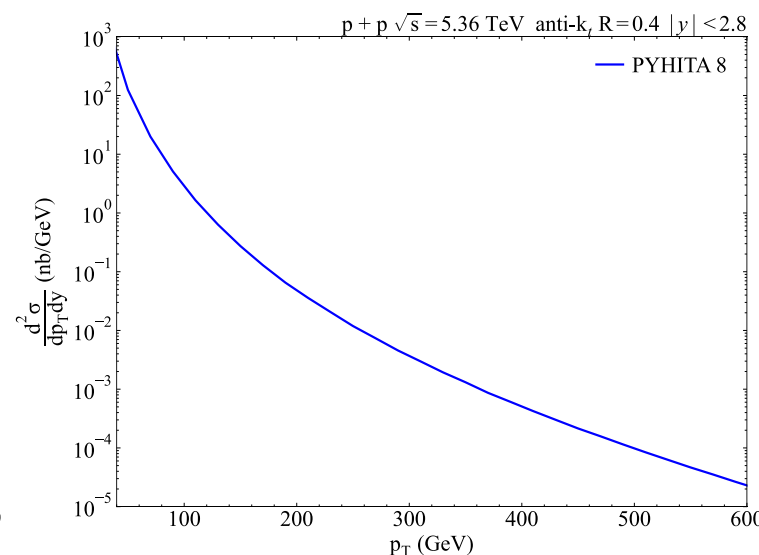
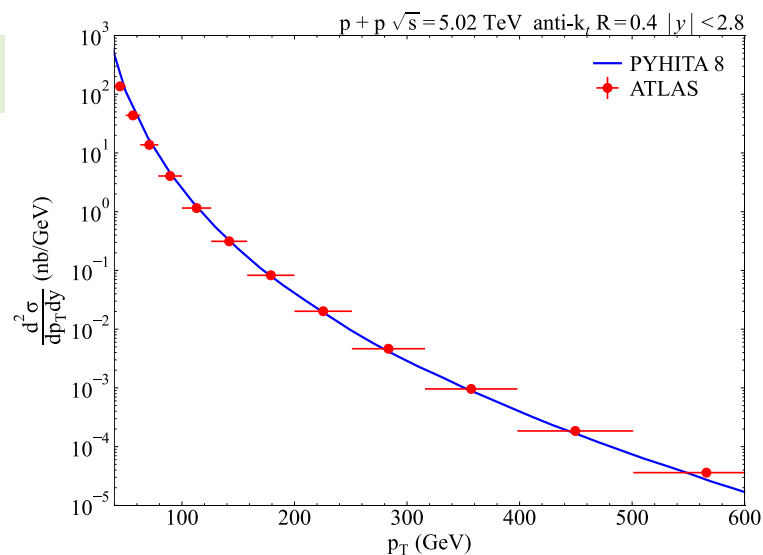
LHC energies

RHIC energy

Hadrons

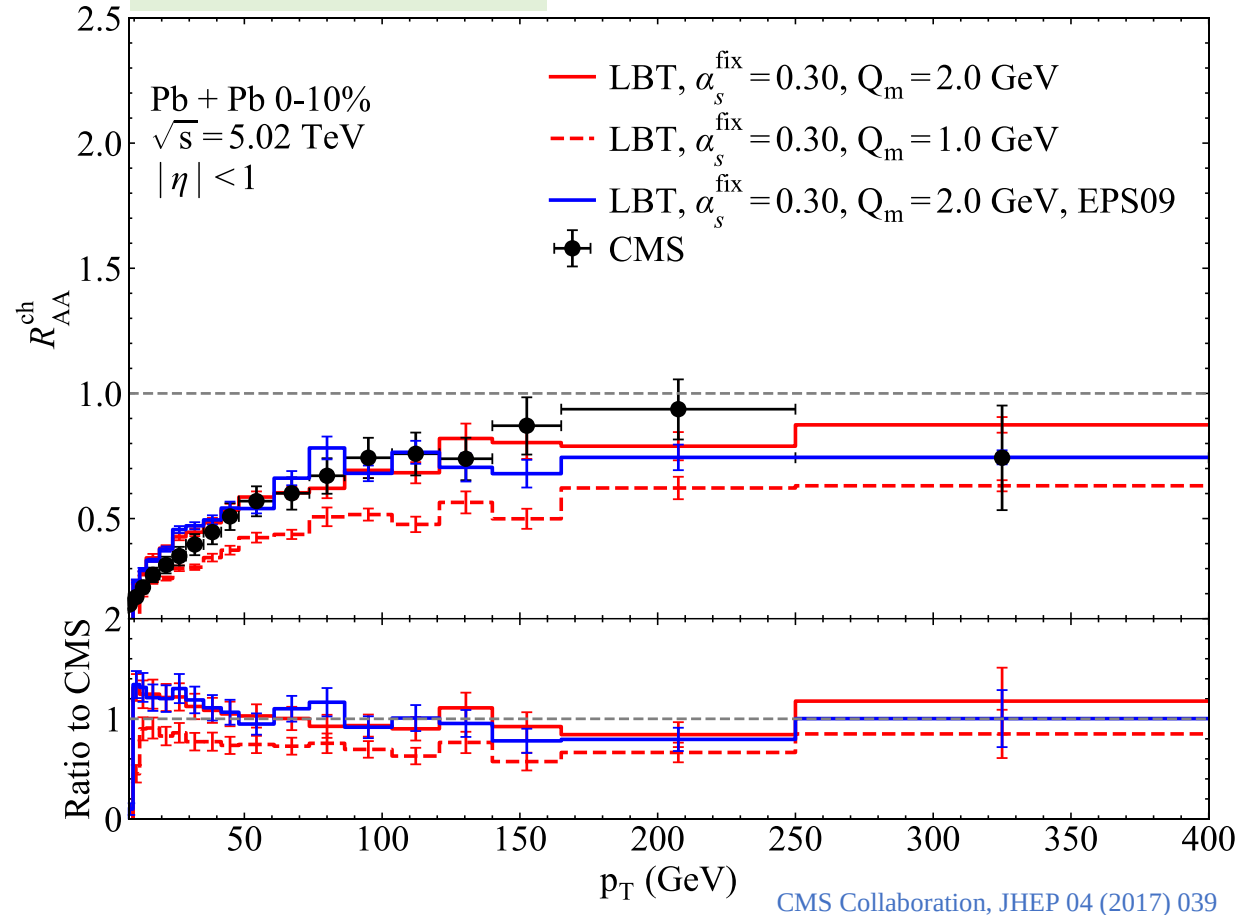


Jets

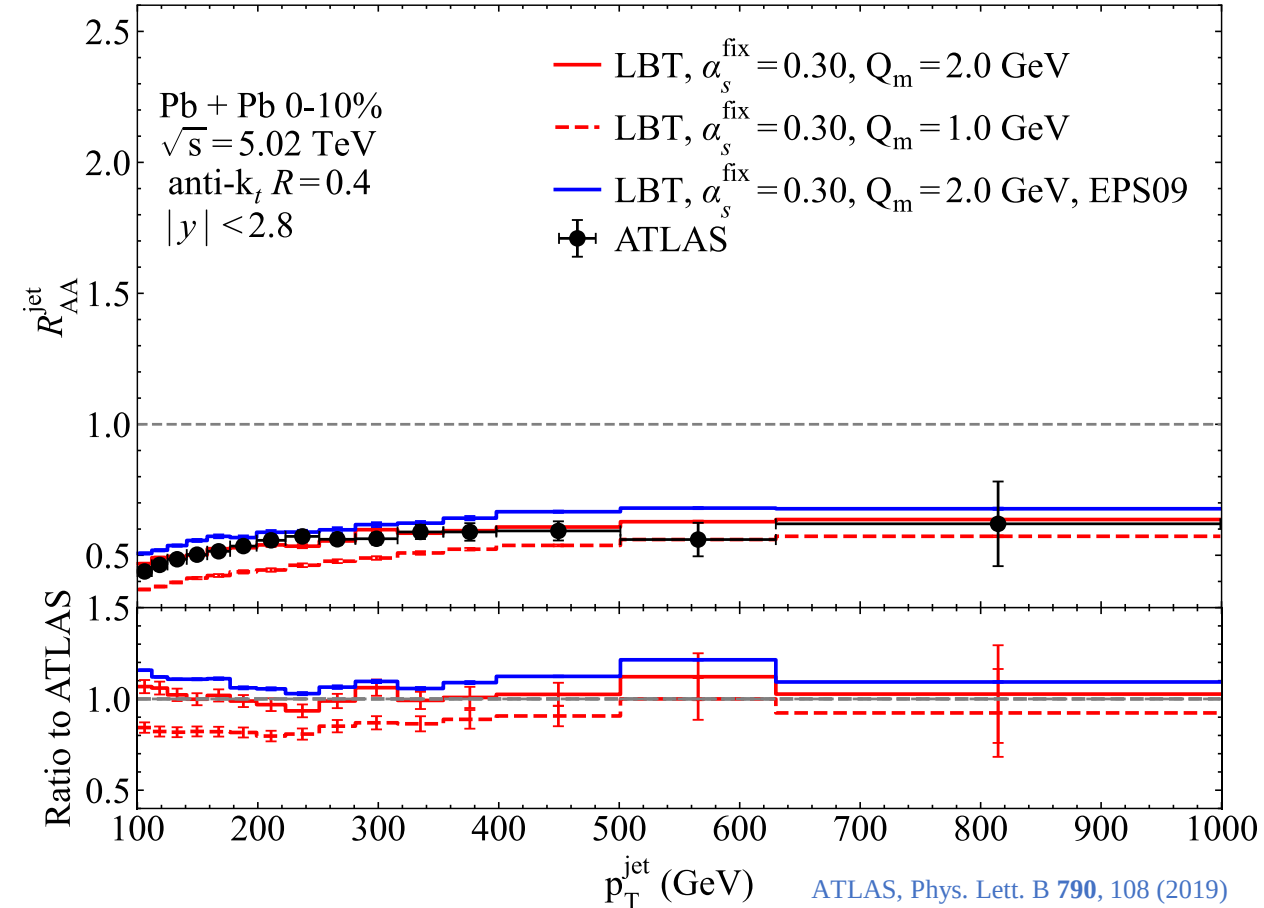


Nuclear modification factor (Hadrons and Jets)

Pb + Pb Hadrons



Pb + Pb inclusive Jets



- LBT model can well describe both hadron and jet suppression ($Q_m = 2.0$ GeV)
- nPDFs effects on R_{AA} in Pb + Pb: **Hadrons**: mild modification
Inclusive jets: significant modification

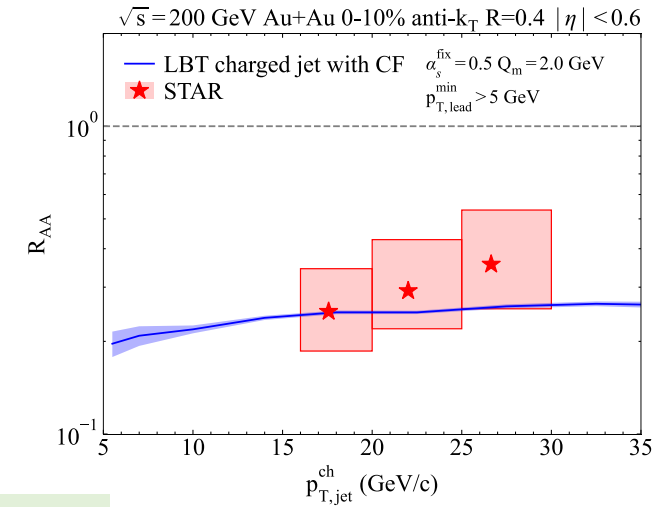
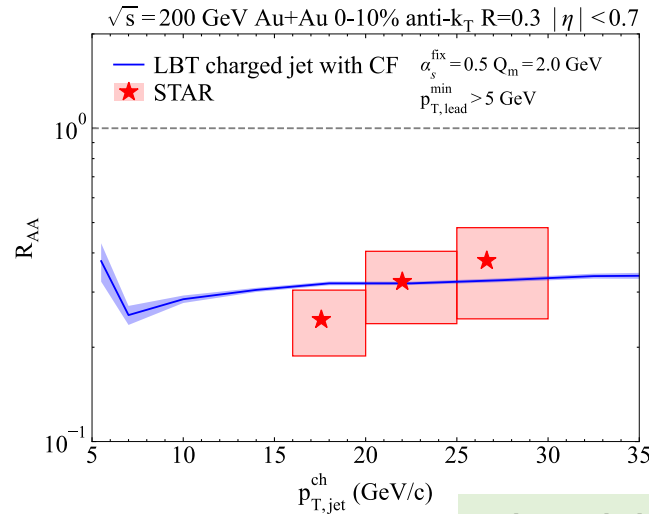
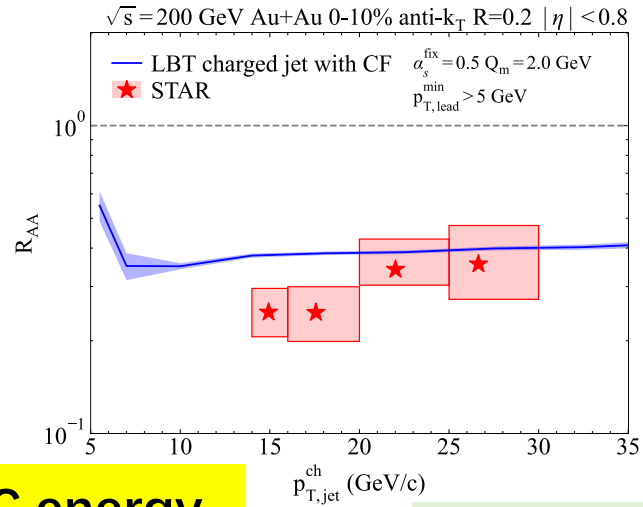
Nuclear modification factor (Hadrons and Jets)

RHIC energy

Au + Au R=0.2

Au + Au R=0.3

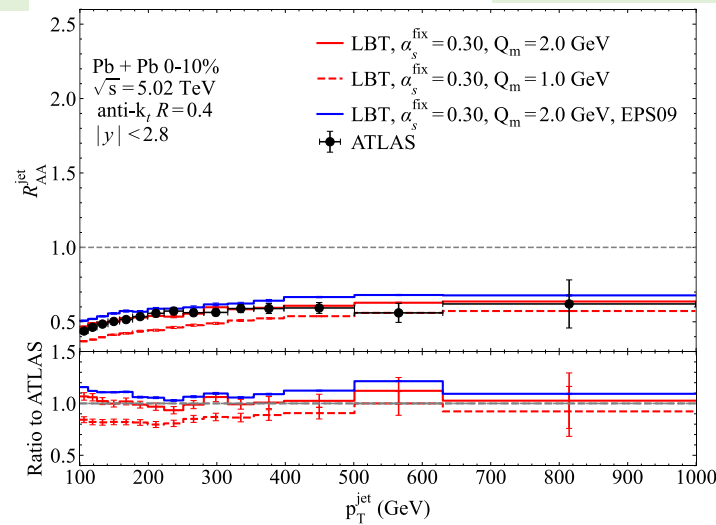
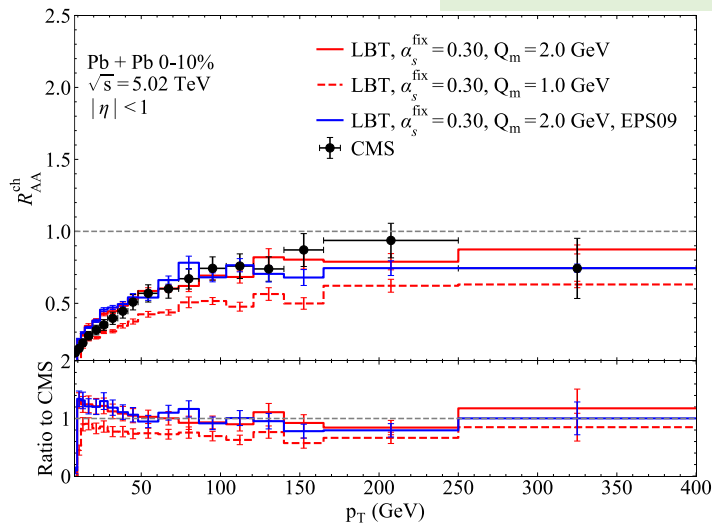
Au + Au R=0.4



LHC energy

Pb + Pb Hadrons

Pb + Pb inclusive Jets

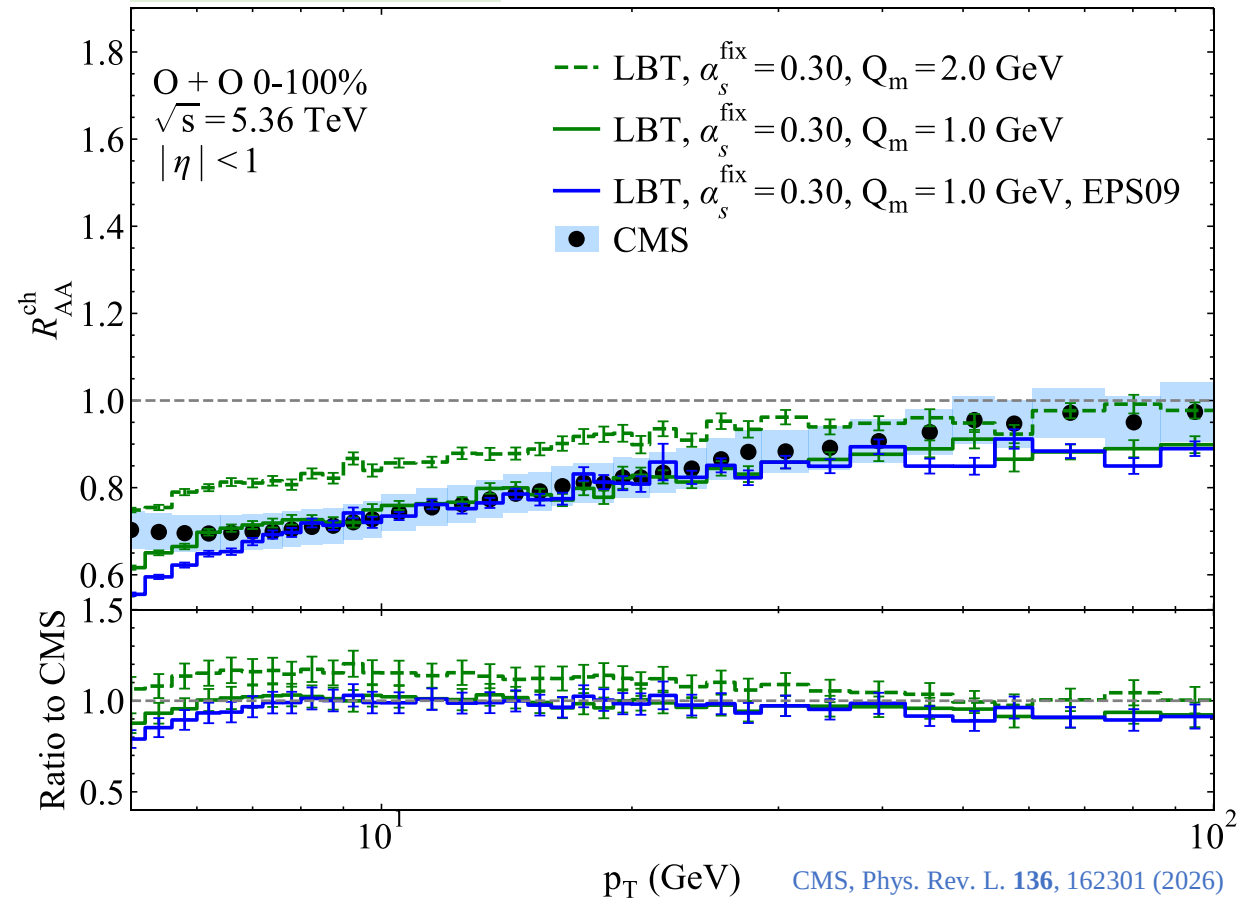


- Significant jet quenching is observed in **heavy-ion collisions**

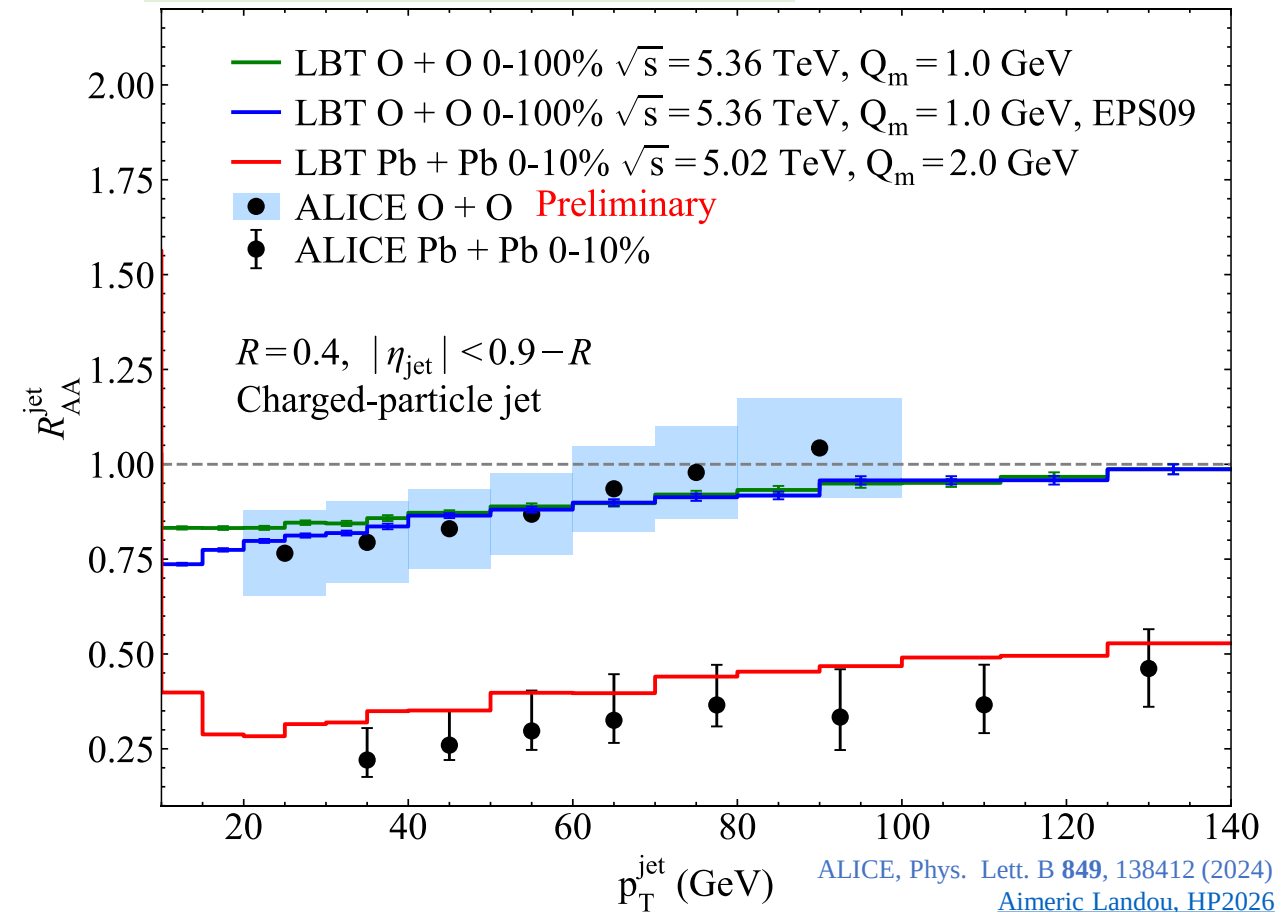
STAR, Phys. Rev. C **102**, 054913 (2020)
 ATLAS, Phys. Lett. B **790**, 108 (2019)
 CMS Collaboration, JHEP **04** (2017) 039

Nuclear modification factor (Hadrons and Jets)

O + O Hadrons



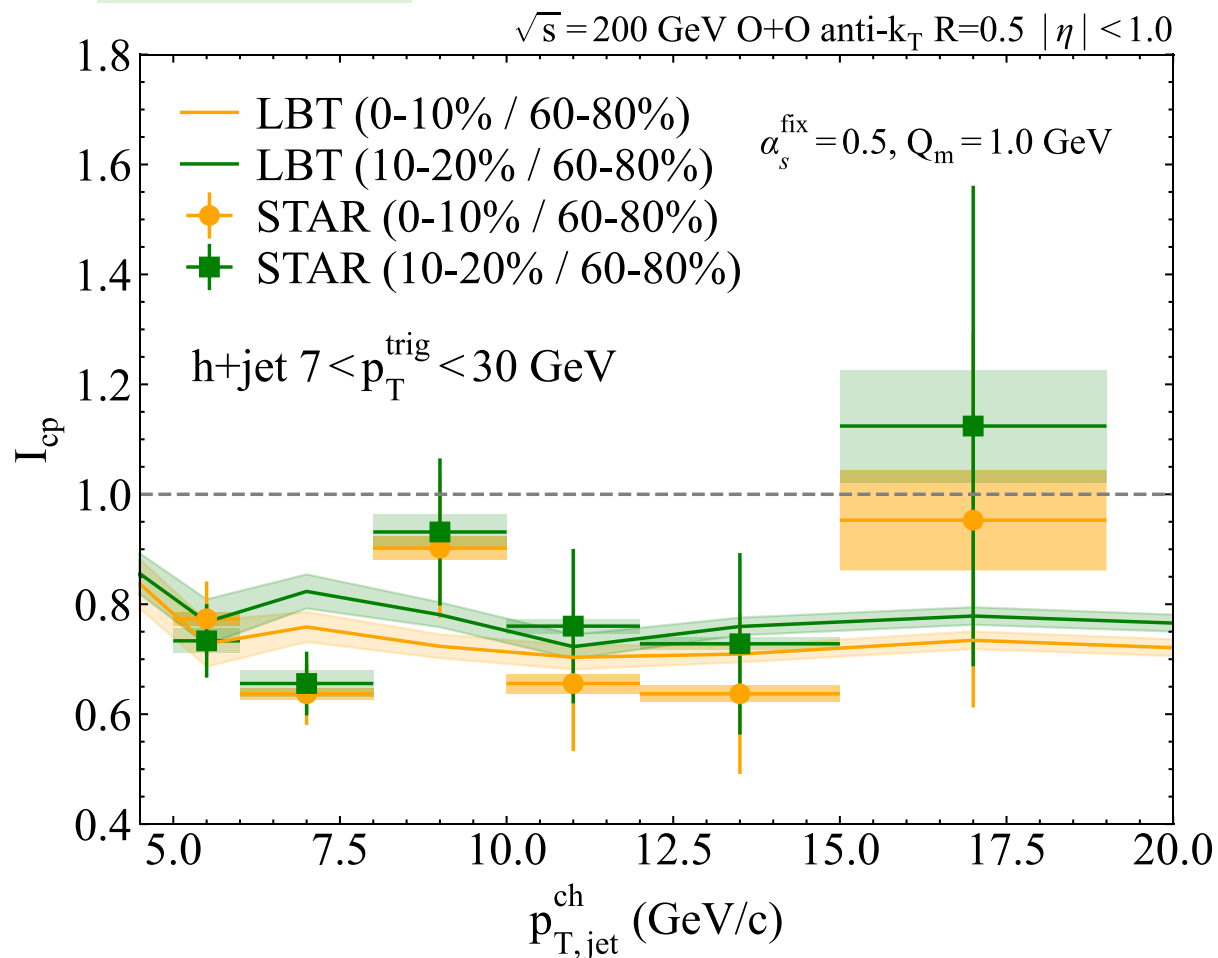
O + O Charged-particle Jet



- Hadron and jet suppression in O+O: energy loss model needed
- nPDFs corrections improve the description of measured data
- O+O: weaker suppression than Pb+Pb

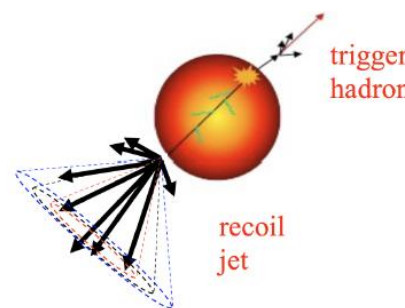
Di-hadron correlation

O + O h+jet



Di-hadron correlation (I_{CP}):

$$I_{CP} = \frac{Y^{\text{central}}}{Y^{\text{peripheral}}}, \quad Y = \frac{1}{N_{\text{trig}}} \frac{d^3 N_{\text{jet}}}{dp_{T,jet}^{\text{ch}} d\Delta\phi d\eta_{\text{jet}}}$$

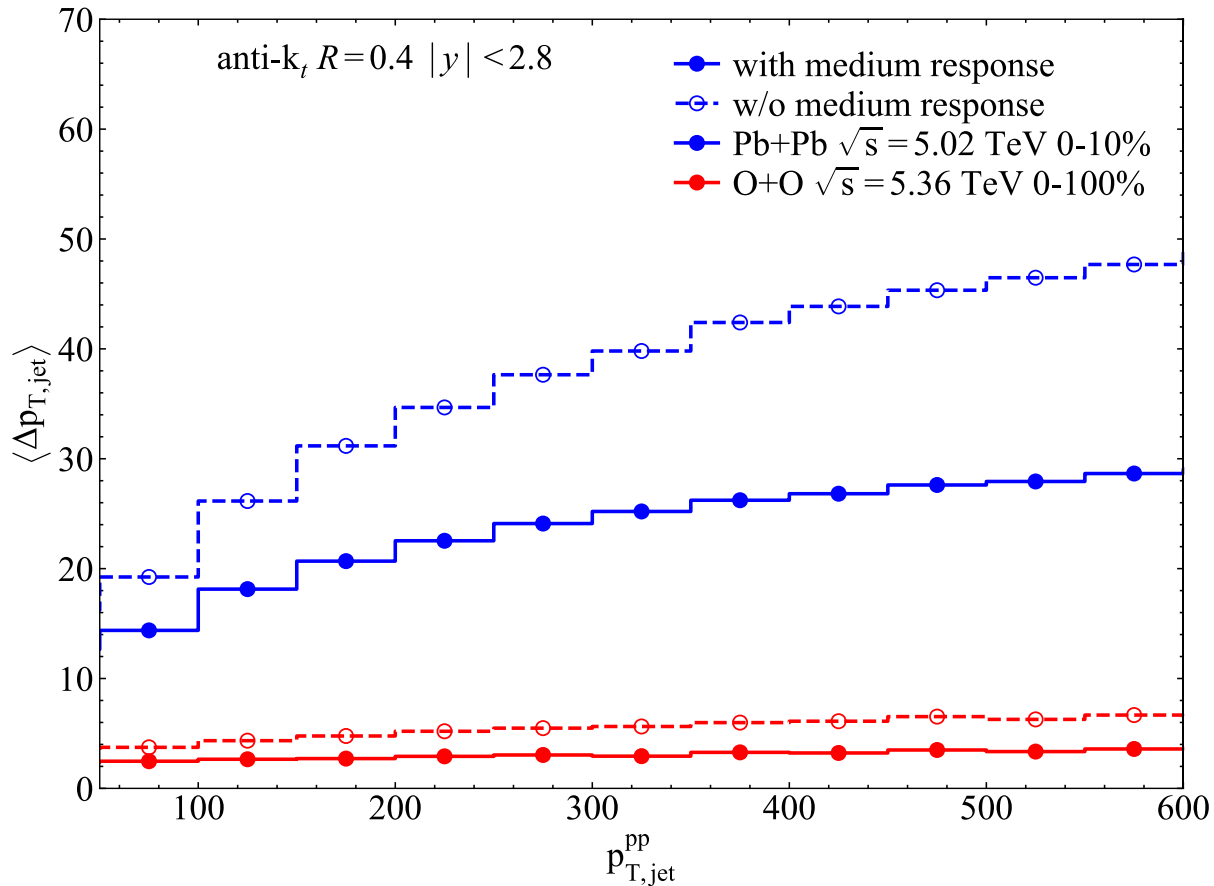


- Probe surface bias
- Access to low- p_T and large- R jets on the away side

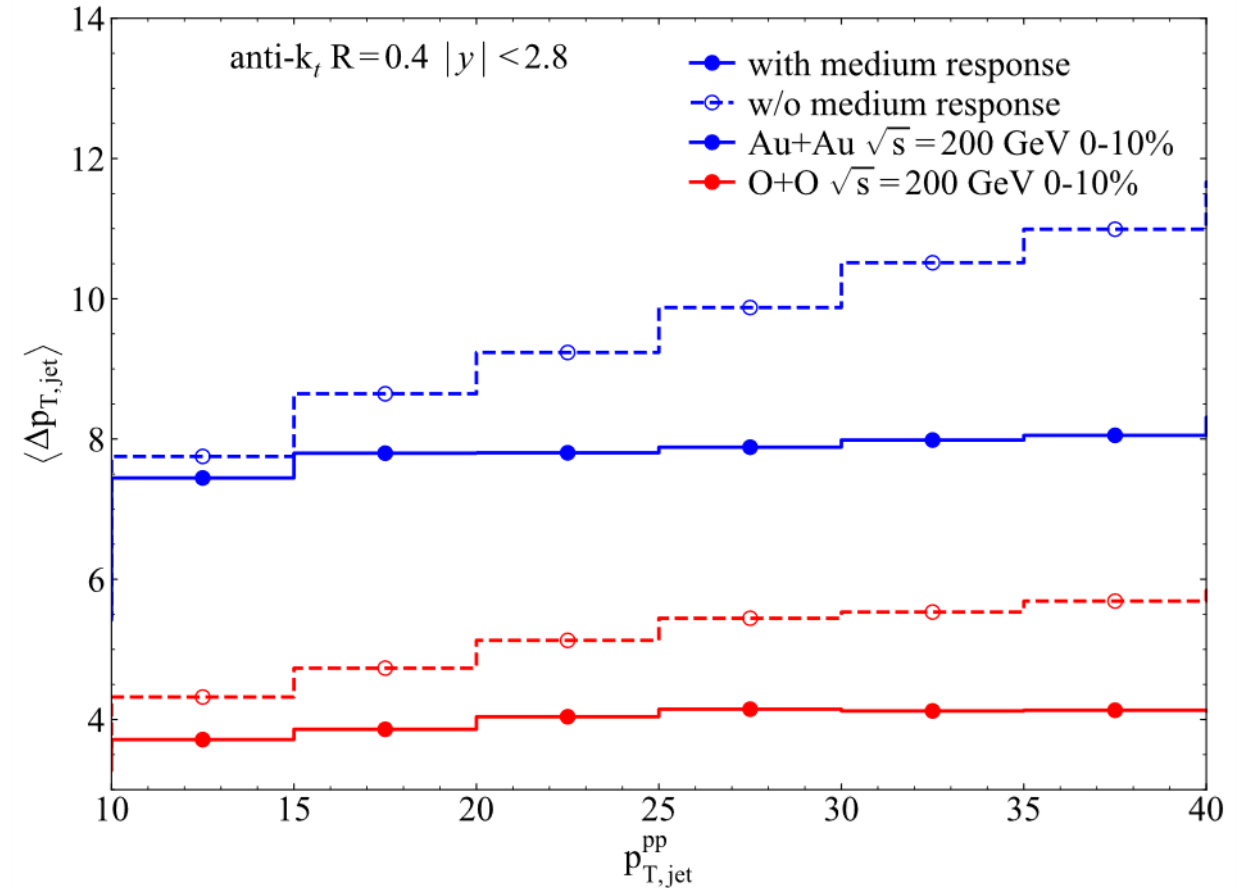
- LBT model can well describe h+jet suppression in RHIC energy

Average jet energy loss distribution

LHC energies



RHIC energy



- O+O collision systems $\rightarrow$ weak jet-medium interaction

Summary

- ✓ LBT model can well describe the experimental data at RHIC and LHC energies
- ✓ Energy loss model is essential for describing hadron and jet suppression in O+O collisions
- ✓ nPDFs corrections improve the description of measured data in O+O collision systems
- ✓ O+O collision systems exhibit weak jet–medium interactions

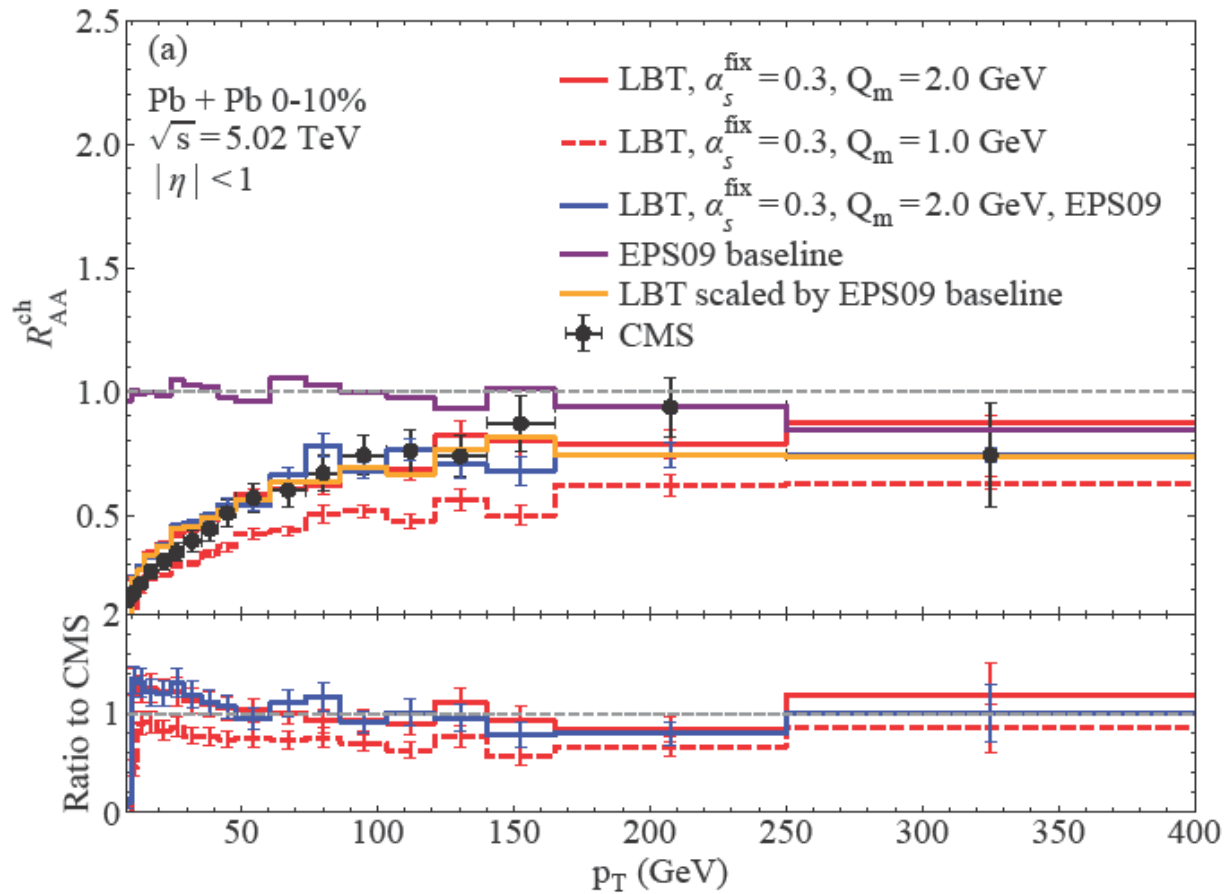
Thank you for your attention!

Back up

	LHC energies	RHIC energy
Larger collision systems (Pb + Pb and Au + Au)	$\alpha_s^{\text{fix}} = 0.3$ $Q_m = 2.0 \text{ GeV}$	$\alpha_s^{\text{fix}} = 0.5$ $Q_m = 2.0 \text{ GeV}$
O+O	$\alpha_s^{\text{fix}} = 0.3$ $Q_m = 1.0 \text{ GeV}$	$\alpha_s^{\text{fix}} = 0.5$ $Q_m = 1.0 \text{ GeV}$

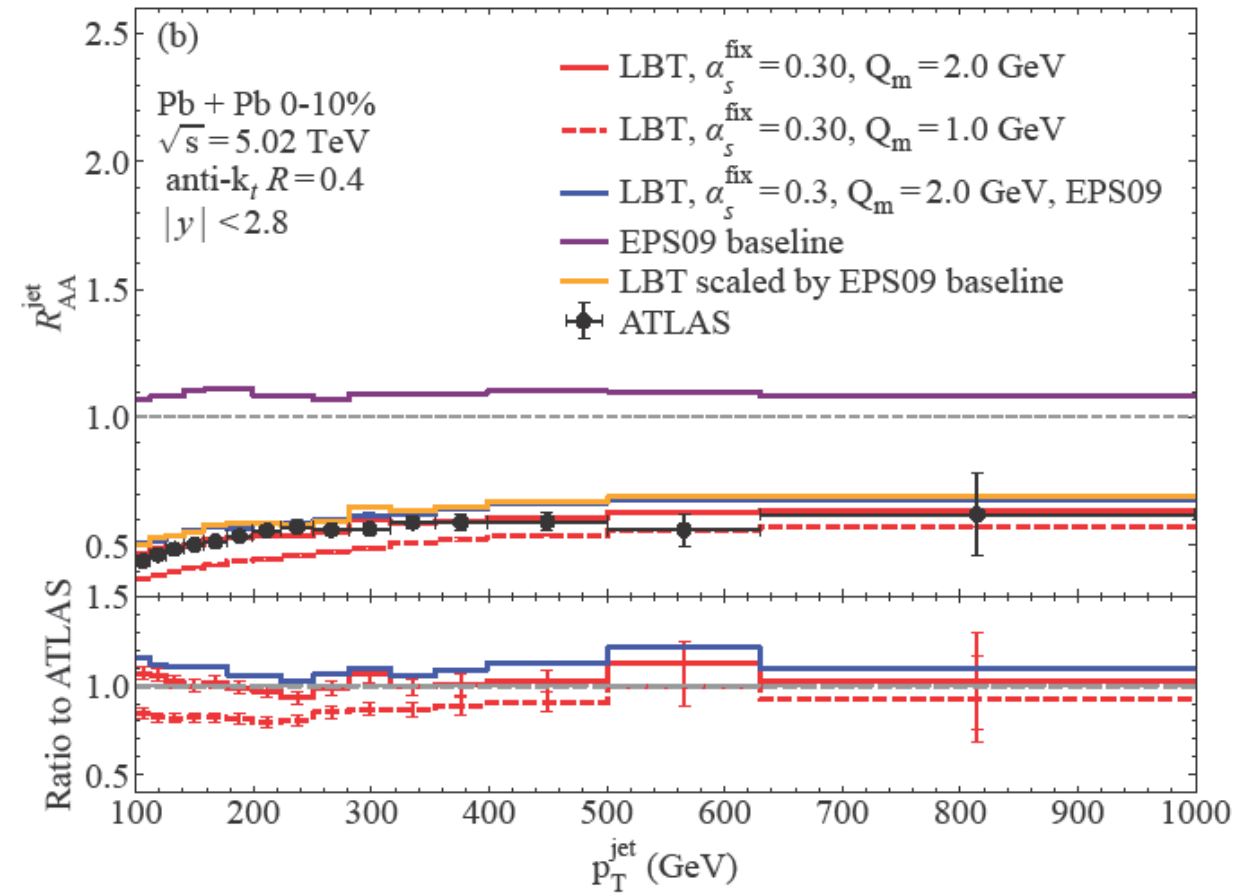
Nuclear modification factor (Hadrons and Jets)

Pb + Pb Hadrons



CMS Collaboration, JHEP 04 (2017) 039

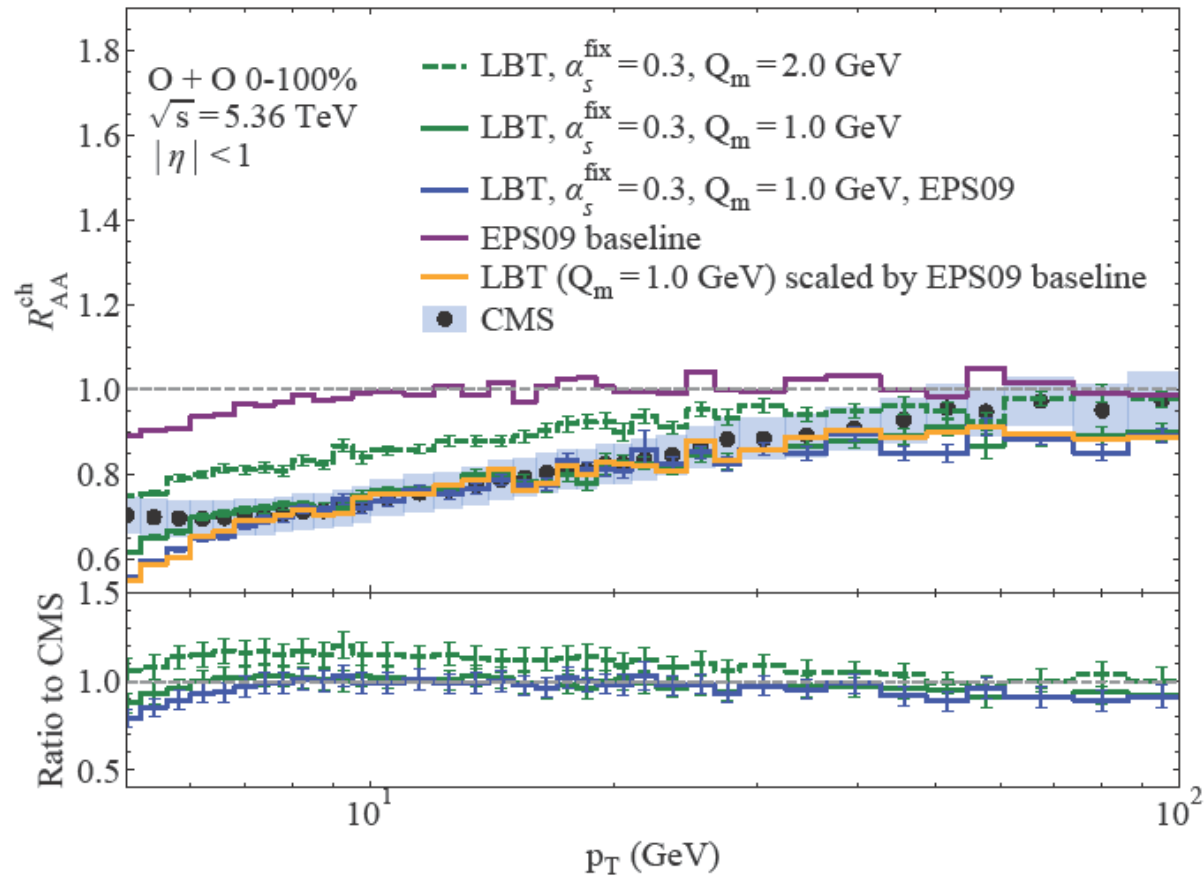
Pb + Pb inclusive Jets



ATLAS, Phys. Lett. B **790**, 108 (2019)

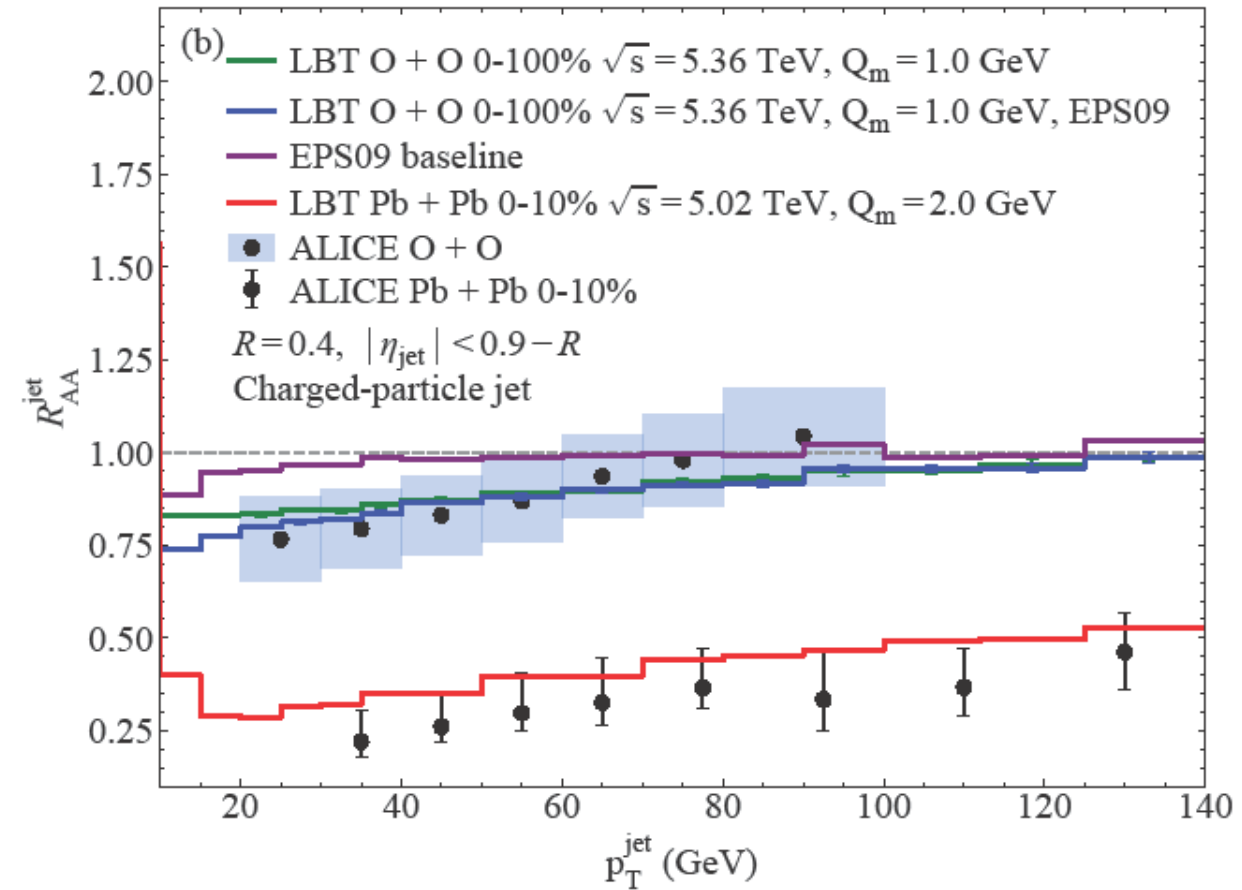
Nuclear modification factor (Hadrons and Jets)

O + O Hadrons



CMS, Phys. Rev. L. **136**, 162301 (2026)

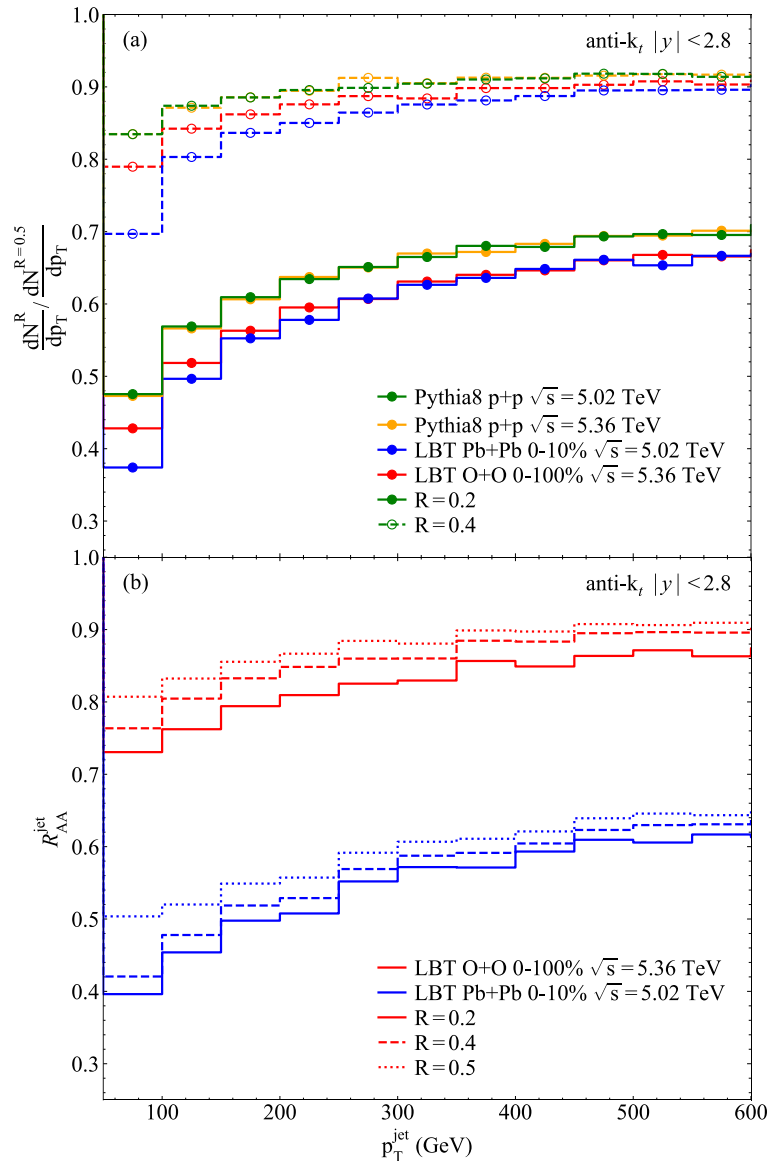
O + O Charged-particle Jet



ATLAS, Phys. Lett. B **849**, 138412 (2024)
Aimeric Landou, HP2026

Cone-size dependence of jet suppression

LHC energies



RHIC energy

