

Questions: Sarte & STARlight

UPC cross sections

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Motivation: Ultra Peripheral Collisions (UPC)

- Weizsaeker-Williams photon from one beam particle, photoproduction (usually VM) on other beam particle

- Target particle polarized proton $p \uparrow$:

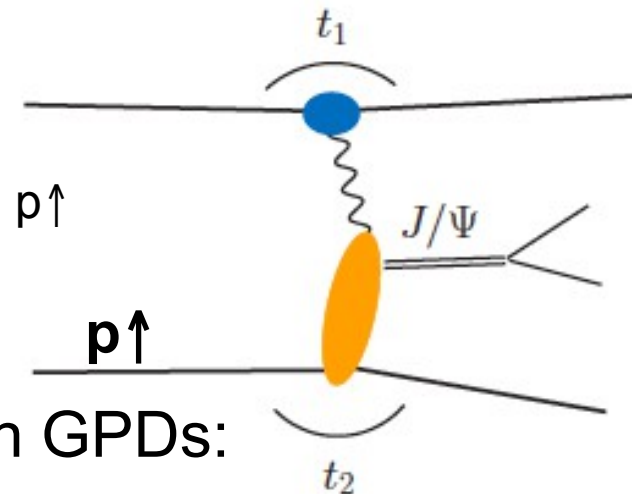
- $d\sigma/d\varphi \propto (1 + A_{UT} \cdot \cos\varphi)$, $\varphi = J/\psi$ azimuthal angle w.r.t. $p \uparrow$

- measure J/ψ transverse asymmetry A_{UT}

- J/ψ sensitive to gluon content; A_{UT} calculable with GPDs:

$A_{UT} \propto E_g \text{ GPD} \Rightarrow$ sensitive to gluon orbital angular momentum L_g

- A first look at this with RHIC, before EIC



More info, talk @ DIS 2016:

<https://indico.desy.de/getFile.py/access?contribId=273&sessionId=5&resId=0&materialId=slides&confId=12482>

Planned RHIC runs

RHIC plans:

- $\sqrt{s}=500$ GeV p↑p↑ Run17 L~400 pb⁻¹
- $\sqrt{s}=200$ GeV p↑Au Run 202? L~1.75 pb⁻¹
- The A_{UT} measurement is proposed in White Papers:
Spin arXiv:1501.01220 Cold QCD arXiv:1602.03922
- For rate estimates we used Sartre

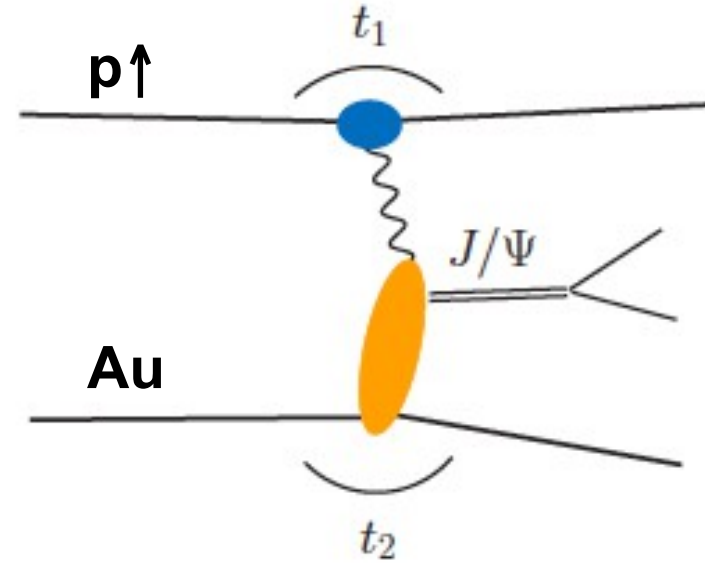
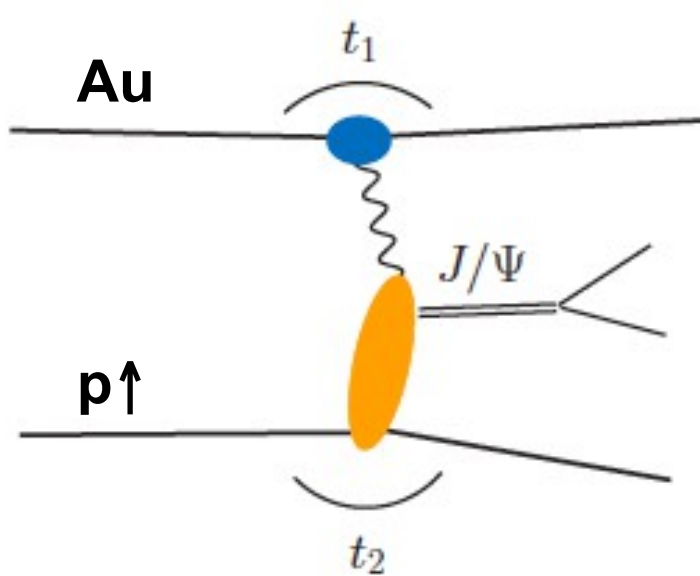
The puzzle

RHIC already had:

- $\sqrt{s}=200$ GeV p↑Au Run 2015 L~240 nb⁻¹
- We have the processed data since last week
- 1st observation:
~ order of magnitude fewer J/ψ than Sartre prediction
- Started checking instrumental effects:
factor 10 is hard to get
- Wondering about Sartre cross sections...

J/ψ in p↑Au UPC

- Here 2 processes:



- Au photon source, p↑ target
- Polarized target: $A_{UT} \propto E_g$
- Boost in photon flux $\propto Z_{Au}^2$

- p↑ photon source, Au target
- Unpolarized target: $A_{UT} \sim 0$
- Boost in γA cross section $\propto A_{Au}^N$

coherent photoproduction: $N=2$
 other opinions about N

- Naively: $\sigma(\text{Au} \rightarrow \gamma \rightarrow \text{p}) / \sigma(\text{p} \rightarrow \gamma \rightarrow \text{Au}) = Z_{Au}^2 / A_{Au}^N$, $N=???$

$$Z_{Au} = 79 \quad A_{Au} = 197$$

Compare: Sartre & STARlight

- Total cross sections for UPC J/ψ :

- STARlight from S.Klein, private communication
- Sartre from (me) running v1.20

	<u>STARlight</u>	<u>Sartre</u>
250 x 250 $p \rightarrow \gamma \rightarrow p$	6.1 nb	9.02 nb
100 x 100 $p \rightarrow \gamma \rightarrow p$	2.4 nb	3.56 nb
100 x 100 $Au \rightarrow \gamma \rightarrow p$	2290 nb	956 nb
100 x 100 $p \rightarrow \gamma \rightarrow Au$	70 nb	831 nb
100 x 100 $Au \rightarrow \gamma \rightarrow Au$		719000 nb

- pp cross sections in fair agreement
- pAu cross sections wildly different
- From ratio two processes, estimate A^N dependence:
STARlight: $N=1$ (STARlight *incoherent* mode?)
Sartre: $N=1.6$

Input from the authors/experts most welcome...