Diffractive studies with EIC

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Outline

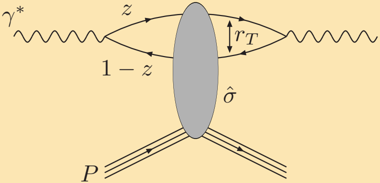
- Universality of the dipole picture
- Diffractive structure function
  Kowalski, T.L. Marquet, Venugopalan 2008
  - Mapping the A, Q^2, $x_{\mathbb{P}}$, β –space
- Coherent and **incoherent** diffraction
  Exclusive J/Ψ with H. Mäntysaari, 2010 & 2013
  - t and transverse structure
- Potential of the EIC

Dipole cross section

DIS at high energy/small x:

dipole cross section.

Given by CGC color field



$$\hat{\sigma}(\mathbf{r}_T) = \int \mathrm{d}^2\mathbf{b}_T \frac{1}{N_c} \mathrm{Tr} \left\langle 1 - U^\dagger\left(\mathbf{b}_T + \frac{\mathbf{r}_T}{2}\right) U\left(\mathbf{b}_T - \frac{\mathbf{r}_T}{2}\right)\right\rangle$$

$$U(\mathbf{x}_T) = P\exp\left\{ig \int \mathrm{d}x^- A^+_{\mathrm{cov}}(\mathbf{x}_T, x^-)\right\}$$

Same U — initial condition for Glasma fields in AA collisions:

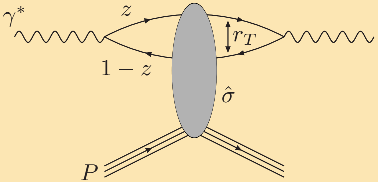
$$A^i_{\text{(one nucleus)}} = \frac{i}{g} U(\mathbf{x}_T)\partial_i U^\dagger(\mathbf{x}_T)$$

Universality of the dipole cross section

$$\sigma_{\text{dip}}(x, \mathbf{r}_T) = \int d^2\mathbf{b}_T \frac{d^2\sigma_{\text{dip}}}{d^2\mathbf{b}_T}$$

$$\sigma_{\text{dip}}(x, \mathbf{r}_T, \mathbf{\Delta}_T) = \int d^2\mathbf{b}_T \frac{d^2\sigma_{\text{dip}}}{d^2\mathbf{b}_T} e^{i\mathbf{b}_T\cdot\mathbf{\Delta}_T}$$

$$\mathbf{\Delta}_T{}^2 = -t$$



From same dipole cross section calculate:

- Total $\gamma^* p$: $\sigma_{L,T}^{\gamma^* p} = \int d^2\mathbf{r}_T \int dz \left|\Psi_{L,T}^{\gamma}(Q^2, \mathbf{r}_T, z)\right|^2 \sigma_{\text{dip}}(x, \mathbf{r}_T)$
- Total diff.: $\frac{\sigma_{L,T}^D}{dt} = \frac{1}{16\pi} \int d^2\mathbf{r}_T \int dz \left|\Psi_{L,T}^{\gamma}(Q^2, \mathbf{r}_T, z)\right|^2 \sigma_{\text{dip}}^2(x, \mathbf{r}_T, \mathbf{\Delta}_T)$
- X-cl. diff.: $\frac{\sigma_{L,T}^D}{dt} = \frac{1}{16\pi} \left|\int d^2\mathbf{r}_T \int dz \left(\Psi^{\gamma}\Psi^{*V}\right)_{L,T} \sigma_{\text{dip}}(x, \mathbf{r}_T, \mathbf{\Delta}_T)\right|^2$

Use:

- S-matrix real
- optical theorem

- $\Psi^{\gamma}(Q^2, \mathbf{r}_T, z) \sim K_{0,1}(\sqrt{z(1-z)}Q|\mathbf{r}_T|)$
  $\Longrightarrow$ momentum scale $Q^2 \sim 1/\mathbf{r}_T{}^2$
- Diffractive: $t \sim$ FT of $\mathbf{b}_T$.

IPsat model: protons

Starting point GBW: Golec-Biernat, Wusthoff 1998 $\sigma_{\rm dip} = \sigma_0 \left(1 - e^{-\frac{\mathbf{r}_T{}^2}{4Q_s(x)^2}}\right)$

1 possible improvement: **Kowalski & Teaney 2003** **IPsat model**

- DGLAP evolution: improves description large Q^2.
- Consistent $\mathbf{b}_T$ dependence for all observables

$$\sigma_{\rm dip}(x, \mathbf{r}_T) = 2 \int \mathrm{d}^2\mathbf{b}_T \left(1 - \exp\left\{-\frac{\pi^2}{2N_c}\alpha_s(\mu^2) xg(x,\mu^2) T_p(\mathbf{b}_T) \mathbf{r}_T{}^2\right\}\right),$$

- $\mu^2 = \frac{C}{\mathbf{r}_T{}^2} + \mu_0^2$, Gaussian $T_p(\mathbf{b}_T)$
- $xg(x, \mu^2)$ evolved with DGLAP, initial condition $\sim x^{\sim 0}$!
  - Consistent with what we expect from small x evolution?
  - Restricts growth of $\mathbf{b}_T$-profile at large $\mathbf{r}_T$: feature or bug?

IPsat: nuclei

Straightforward generalization to nuclei:

$$\frac{\mathrm{d}\sigma^A_{\mathrm{dip}}}{\mathrm{d}^2\mathbf{b}_T} = 2\left(1 - \exp\left\{-\frac{\pi^2}{2N_c}\alpha_s(\mu^2)xg(x,\mu^2)\sum_{i=1}^{A} T_p(\mathbf{b}_T - \mathbf{b}_{T\,i})\mathbf{r}_T{}^2\right\}\right),$$

- $\mathbf{b}_{T\,i}$: nucleon positions, from Woods-Saxon, average $\langle\cdot\rangle_{\mathrm{N}}$
- Proton radius $\sim$ 0.6fm, much less than the nucleon-nucleon distance. $\Longrightarrow$ **lumpy** nucleus $\Longrightarrow$ visible in **incoherent** diffraction

"Glauber" limit $A \to \infty$, $R_p \ll R_A$

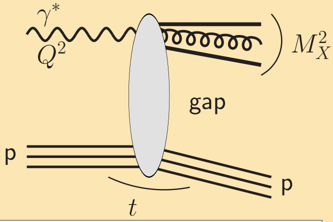
$$\left\langle \frac{\mathrm{d}\sigma^A_{\mathrm{dip}}}{\mathrm{d}^2\mathbf{b}_T}\right\rangle_{\mathrm{N}} \approx_{A\to\infty} 2\left[1 - e^{-\frac{AT_A(\mathbf{b}_T)}{2}\sigma^p_{\mathrm{dip}}}\right]$$

($\int \mathrm{d}^2\mathbf{b}_T T_A(\mathbf{b}_T) = 1 \Longrightarrow T_A(\mathbf{0}_T) \sim A^{-2/3}$)

Diffractive structure function

$$F_2^{D(3)}(x_{\mathbb{P}}, \beta, Q^2) = \int \mathrm{d}t F_2^{D(4)}(x_{\mathbb{P}}, \beta, Q^2, t)$$

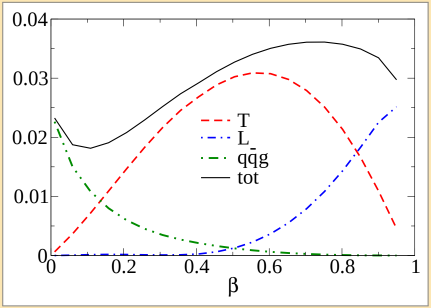
$$x = x_{\mathbb{P}} \beta \qquad \beta = \frac{Q^2}{Q^2 + M_X^2}$$



Gap $\sim \ln \frac{1}{x_{\mathbb{P}}}$ rapidity of $X \sim \ln \frac{1}{\beta}$

Essential regimes:

- Small $\beta \ll 1$: dominated by higher Fock ($q\bar{q}g$ etc.)
- Medium $\beta \sim 0.5$: dominated by transverse $q\bar{q}$
- Large $\beta \to 1$: longitudinal $q\bar{q}$.



Proton, $Q^2 = 5\mathrm{GeV}^2$, $x_{\mathbb{P}} = 10^{-3}$

(IPsat)

Computing F_2^D

The structure function is

$$x_{\mathbb{P}} F_2^D = \underbrace{x_{\mathbb{P}} F_{T,q\bar{q}}^D + x_{\mathbb{P}} F_{L,q\bar{q}}^D}_{\alpha_s^0} + \underbrace{x_{\mathbb{P}} F_{T,q\bar{q}g}^D}_{\alpha_s} + \underbrace{\text{higher Fock states}}_{\alpha_s^2}$$

$$x_{\mathbb{P}} F_{T,q\bar{q}}^D = \frac{N_c Q^4}{16\pi^3\beta} \sum_f e_f^2 \int_{z_0}^{1/2} \mathrm{d}z z(1-z) \left[\varepsilon^2 (z^2 + (1-z)^2)\Phi_1 + m_f^2 \Phi_0\right]$$

$$x_{\mathbb{P}} F_{L,q\bar{q}}^D = \frac{N_c Q^6}{4\pi^3\beta} \sum_f e_f^2 \int_{z_0}^{1/2} \mathrm{d}z z^3 (1-z)^3 \Phi_0$$

$$\Phi_n = \int \mathrm{d}^2\mathbf{b}_T \left[\int_0^\infty \mathrm{d}r r K_n(\varepsilon r) J_n(kr) \frac{\mathrm{d}\sigma_{\mathrm{dip}}}{\mathrm{d}^2\mathbf{b}_T}(\mathbf{b}_T, \mathbf{r}_T, x_{\mathbb{P}})\right]^2,$$

- $\int_{-\infty}^0 \mathrm{d}t \implies \int \mathrm{d}^2\mathbf{b}_T$: easy to evaluate
- Differential in t: tougher numerically

$q\bar{q}g$

Marquet 2007, Kowalski, T.L., Marquet, Venugopalan 2008

Interpolate between large Q^2, finite β ("GBW") and $\beta \to 0$ ("MS"):

$$x_{\mathbb{P}} F_2^{\mathrm{D}}(x_{\mathbb{P}}, \beta, Q^2) = \frac{x_{\mathbb{P}} F^{\mathrm{D}\,(\mathrm{GBW})}_{T,q\bar{q}g}(x_{\mathbb{P}}, \beta, Q^2) \times x_{\mathbb{P}} F^{\mathrm{D}\,(\mathrm{MS})}_{T,q\bar{q}g}(x_{\mathbb{P}}, Q^2)}{x_{\mathbb{P}} F^{\mathrm{D}\,(\mathrm{GBW})}_{T,q\bar{q}g}(x_{\mathbb{P}}, \beta = 0, Q^2)}.$$

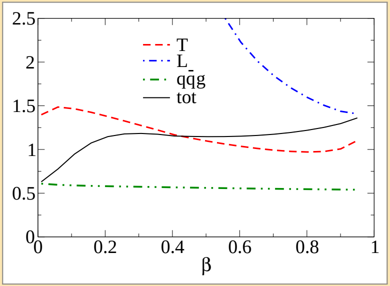
$$x_{\mathbb{P}} F^{\mathrm{D}\,(\mathrm{GBW})}_{T,q\bar{q}g} = \frac{\alpha_s \beta}{8\pi^4} \sum_f e_f^2 \int \mathrm{d}^2\mathbf{b}_T \int_\beta^1 \mathrm{d}z \left[\left(1 - \frac{\beta}{z}\right)^2 + \left(\frac{\beta}{z}\right)^2\right] \int_0^{Q^2} \mathrm{d}k^2 k^4 \ln \frac{Q^2}{k^2} \times \left[\int_0^\infty \mathrm{d}r r K_2(\sqrt{z} kr) J_2(\sqrt{1-z} kr) \frac{\mathrm{d}\tilde{\sigma}_{\mathrm{dip}}}{\mathrm{d}^2\mathbf{b}_T}(\mathbf{b}_T, \mathbf{r}_T, x_{\mathbb{P}})\right]^2.$$

$$x_{\mathbb{P}} F^{\mathrm{D}\,(\mathrm{MS})}_{T,q\bar{q}g} = \frac{C_F \alpha_s Q^2}{4\pi^4 \alpha_{\mathrm{em}}} \int \mathrm{d}^2\mathbf{b}_T\, \mathrm{d}^2\mathbf{r}_T\, \mathrm{d}^2\mathbf{r}_T{}' \int_0^1 \mathrm{d}z \left|\Psi_T^{\gamma^*}(r, Q, z)\right|^2 \frac{\mathbf{r}_T{}^2}{(\mathbf{r}_T{}')^2 (\mathbf{r}_T - \mathbf{r}_T{}')^2} \left[\mathcal{N}(\mathbf{b}_T, \mathbf{r}_T{}', x_{\mathbb{P}}) + \mathcal{N}(\mathbf{r}_T - \mathbf{r}_T{}') - \mathcal{N}(\mathbf{r}_T) - \mathcal{N}(\mathbf{r}_T{}')\mathcal{N}(\mathbf{r}_T - \mathbf{r}_T{}')\right]^2$$

Nuclear effects: β-dependence

Essential regimes:

- Small $\beta \ll 1$: $q\bar{q}g$ strongly suppressed (black disk limit)
- Medium $\beta \sim 0.5$: transverse $q\bar{q}$ enhanced.
- Large $\beta \to 1$: longitudinal $q\bar{q}$ very much enhanced.



Au at $Q^2 = 5\text{GeV}^2$ and $x_{\mathbb{P}} = 10^{-3}$

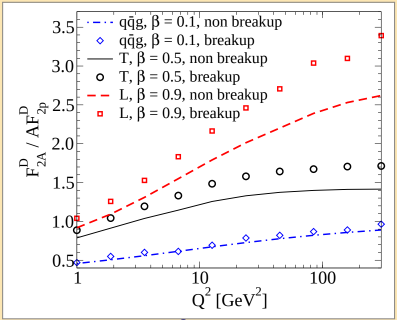
Note: plotting $\frac{F^D_{2A,(x)}}{AF^D_{2\ ,(x)}}$ with $x = L, T, q\bar{q}g,$ tot.

Nuclear effects: Q^2-dependence

Nuclei have smaller Q^2/Q_s^2 at same $x_{\mathbb{P}}$, Q^2

▼

Nuclear enhancement of F_2^D's grows with Q^2

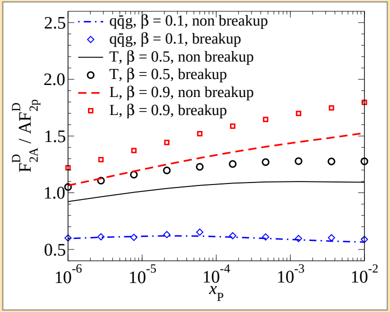


Au at $x_{\mathbb{P}} = 10^{-3}$

Non breakup $=$ coherent
Breakup $=$ coherent $+$ incoherent

Nuclear effects: $x_{\mathbb{P}}$-dependence

At smaller $x_{\mathbb{P}}$ also proton closer to black disk limit $\Longrightarrow$ smaller enhancement in $q\bar{q}$-components.

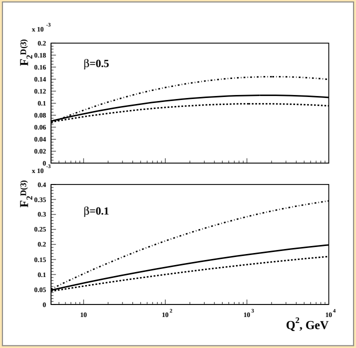


Au at $Q^2 = 5\text{GeV}^2$

Nuclear effects: $x_{\mathbb{P}}$-dependence

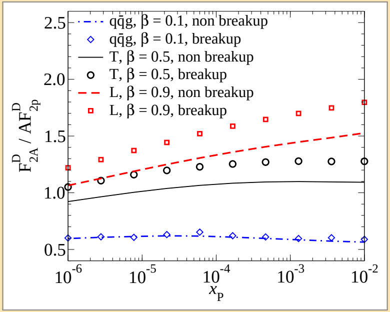
At smaller $x_{\mathbb{P}}$ also proton closer to black disk limit $\Longrightarrow$ smaller enhancement in $q\bar{q}$-components.

Contrast with leading twist: Nuclear suppression at all β



Frankfurt, Guzey, Strikman, 2003,

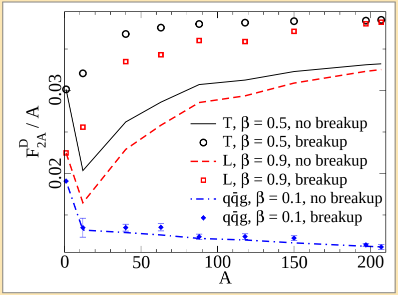
Dot-dash is proton



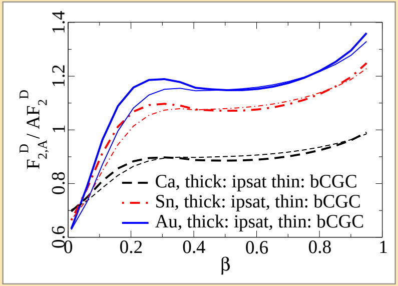
Au at $Q^2 = 5\text{GeV}^2$

Results: *A*-dependence

Small nuclei are more dilute than proton: coherent diffraction suppressed



Different components at $x_{\mathbb{P}} = 10^{-3}$ and $Q^2 = 5\text{GeV}^2$ ⟹



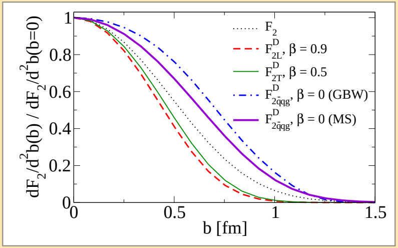
⟸ Different nuclei vs β

Note: $\mathbf{b}_T$-dependence of $q\bar{q}$, inclusive, $q\bar{q}g$

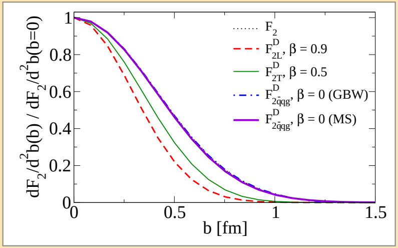
Plots here for proton, same would be for coherent diffraction

Dominant impact parameters different:

$$b^{\text{diff}}(q\bar{q}) < b^{\text{incl}} < b^{\text{diff}}(q\bar{q}g)$$



Different components at
$x_{\mathbb{P}} = 10^{-3}$ and $x_{\mathbb{P}} = 10^{-3}$
$Q^2 = 1\text{GeV}^2$



Different components at
$x_{\mathbb{P}} = 10^{-3}$ and $x_{\mathbb{P}} = 10^{-3}$
$Q^2 = 100\text{GeV}^2$

b-dependence beyond Glauber

Denote $\frac{d\sigma_{dip}}{d^2\mathbf{b}_T}(\mathbf{r}_T, \mathbf{b}_T) = 2(1 - S(\mathbf{r}_T, \mathbf{b}_T))$.

- Glauber independent scatterings:
  $S_A(\mathbf{r}_T, \mathbf{b}_T) = \prod_{i=1}^{A} S_p(\mathbf{r}_T, \mathbf{b}_T - \mathbf{b}_{Ti})$, $\Longrightarrow$ for IPsat equivalent to
  $Q_s^2(\mathbf{b}_T) \sim T_p(\mathbf{b}_T) \to \sum_{i=1}^{A} T_p(\mathbf{b}_T - \mathbf{b}_{Ti})$,
  because $S_A(\mathbf{r}_T, \mathbf{b}_T) \sim e^{-{\mathbf{r}_T}^2 Q_s^2/4}$

$$\sigma_{\gamma^* A} \sim A^{2/3}\left(1 - e^{-{\mathbf{r}_T}^2 Q_s^{p2} A^{1/3}/4}\right) \sim A \text{ for large } Q^2$$

- Not so with BK etc. evolution, when $S_A(\mathbf{r}_T, \mathbf{b}_T) \sim e^{-\left({\mathbf{r}_T}^2 Q_s^2\right)^\gamma/4}$

$$\sigma_{\gamma^* A} \sim A^{2/3}\left(1 - e^{-\left({\mathbf{r}_T}^2 Q_s^{p2} A^{1/3}\right)^\gamma/4}\right) \sim A^{2/3+\gamma/3}$$

To combine BK with realistic nuclear geometry need b-dependent BK evolution $\Longrightarrow$ not (really) doable ...

What would be the best parametrization?

More on t-dependence

Quasielastic = coherent + incoherent

$$\frac{\mathrm{d}\sigma^{\gamma^* A \to VA^*/A}}{\mathrm{d}t} = \frac{1}{16\pi} \left\langle |\mathcal{A}(x_{\mathbb{P}}, Q^2, \mathbf{\Delta}_T)|^2 \right\rangle_{\mathrm{N}}$$

Coherent

$$\frac{\mathrm{d}\sigma^{\gamma^* A \to VA}}{\mathrm{d}t} = \frac{1}{16\pi} \left| \left\langle \mathcal{A}(x_{\mathbb{P}}, Q^2, \mathbf{\Delta}_T) \right\rangle_{\mathrm{N}} \right|^2$$

Incoherent is fluctuations:

$$\frac{\mathrm{d}\sigma^{\gamma^* A \to VA^*}}{\mathrm{d}t} \sim \left\langle |\mathcal{A}(x_{\mathbb{P}}, Q^2, \mathbf{\Delta}_T)|^2 \right\rangle_{\mathrm{N}} - \left| \left\langle \mathcal{A}(x_{\mathbb{P}}, Q^2, \mathbf{\Delta}_T) \right\rangle_{\mathrm{N}} \right|^2$$

Here average over nucleon positions denoted as

$$\langle \mathcal{O}(\{\mathbf{b}_{Ti}\}) \rangle_{\mathrm{N}} \equiv \int \prod_{i=1}^{A} \left[\mathrm{d}^2\mathbf{b}_{Ti} T_A(\mathbf{b}_{Ti}) \right] \mathcal{O}(\{\mathbf{b}_{Ti}\}).$$

(For interpretation coherent=mean, incoherent=fluctuations see T. Toll's talk)

Case study: incoherent J/Ψ

Approximations used in T.L.& Mäntysaari, 2010, 2013

- Factorized b-dependence: **Note** $\sigma_0 = 4\pi B_p$ for gaussian $T_p(\mathbf{b}_T)$.

$$\frac{\mathrm{d}\sigma^{\mathrm{p}}_{\mathrm{dip}}}{\mathrm{d}^2\mathbf{b}_T}(\mathbf{r}_T, \mathbf{b}_T, x) = 2T_p(\mathbf{b}_T)\mathcal{N}(\mathbf{r}_T, x)$$

- "fIPsat" $\mathcal{N}(\mathbf{r}_T, x) = 1 - \exp\left(-r^2 \frac{1}{2\pi B_p} \frac{\pi^2}{2N_c} \alpha_s\left(\mu(r^2)\right) xg\left(x, \mu(r^2)\right)\right)$
  Really Bartels, Golec-Biernat, Kowalski 2002
- Also use IIM Iancu, Itakura, Munier for proton, generalize to nuclei with:

$$S_A(\mathbf{r}_T, \mathbf{b}_T, x) = \prod_{i=1}^{A} S_p(\mathbf{r}_T, \mathbf{b}_T - \mathbf{b}_{Ti}, x).$$

- Real part $1 + \beta^2$ and skewness corrections R_g as in Kowalski, Motyka, Watt 2006 , depend on $\lambda \equiv \frac{\mathrm{d}\mathcal{A}}{\mathrm{d}\ln 1/x}$

Notation:

$$\frac{\mathrm{d}\sigma^{\gamma^* A \to VA^*}}{\mathrm{d}t} = \frac{R_g^2(1+\beta^2)}{16\pi} \int \frac{\mathrm{d}z}{4\pi}\frac{\mathrm{d}z'}{4\pi}\, \mathrm{d}^2\mathbf{r}_T\, \mathrm{d}^2\mathbf{r}_T{}'$$
$$\times \left[\Psi_V^*\Psi\right](r, z, Q)\, \left[\Psi_V^*\Psi\right](r', z', Q) \left\langle \left|\mathcal{A}_{q\bar{q}}\right|^2 (x_{\mathbb{P}}, r, r', \mathbf{\Delta}_T)\right\rangle_N .$$

Equation for incoherent

Incoherent at large enough t:

$$\left\langle \left|\mathcal{A}_{q\bar{q}}\right|^2 (x_{\mathbb{P}}, r, r', \boldsymbol{\Delta}_T) \right\rangle_{\mathrm{N}} = A\,(4\pi B_p)^2\, e^{-B_p \boldsymbol{\Delta}_T{}^2} \mathcal{N}(r)\mathcal{N}(r') \int \mathrm{d}^2\mathbf{b}_T\, T_A(b)$$
$$\times \exp\left\{-2\pi B_p (A-1)\, T_A(b) \left[\mathcal{N}(r) + \mathcal{N}(r')\right]\right\}$$

Interpretation:

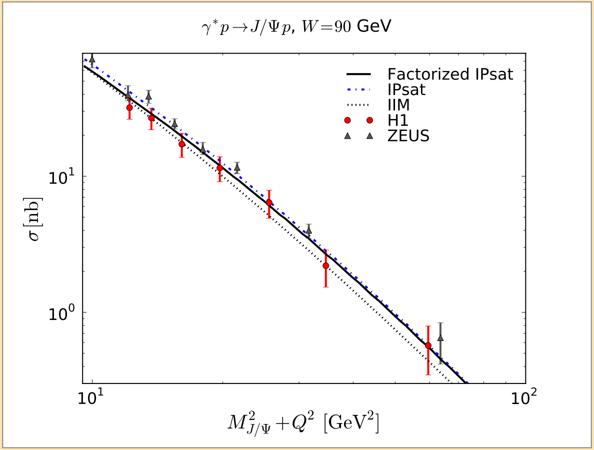
- $\sim A\times$ squared amplitude for proton
- nuclear attenuation factor: must *not* scatter inelastically off the other $A-1$ nucleons (otherwise the interaction would not be diffractive) .

See e.g. Kopeliovich, Nemchik, Schaefer, Tarasov 2001

For comparison: coherent in similar approximation

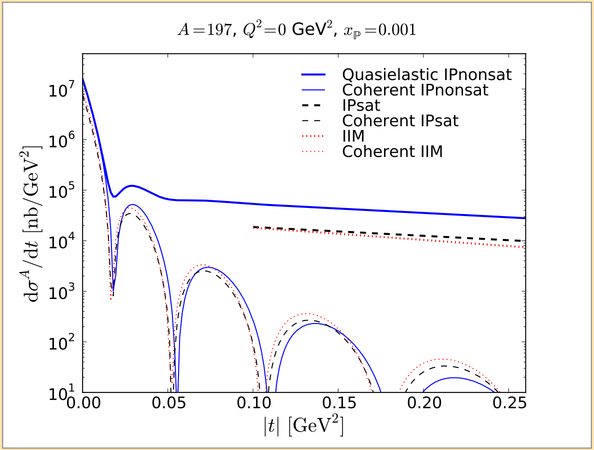
$$\left\langle \mathcal{A}(x_{\mathbb{P}}, Q^2, \boldsymbol{\Delta}_T) \right\rangle_{\mathrm{N}} = \int \frac{\mathrm{d}z}{4\pi}\, \mathrm{d}^2\mathbf{r}_T\, \mathrm{d}^2\mathbf{b}_T\, e^{-i\mathbf{b}_T\cdot\boldsymbol{\Delta}_T} [\Psi_V^*\Psi](r, Q^2)$$
$$\times\, 2\left[1 - \exp\left\{-2\pi B_p A T_A(b) \mathcal{N}(r, x_{\mathbb{P}})\right\}\right].$$

Check HERA



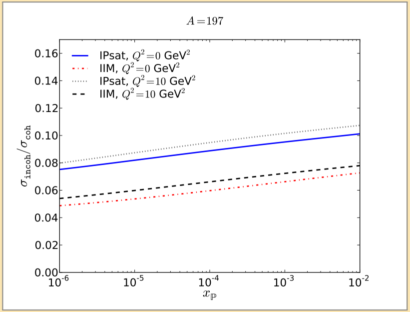
Works, skewness and real part correction $R_g^2(1+\beta^2)$ essential.

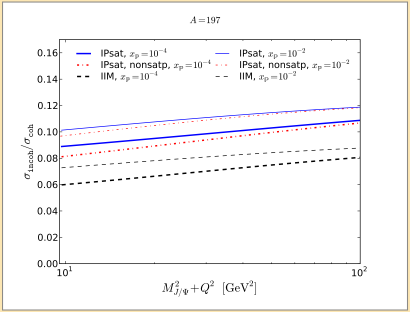
Coherent and incoherent cross sections



IPnonsat: linearized in r, [Caldwell, Kowalski 2009] , explicitly $A \times \sigma_p$.
Factor of 3 suppression from $A\sigma_p$ in incoherent.

Nuclear suppression, dependence on x and Q^2





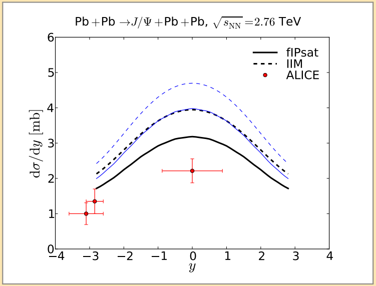
- Not very striking differences in shape of $x_{\mathbb{P}}$, Q^2-dependence.
- Constraint comes from different σ_0, related to B_p, i.e:
  1. Different fits to inclusive data require different normalizations σ_0/B_p
  2. Influences incoherent and coherent diffraction in different ways
  3. Inclusive, coherent and incoherent constrain parametrizations differently.

UPC, comparison to LHC

T.L., Mäntysaari arXiv:1301.4095

Coherent:

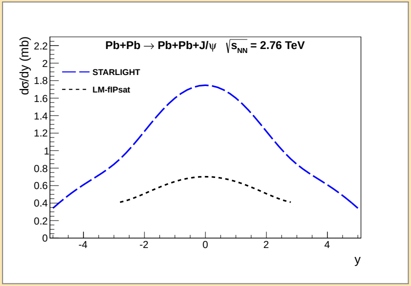
Different J/ψ wavefunctions, σ_{dip},



- R_g^2 is **large**; $1+\beta^2$ also.
  - ep data requires (?) these
  - γA (UPC) better without
- Wavefunction differences significant for $Q^2 = 0$

Incoherent

Dipole model vs. STARLIGHT



Plot Nystrand

- Big difference vs. STARLIGHT
- Suppression vs $A \times \sigma_{\gamma p}$ clear prediction of dipole picture.

(PHENIX $y = 0$ UPC J/Ψ: measurement $76 \pm 35 \mu$b, '
Calculation 108μb. Compare 119μb Toll, Ullrich with 116% correction $R_g^2(1+\beta^2)$)

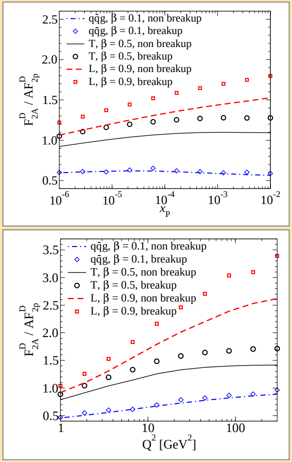
Physics at EIC $F_2^{D(3)}$

Assume 130 GeV on 30 GeV:

$x \gtrsim 7 \times 10^{-5}$ **for** $Q^2 = 1$ or $Q^2 \lesssim 140\text{GeV}^2$ **for** $x = 0.01$.

t-integrated:

- Basic features of nuclear enhancement/suppression vs β should be seen $\Longrightarrow$ validation of dipole picture
- Some structure in Q^2
- Energy dependence not very conclusive

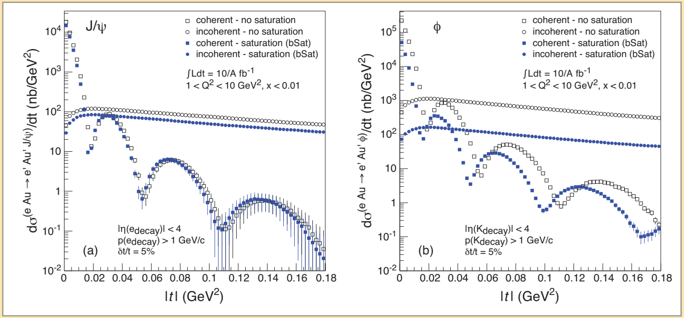


Kowalski, T.L., Marquet, Venugopalan

Physics at EIC: exclusive vector mesons

Transverse structure

- What is the resolution in t?
- Also information in the incoherent/diffractive ep t range
- Lighter mesons (larger r) more sensitive to saturation, but also bigger ambiguities in LC-wavefunction.

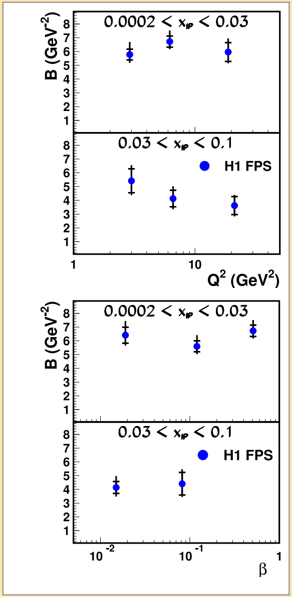


Toll, Ullrich

Physics at EIC: $F_2^{D(4)}$

No calculations to present here . . .

- Measure t-slope B in
  - The proton/incoherent region $-t \sim 0.5\text{GeV}^2$: easy?
  - The coherent region $-t \sim 0.02\text{GeV}^2$: too hard?
- Look at M_X and Q^2 dependence in B.
  $\Longrightarrow$ Beyond factorized $\mathbf{b}_T$-profiles
- Can one improve on HERA? $\Longrightarrow$
- Same for nuclei (incoherent)



H1 2006

Conclusion

- Universality of dipole picture: lot of predictive power, in principle.
- Impact parameter dependence
  - IPsat nice: fit to ep $\Longrightarrow$ unambiguous prediction for eA
  - $\nexists$ real b-dependent BK/JIMWLK calculation!
- Normalization: should avoid proliferation of K factors (cf. hadron-hadron phenomenology)
- EIC:
  - Limited sensitivity to intricacies of evolution in x
  - Good resolution in t for nuclei and protons would be very valuable
  - **Measure also incoherent diffraction**

    t similar to ep, and nontrivial nuclear effects!

    Probe fluctuations in the gluon density

POETIC IV in Jyväskylä

Stellenbosch — Bloomington — Valparaíso —

University of Jyväskylä Department of Physics
$\sim$ **August 26 – 30, 2013**

Organizing committee:

- T. Lappi
- K. J. Eskola
- T. Renk
- H. Mäntysaari
- …