Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

Jets Photoproduction in ultraperipheral collisions at RHIC

Presenter(s): Zilong Chang, Xiaoxuan Chu, Kong Tu

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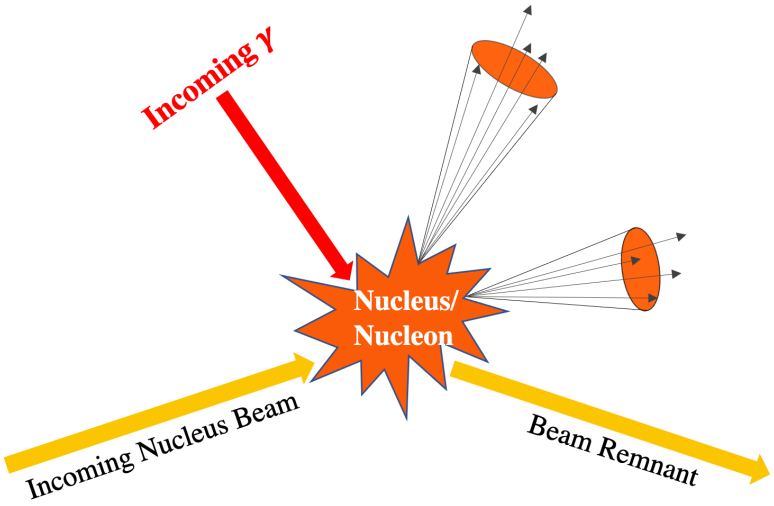
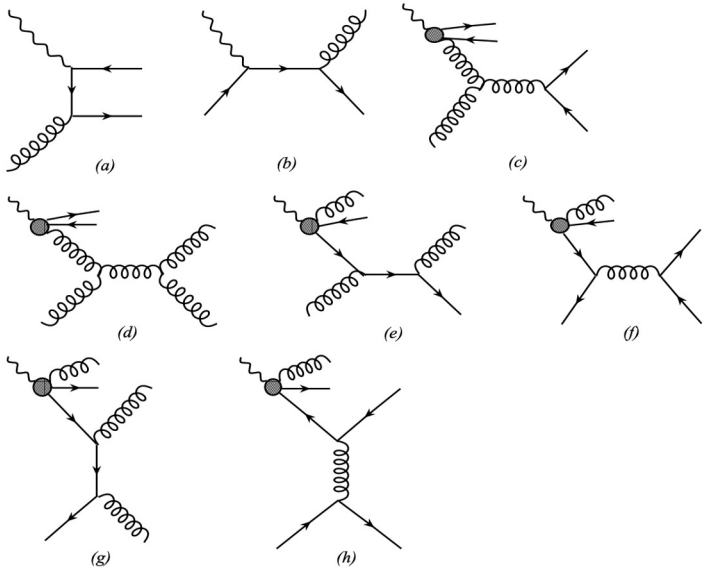
Rich Physics of jet photoproduction

HERA ep, LHC/RHIC UPC, and the future EIC



Dijet in Photoproduction



Feynman diagrams for dijet photoproduction from direct, (a) and (b), and resolved photons (c)-(h)

Incoming photon:

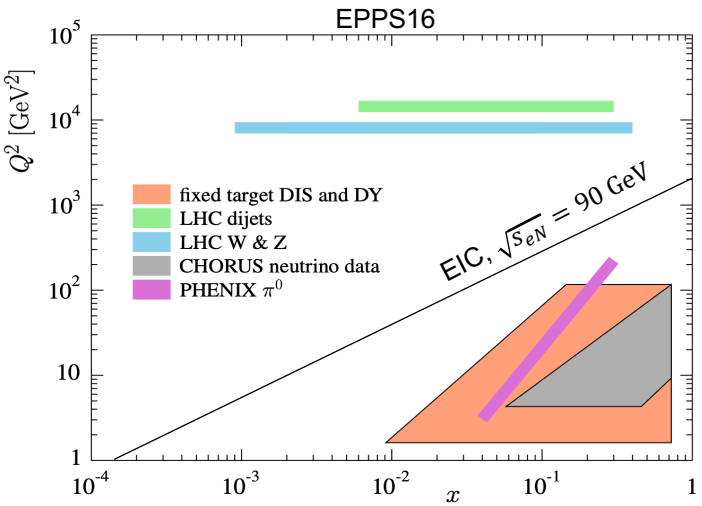
- Photon partonic structure: direct/resolved photon (x_γ), photon PDFs
- Photon spin structure: transverse/longitudinal spin of the photon and their interference

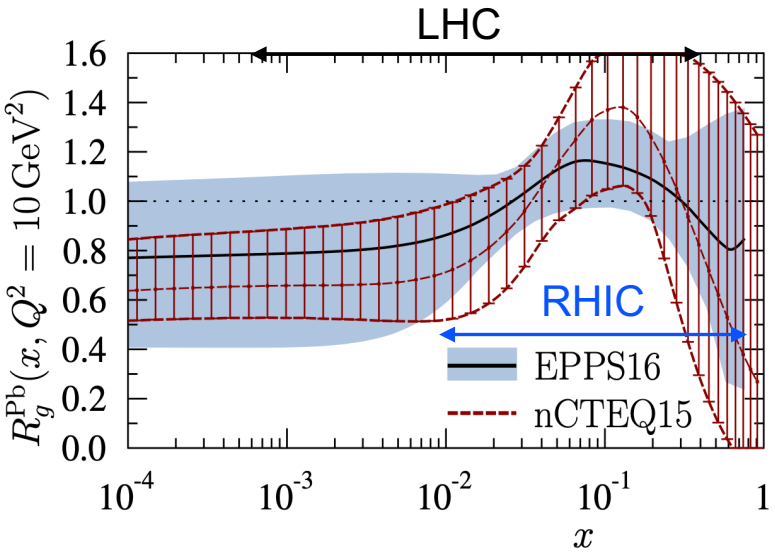
Target nucleus/nucleon:

- Incoming photon probing (diffractive) (n)PDFs, non-linear gluon dynamics, gluon radiations
- Target nucleon spin structure: gluon polarizations, etc

Why RHIC?

- High energy jet photoproduction had been studied at HERA in ep collisions; only few studies had been done with heavy nucleus at the LHC
- **However, not a single study at RHIC**
- RHIC energy serves as an intermediate energy range, which is complementary to the LHC and close transition to the EIC





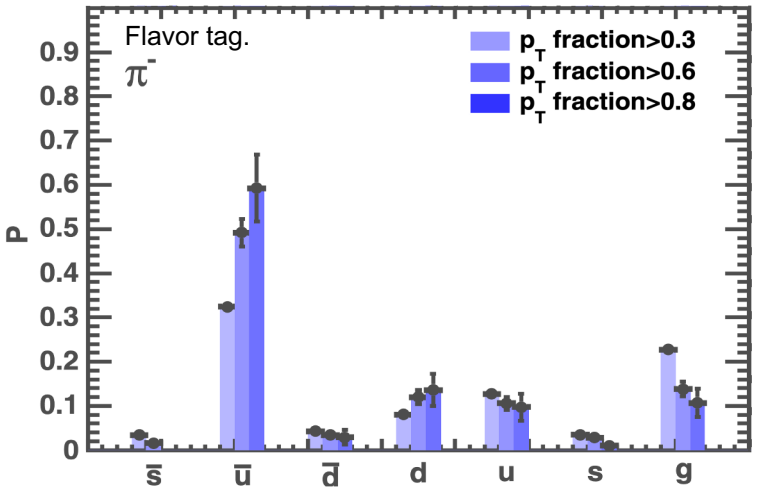
Sensitive probe to transition regions between the dense- and dilute-limit of parton density and photoproduction to electroproduction (EIC)

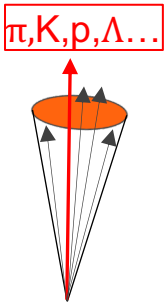
Inclusive jet measurement

- **Single jet photoproduction differential cross section in heavy nuclei at RHIC:**
  - Experimental inputs to nPDFs, moderate to large x, high-order cal., different models
  - Baseline for diffractive JPsi measurements at RHIC: saturation/shadowing
  - **PID hadrons in jet** → Fragmentation:
    - Flavor tagging→ advantage of PID; test universality; path to EIC
    - Λ-polarization in jet. Polarizing FFs?. advantage in UPC → low energy

Will use the data from

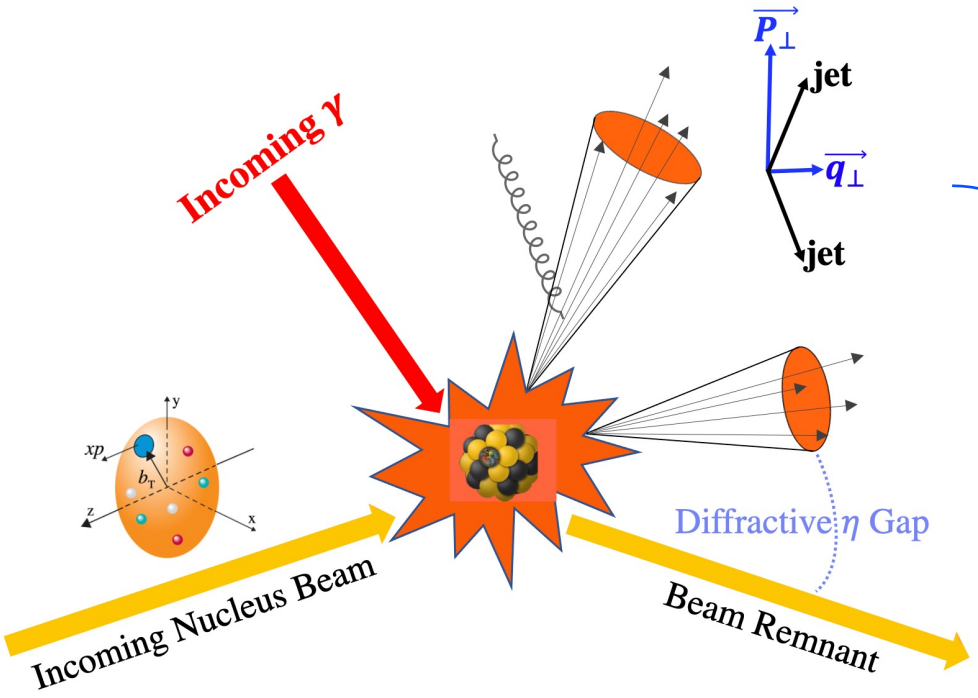
Year	System	$\sqrt{s}$ (GeV)
2023	Au+Au	200
2024	p+p, p+Au	200
2025	Au+Au	200



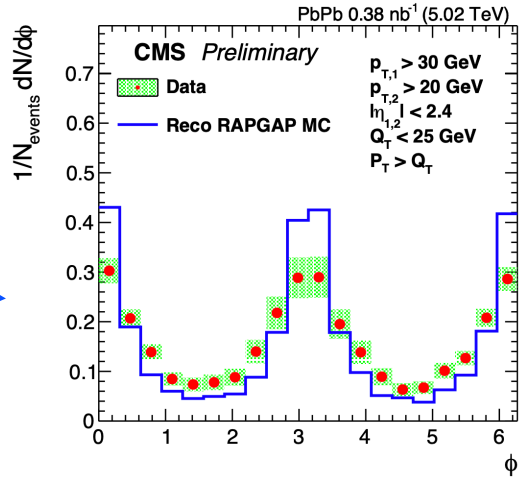


Di-jet measurement

- **Inclusive or diffractive dijets photoproduction in heavy nucleus at RHIC:**
  - Azimuthal anisotropy → different sources expected in diffractive/inclusive dijet



Dijet in Photoproduction



- **Linearly polarized gluons:** small in UPC
- **Gluon Wigner distribution:** no magnitude of the signal predicted
- **Soft gluon radiation**: affecting more in inclusive than in diffractive

First measurement of jets photoproduction in UPC at RHIC, complementary to the LHC, and informative to the science of the EIC