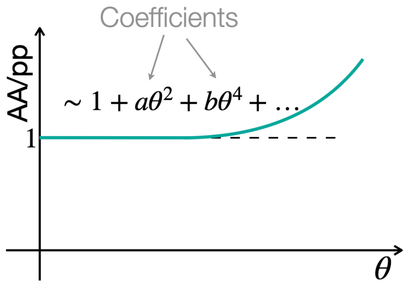
Janice's Impressions on QM 2025

- Hard probe:
  greater control on model predictions of jet substructure & EEC observable, paving the way to study QCD across different scales in systems with or without the presence of a medium (HI vs. pp), including effects from pQCD, non-perturbative QCD, and QGP phenomena such as medium-induced wake.

Jet substructure & EEC (EX)

Jet substructure & EEC (TH)

Energy correlators: discussion of parametric form

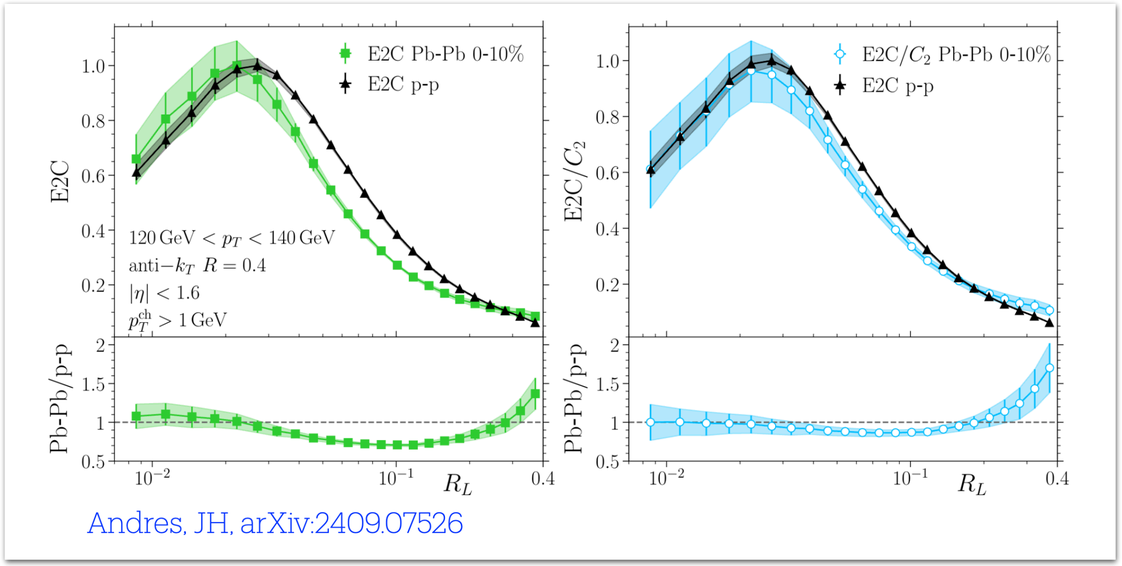


Universal structure for different physics e.g.

- Light-ray OPE/high-twist formalism
  [Andres, Dominguez, Holguin, Marquet, Moult arXiv: 2411.15298]
  [Fu, Müller, Sirimanna arXiv: 2411.04866]
- Classic medium response
  [Barata, Kuzmin, Milhano, Sadofyev arXiv: 2412.03616]
  [Barata, Moult, Sadofyev, Silva arXiv: 2503.13603]

… and higher-point correlators

Centrality, system-size and R-scan to disentangle between medium-induced and medium-response contributions to the EEC



Andres, JH, arXiv:2409.07526

Jack Holguin -- Tackling selection bias in heavy-ion jets with energy correlators

$$-\frac{\bar{\varepsilon}\,P(R_L)}{p_T}\frac{\mathrm{d}\ln f_{\mathrm{EEC}}^{\mathrm{pp}}(R_L)}{\mathrm{d}\ln R_L} + \mathcal{O}\left(\frac{\overline{\varepsilon^2}}{p_T^2}\right)$$

$$C_2(R_L) \equiv \left(\frac{F_{\mathrm{ENC}}^{\mathrm{AA}}(R_L,p)}{F_{\mathrm{ENC}}^{\mathrm{pp}}(R_L,2)}\right)^{\frac{2}{3}} - \frac{E_{\mathrm{peak}}}{3}$$

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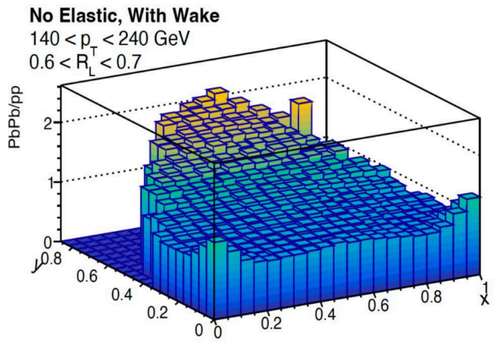
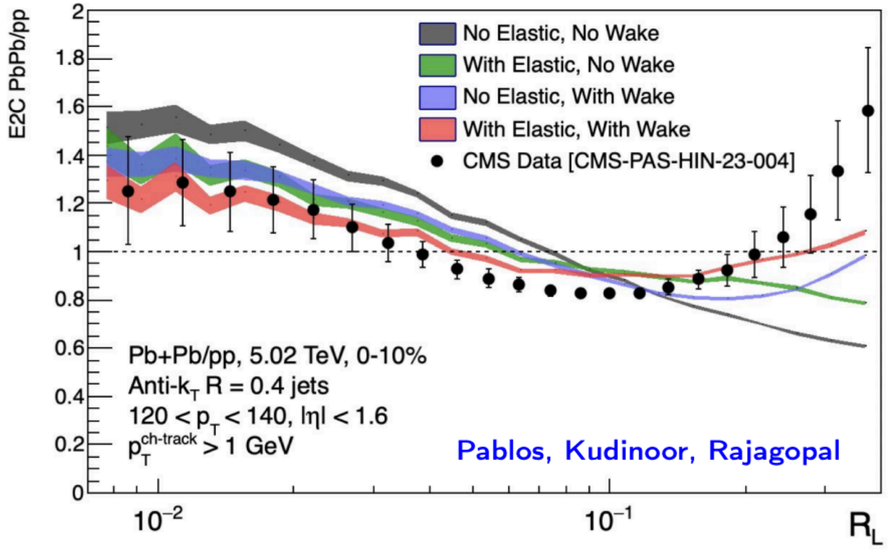
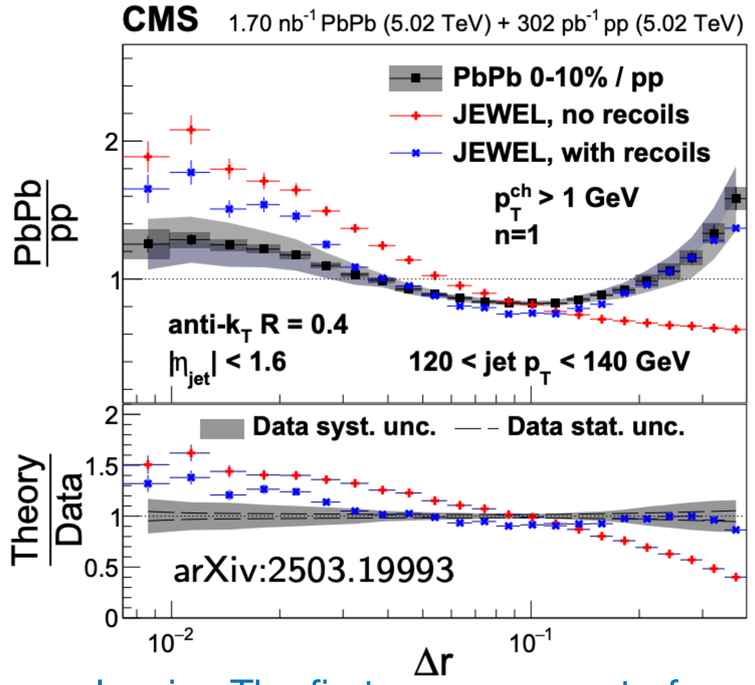


Arjun Kudinoor's talk on Monday at 17:00



Arjun -- Imaging the Jet-Induced Medium Response with Energy Correlators



Jussi -- The first measurement of energy-energy correlator of jets in PbPb collisions at CMS

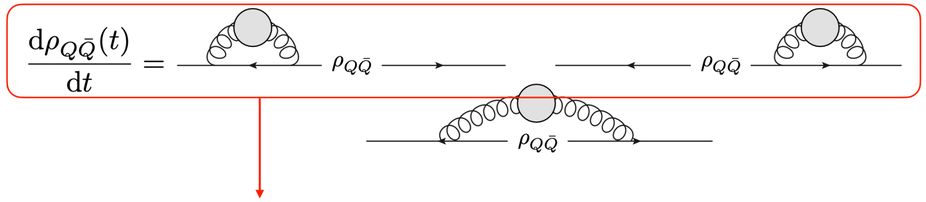
Janice's Impressions on QM 2025

- Quarkonia as probe of QGP
  **Not about new results, but personal interest*

Open Quantum System for Quarkonium

- **QGP + $Q\bar{Q}$ = closed quantum system; $Q\bar{Q}$ = open quantum system**

$$\rho_{Q\bar{Q}}(t) = \mathrm{Tr}_{\mathrm{QGP}}[U(t)\rho_{\mathrm{tot}}(0)U^{\dagger}(t)]$$



Summation similar to T-matrix approach

Case 3: Boltzmann Equation in Quantum Optical & Classical

- **Rigorous derivation $M \gg Mv \gg T, \Lambda_{\mathrm{QCD}}$**

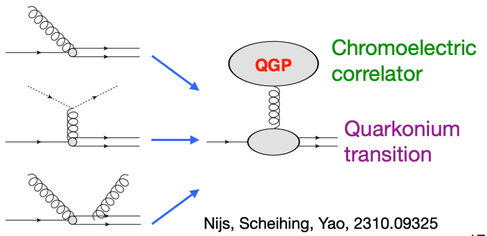
$$\frac{dn_{\mathcal{B}}(t,\mathbf{x})}{dt} = -\Gamma\, n_{\mathcal{B}}(t,\mathbf{x}) + F(t,\mathbf{x})$$

Yao, Mehen, 1811.07027, 2009.02408

$$\Gamma = \int \frac{d^3p_{\mathrm{rel}}}{(2\pi)^3} |\langle\psi_b|\boldsymbol{r}|\Psi_{\boldsymbol{p}_{\mathrm{rel}}}\rangle|^2 [g_{\mathrm{adj}}^{++}]^{>}(-\Delta E)$$

$$F = \int \frac{d^3p_{\mathrm{cm}}}{(2\pi)^3} \frac{d^3p_{\mathrm{rel}}}{(2\pi)^3} f_{Q\bar{Q}} |\langle\psi_b|\boldsymbol{r}|\Psi_{\boldsymbol{p}_{\mathrm{rel}}}\rangle|^2 [g_{\mathrm{adj}}^{--}]^{>}(\Delta E)$$

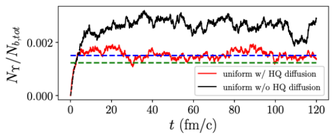
$$f_{Q\bar{Q}} \neq f_Q f_{\bar{Q}}$$



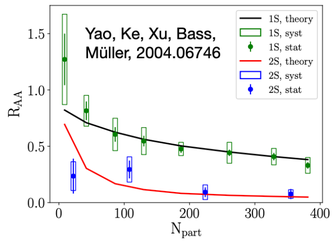
Nijs, Scheihing, Yao, 2310.09325

- **Duke-MIT: coupled Boltzmann equations for open heavy quarks and quarkonia**

Open heavy quark dynamics crucial for quarkonium equilibrium



Yao, Müller, 1709.03529

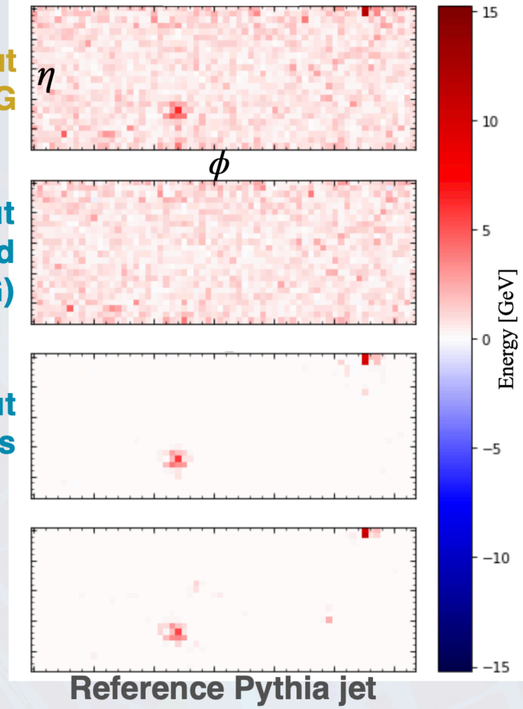


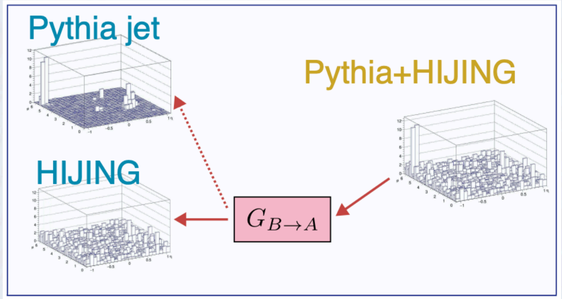
- Generative AI

[Yeonju -- sPHENIX Novel Jet Background Subtraction and Full Detector Simulation Using Self-Supervised Generative AI Models]

Performance

- Calorimeter η vs ϕ images are used for training for two domains
  - ➡ A domain: Pythia and HIJING, separately
  - ➡ B domain: Pythia + HIJING
- Inference: UVCGAN takes **B** image as input and generates **A** images
- Preliminary results look promising!





Reference Pythia jet

Jets are separated from background while preserving the high dimensional information !