

Jet photoproduction in ultraperipheral collisions at RHIC and its implication to the EIC

Xiaoxuan Chu, Brian Page, Kong Tu, Zhengqiao Zhang
Cold QCD Group
08.29.2022

Motivation

- High energy jet photoproduction had been studied at HERA in [ep collisions](#): PLB 481 (2000) 199, PLB 551 (2003) 226, EPJC 51, 289 (2007)
- Only two measurements at the LHC:
 - Dijets cross section in PbPb UPC
 - Diffractive dijets azimuthal angle correlation in PbPb UPC: [2205.00045](#)
- **However, not a single study at RHIC**
- They are excellent probes to nPDFs, non-linear gluon dynamics, gluon radiations, gluon polarizations, etc
- RHIC energy serves as an intermediate energy range, which is complementary to the LHC and close transition to the EIC

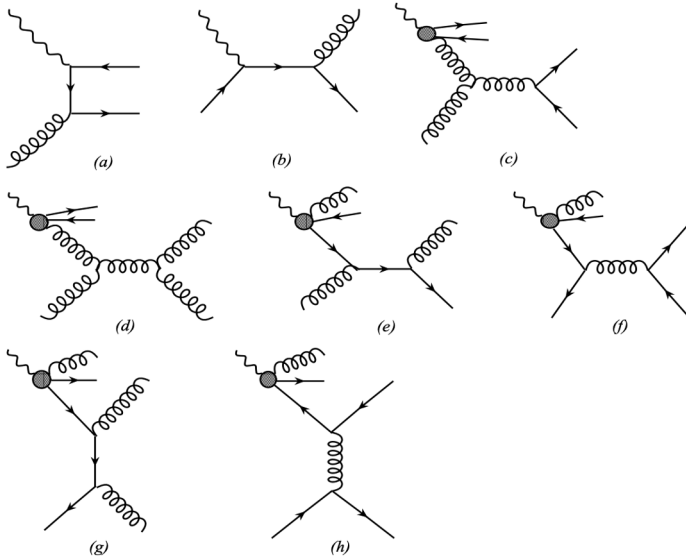


FIG. 1. Feynman diagrams for dijet photoproduction from direct, (a) and (b), and resolved photons, (c)-(h). Only a sample of the resolved diagrams are shown. Crossed diagrams are not shown.

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

Potential measurements

- **Single jet photoproduction differential cross section in heavy nuclei at RHIC:**

- Experimental inputs to nPDFs, NLO calculations, and many different models; huge impact
- One of the measurements that can be used as a baseline for diffractive J/ψ measurements at RHIC. One way to distinguish shadowing and saturation model

$$\left[\frac{\sigma_{J/\psi}(M_x^2 = 10)}{\sigma_{\text{inc}}} \right]_{\text{Au}} > ? \left[\frac{\sigma_{J/\psi}(M_x^2 = 10)}{\sigma_{\text{inc}}} \right]_{\text{p}} \quad \text{*inc=inclusive jet (> 5 GeV)}$$

- Jet substructure?

- **PID hadrons in jet:**

- Fragmentation: Flavor tagging/separation
- Lambda-polarization in jet. Polarizing FFs?. There's a huge advantage in UPC → low energy

- **Inclusive or diffractive dijets photoproduction in heavy nucleus at RHIC**

- Azimuthal angle correlations, $\cos(n\phi)$, etc
- Cross sections (nPDFs, etc)
- Ratio measurements between diffractive and inclusive. (Factorization breaking, etc.)

- This can be studied (theoretically) in frameworks of TMDs, Gluon polarization and/or saturations, etc. There are much more models than data available. **Close transition to the EIC.**