Incoherent Diffractive Dijet Production in Electron DIS off Nuclei

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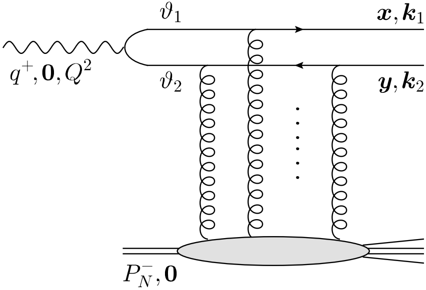
Content

- Dijets in electron DIS off nuclei
- Incoherent diffractive process
- CGC correlator at 4-gluon exchange and in correlation limit
- "Factorization" into hard $\times$ semi-hard factors
- Cross section and angular correlations
- Next to leading kinematic twists
- 2+1 jets contribution

Right moving (RM) virtual photon, left moving (LM) hadron/nucleus

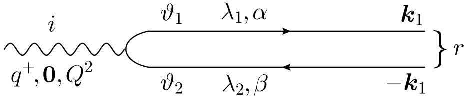
γ^* decay to RM $q\bar{q}$ pair, scattering off strong color field



Size $\boldsymbol{r} = \boldsymbol{x} - \boldsymbol{y}$, center of energy $\boldsymbol{b} = \vartheta_1 \boldsymbol{x} + \vartheta_2 \boldsymbol{y}$

Dijet imbalance $\boldsymbol{\Delta} = \boldsymbol{k}_1 + \boldsymbol{k}_2$, relative momentum $\boldsymbol{P} = \vartheta_2 \boldsymbol{k}_1 - \vartheta_1 \boldsymbol{k}_2$

No scattering $\rightsquigarrow$ no $\boldsymbol{b}$ dependence



$q\bar{q}$ component of transverse γ^* in coordinate space

$$\left|\gamma_T^i(q)\right\rangle_{q\bar{q}} = \sum_{\lambda_{1,2}=\pm 1/2} \sum_{\alpha,\beta=1}^{N_c} \delta_{\alpha\beta} \int_0^1 \mathrm{d}\vartheta_1 \mathrm{d}\vartheta_2\, \delta(1-\vartheta_1-\vartheta_2) \int \mathrm{d}^2\boldsymbol{x}\, \mathrm{d}^2\boldsymbol{y} \times \widetilde{\psi}^i_{\lambda_1\lambda_2}(\vartheta_1, \boldsymbol{r}) \left| q^\alpha_{\lambda_1}(\vartheta_1, \boldsymbol{x})\, \bar{q}^\beta_{\lambda_2}(\vartheta_2, \boldsymbol{y})\right\rangle$$

with wavefunction (WF)

$$\widetilde{\psi}^i_{\lambda_1\lambda_2}(\vartheta, \boldsymbol{r}) = -\sqrt{\frac{q^+}{2}}\, \frac{iee_f}{(2\pi)^2}\, \varphi^{il}_{\lambda_1\lambda_2}(\vartheta)\, \frac{\bar{Q}r^l}{r} K_1(\bar{Q}r), \qquad \bar{Q}^2 = \vartheta_1\vartheta_2 Q^2$$

φ contains EM vertex helicity structure

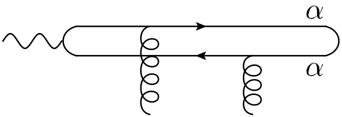
Eikonal multiple scattering of quark off target color field

$$V(\boldsymbol{x}) = \mathrm{T}\exp\left[ig\int \mathrm{d}x^{+} t^{a} A_{a}^{-}(x^{+},\boldsymbol{x})\right]$$

For the $q\bar{q}$ pair let

$$\delta_{\alpha\beta} \to \left[V(\boldsymbol{x})V^{\dagger}(\boldsymbol{y}) - \mathbb{1}\right]_{\alpha\beta}$$

Diffraction: close dipole color line in DA (and separately in CCA)



$$\left[V(\boldsymbol{x})V^{\dagger}(\boldsymbol{y}) - \mathbb{1}\right]_{\alpha\beta} \to \left\{\frac{1}{N_c}\,\mathrm{tr}\left[V(\boldsymbol{x})V^{\dagger}(\boldsymbol{y})\right] - 1\right\}\delta_{\alpha\beta}$$
$$\equiv \left[S(\boldsymbol{x},\boldsymbol{y}) - 1\right]\delta_{\alpha\beta} = -T(\boldsymbol{x},\boldsymbol{y})\,\delta_{\alpha\beta}$$

Diffractive Dijet Cross Section

In transverse sector

$$\frac{\mathrm{d}\sigma_{\mathrm{D}}^{\gamma_T^* A\to q\bar{q}X}}{\mathrm{d}\vartheta_1 \mathrm{d}\vartheta_2\, \mathrm{d}^2\boldsymbol{P}\mathrm{d}^2\boldsymbol{\Delta}} = \frac{\alpha_{\mathrm{em}}\, N_c}{2\pi^2}\left(\sum e_f^2\right)\,\delta(1-\vartheta_1-\vartheta_2)\,\left(\vartheta_1^2+\vartheta_2^2\right)\int \frac{\mathrm{d}^2\boldsymbol{b}}{2\pi}\,\frac{\mathrm{d}^2\bar{\boldsymbol{b}}}{2\pi}\,\frac{\mathrm{d}^2\boldsymbol{r}}{2\pi}\,\frac{\mathrm{d}^2\bar{\boldsymbol{r}}}{2\pi}$$
$$\times\, e^{-i\boldsymbol{\Delta}\cdot(\boldsymbol{b}-\bar{\boldsymbol{b}})-i\boldsymbol{P}\cdot(\boldsymbol{r}-\bar{\boldsymbol{r}})}\,\frac{\boldsymbol{r}\cdot\bar{\boldsymbol{r}}}{r\bar{r}}\,\bar{Q}^2 K_1\big(\bar{Q}r\big)K_1\big(\bar{Q}\bar{r}\big)\langle T(\boldsymbol{x},\boldsymbol{y})T(\bar{\boldsymbol{y}},\bar{\boldsymbol{x}})\rangle$$

QCD dynamics in correlator $\langle T(\boldsymbol{x},\boldsymbol{y})T(\bar{\boldsymbol{y}},\bar{\boldsymbol{x}})\rangle$

Target average to be taken with CGC wave-function

- $\langle T(\boldsymbol{x},\boldsymbol{y})\rangle\langle T(\bar{\boldsymbol{y}},\bar{\boldsymbol{x}})\rangle \to$ Coherent diffraction
- $\langle T(\boldsymbol{x},\boldsymbol{y})T(\bar{\boldsymbol{y}},\bar{\boldsymbol{x}})\rangle - \langle T(\boldsymbol{x},\boldsymbol{y})\rangle\langle T(\bar{\boldsymbol{y}},\bar{\boldsymbol{x}})\rangle \to$ Incoherent diffraction

Homogeneous target: coherent diffraction $\sim \delta^2(\boldsymbol{\Delta})$ (smeared to $1/R_A$)

Negligible momentum transfer and dijet imbalance

Variance of scattering amplitude

$$\mathcal{W}_{\mathrm{D}} = \langle T(\boldsymbol{x},\boldsymbol{y}) T(\bar{\boldsymbol{y}},\bar{\boldsymbol{x}})\rangle - \langle T(\boldsymbol{x},\boldsymbol{y})\rangle\langle T(\bar{\boldsymbol{y}},\bar{\boldsymbol{x}})\rangle$$

- Pomeron loops: particle number fluctuations in target
- Hot spots (Demirci, Lappi, Schlichting)
- $1/N_c^2$ color fluctuations (MV model, JIMWLK) (Marquet, Weigert)

Homogeneous target: $\boldsymbol{r}, \bar{\boldsymbol{r}}, \boldsymbol{B} \equiv \boldsymbol{b} - \bar{\boldsymbol{b}}$ independent variables

$$\frac{\mathrm{d}\sigma_{\mathrm{D}}^{\gamma_T^* A \to q\bar{q}X}}{\mathrm{d}\vartheta_1 \mathrm{d}\vartheta_2\, \mathrm{d}^2\boldsymbol{P} \mathrm{d}^2\boldsymbol{\Delta}} = \cdots \frac{S_\perp}{2\pi} \int \frac{\mathrm{d}^2\boldsymbol{B}}{2\pi}\, \frac{\mathrm{d}^2\boldsymbol{r}}{2\pi}\, \frac{\mathrm{d}^2\bar{\boldsymbol{r}}}{2\pi} e^{-i\boldsymbol{\Delta}\cdot\boldsymbol{B} - i\boldsymbol{P}\cdot(\boldsymbol{r}-\bar{\boldsymbol{r}})} \times \frac{\boldsymbol{r}\cdot\bar{\boldsymbol{r}}}{r\bar{r}}\, \bar{Q}^2\, K_1\big(\bar{Q}r\big) K_1\big(\bar{Q}\bar{r}\big) \mathcal{W}_{\mathrm{D}}(\boldsymbol{r}, \bar{\boldsymbol{r}}, \boldsymbol{B})$$

$\rightsquigarrow$ Non-zero momentum transfer and dijet imbalance

- Energy conservation

$$x_{\rm gap} P_N^- = \frac{1}{2q^+}\left(\frac{k_{1\perp}^2}{\vartheta_1} + \frac{k_{2\perp}^2}{\vartheta_2} + Q^2\right) \Longrightarrow x_{\rm gap} = \frac{Q^2}{W^2}\Bigg(1 + \underbrace{\frac{P_\perp^2}{\bar{Q}^2}}_{\mathcal{O}(1)} + \underbrace{\frac{\Delta_\perp^2}{Q^2}}_{\ll 1}\Bigg)$$

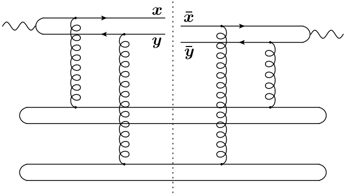
Consider $Y_{\rm gap}$ as independent of $P_\perp$

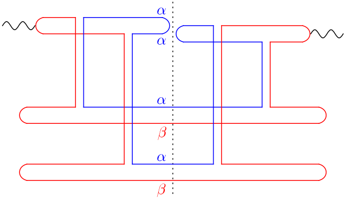
- Symmetric splitting $\vartheta_1 \sim \vartheta_2 \sim 1/2$

$$\frac{{\rm d}\sigma_{\rm D}^{\gamma_T^* A \to q\bar{q}X}}{{\rm d}\vartheta_1 {\rm d}\vartheta_2\, {\rm d}^2\boldsymbol{P} {\rm d}^2\boldsymbol{\Delta}} = \underbrace{\vartheta_1\vartheta_2}_{\sim 1/4} \frac{{\rm d}\sigma_{\rm D}^{\gamma_T^* A \to q\bar{q}X}}{{\rm d}\eta_1 {\rm d}\eta_2\, {\rm d}^2\boldsymbol{P} {\rm d}^2\boldsymbol{\Delta}}$$

CGC Correlator at 4-Gluon Exchange

Assume Gaussian CGC WF, only pieces connecting DA with CCA survive:





$$\frac{g^4}{4N_c^2}\sum_{a,b}\langle\alpha_{\boldsymbol{x}}^a\,\alpha_{\bar{\boldsymbol{y}}}^b\rangle\langle\alpha_{\boldsymbol{y}}^a\,\alpha_{\bar{\boldsymbol{x}}}^b\rangle=\frac{g^4}{4N_c^2}\sum_{a}\langle\alpha_{\boldsymbol{x}}^a\,\alpha_{\bar{\boldsymbol{y}}}^a\rangle\langle\alpha_{\boldsymbol{y}}^a\,\alpha_{\bar{\boldsymbol{x}}}^a\rangle=\sum_{a,b}\frac{g^4}{4N_c^2(N_c^2-1)}\langle\alpha_{\boldsymbol{x}}^a\,\alpha_{\bar{\boldsymbol{y}}}^a\rangle\langle\alpha_{\boldsymbol{y}}^b\,\alpha_{\bar{\boldsymbol{x}}}^b\rangle$$

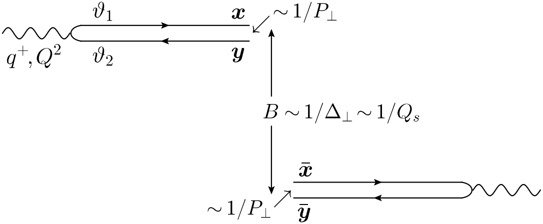
Target colorless substructures exchange only one gluon in DA (CCA)

Put together all 16 terms, add/subtract "same point correlators"

$$\mathcal{W}_{\rm D}(\boldsymbol{r},\bar{\boldsymbol{r}},\boldsymbol{B})\simeq\frac{1}{2(N_c^2-1)}\left[\mathcal{T}(\boldsymbol{x},\bar{\boldsymbol{y}})+\mathcal{T}(\boldsymbol{y},\bar{\boldsymbol{x}})-\mathcal{T}(\boldsymbol{x},\bar{\boldsymbol{x}})-\mathcal{T}(\boldsymbol{y},\bar{\boldsymbol{y}})\right]^2$$
$$\simeq\frac{1}{2(N_c^2-1)}\,r^i\bar{r}^j r^k\bar{r}^l\partial^i\partial^j\mathcal{T}(\boldsymbol{B})\partial^k\partial^l\mathcal{T}(\boldsymbol{B})$$

Incoherent scattering $\leftrightarrow$ $1/N_c^2$ suppression

Extend above to correlation limit $P_\perp \gg \Delta_\perp, Q_s \longleftrightarrow r, \bar{r} \ll B, 1/Q_s$



$\langle TT \rangle$ known at finite-N_c, expand for small $r, \bar{r}$, let B arbitrary

$$\mathcal{W}_{\rm D}(\boldsymbol{r}, \bar{\boldsymbol{r}}, \boldsymbol{B}) \simeq \frac{C_F}{2N_c^3}\, r^i \bar{r}^j r^k \bar{r}^l\, \Phi(\mathcal{S}_g(B))\, [\partial^i \partial^j \ln \mathcal{S}_g(B)]\, [\partial^k \partial^l \ln \mathcal{S}_g(B)]$$

Same structure as in 4 gluon exchange approxximation

Angular correlation between $\boldsymbol{r}$ and $\boldsymbol{B}$, hence between $\boldsymbol{P}$ and $\boldsymbol{\Delta}$

Tensorial Factorization of Cross Section

Hard integrals over $\boldsymbol{r}$,$\bar{\boldsymbol{r}}$ factorize from semi-hard over $\boldsymbol{B}$

Factorization holds at cross section (not at amplitude) level

$$\frac{\mathrm{d}\sigma_{\mathrm{D}}^{\gamma_T^* A\to q\bar{q}X}}{\mathrm{d}\vartheta_1 \mathrm{d}\vartheta_2\, \mathrm{d}^2\boldsymbol{P} \mathrm{d}^2\boldsymbol{\Delta}} = \frac{S_\perp \alpha_{\mathrm{em}}\, N_c}{4\pi^3} \left(\sum e_f^2\right) \delta(1-\vartheta_1-\vartheta_2) \left(\vartheta_1^2+\vartheta_2^2\right) \frac{C_F}{2N_c^3} \left|\mathcal{A}_{\mathrm{D}}^T\right|^2$$

Reduced cross section

$$\boxed{\left|\mathcal{A}_{\mathrm{D}}^T\right|^2 = H_T^{iks}(\boldsymbol{P},\bar{Q})\, H_T^{jls*}(\boldsymbol{P},\bar{Q})\, \mathcal{G}_{\mathrm{D}}^{ij,kl}(\boldsymbol{\Delta})}$$

Hard factor trivial to calculate

$$H_T^{iks}(\boldsymbol{P},\bar{Q}) = -\frac{2i}{(P_\perp^2+\bar{Q}^2)^2}\left(\delta^{ik}P^s + \delta^{is}P^k + \delta^{ks}P^i\right) + \frac{8iP^iP^kP^s}{(P_\perp^2+\bar{Q}^2)^3}$$

Scales like $1/P_\perp^3$ for $\bar{Q} \sim P_\perp$

Semi-Hard Function and its Decomposition

Semi-hard factor with dimension of mass squared

$$\mathcal{G}_{\mathrm{D}}^{ij,kl}(\boldsymbol{\Delta}) = \int \frac{\mathrm{d}^2\boldsymbol{B}}{2\pi}\, e^{-i\boldsymbol{\Delta}\cdot\boldsymbol{B}}\, \Phi(\mathcal{S}_g(B))\, [\partial^i\partial^j \ln \mathcal{S}_g(B)]\, [\partial^k\partial^l \ln \mathcal{S}_g(B)]$$

Square of structure appearing in WW gluon TMD

$$\partial^i\partial^j \ln \mathcal{S}_g(B) = \frac{\delta^{ij}}{2} \underbrace{\frac{1}{B}\frac{\partial}{\partial B}\left(B\frac{\partial \ln \mathcal{S}_g}{\partial B}\right)}_{F_+(B)} + \left(\frac{B^i B^j}{B^2} - \frac{\delta^{ij}}{2}\right) \underbrace{B\frac{\partial}{\partial B}\left(\frac{1}{B}\frac{\partial \ln \mathcal{S}_g}{\partial B}\right)}_{F_-(B)}$$

$\mathcal{G}_{\mathrm{D}}^{ij,kl}(\boldsymbol{\Delta})$ decomposed into terms $\propto$ to $\delta^{ij}\delta^{kl}$ or $\delta^{ij}\Delta^k\Delta^l$ or $\Delta^i\Delta^j\Delta^k\Delta^l$

$\rightsquigarrow$ Four coefficients $\mathcal{G}_{\mathrm{D}}^{(n)}(\Delta_\perp)$: "distributions" (cf. xG, xh in inclusive)

$$\mathcal{G}_{\mathrm{D}}^{[+,-,1,2]} = \int \frac{\mathrm{d}^2\boldsymbol{B}}{2\pi}\, e^{-i\boldsymbol{\Delta}\cdot\boldsymbol{B}}\, \Phi(\mathcal{S}_g(B))[F_+^2, F_-^2, F_+F_- \cos 2\phi_{\Delta B}, F_-^2 \cos 4\phi_{\Delta B}]$$

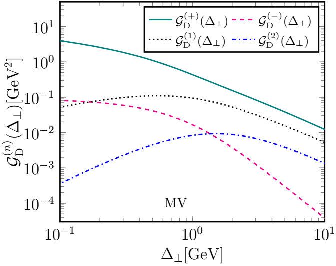
(Reduced) Cross Section

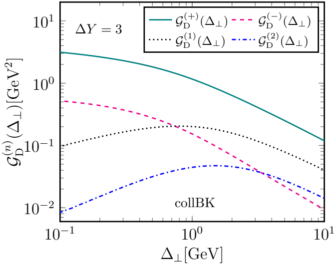
Compact analytic expression in correlation limit $P_\perp \gg \Delta_\perp, Q_s$

$$\left|\mathcal{A}_{\mathrm{D}}^T\right|^2 = \frac{4P_\perp^2(3\bar{Q}^4 + P_\perp^4)}{(P_\perp^2 + \bar{Q}^2)^6}\,\mathcal{G}_{\mathrm{D}}^{(+)}(\Delta_\perp) + \frac{8\bar{Q}^4 P_\perp^2}{(P_\perp^2 + \bar{Q}^2)^6}\,\mathcal{G}_{\mathrm{D}}^{(-)}(\Delta_\perp) + \frac{16\bar{Q}^2 P_\perp^2(\bar{Q}^2 - P_\perp^2)\cos 2\phi}{(P_\perp^2 + \bar{Q}^2)^6}\,\mathcal{G}_{\mathrm{D}}^{(1)}(\Delta_\perp) - \frac{8\bar{Q}^2 P_\perp^4 \cos 4\phi}{(P_\perp^2 + \bar{Q}^2)^6}\,\mathcal{G}_{\mathrm{D}}^{(2)}(\Delta_\perp)$$

- Simple 1D integration (Bessel transform) to get $\mathcal{G}_{\mathrm{D}}^{(n)}(\Delta_\perp)$
- Dependence on $P_\perp$, $\Delta_\perp$ and also on $\phi = \angle(\boldsymbol{P}, \boldsymbol{\Delta})$
- For $\bar{Q} \sim P_\perp$ all hard factors $\sim 1/P_\perp^6$, like in exclusive dijets
- One-to-one correspondence between angles $\phi_{\Delta B}$ and ϕ: $\cos n\phi_{\Delta B} \rightsquigarrow \cos n\phi$

Momentum Dependence of "Distributions"



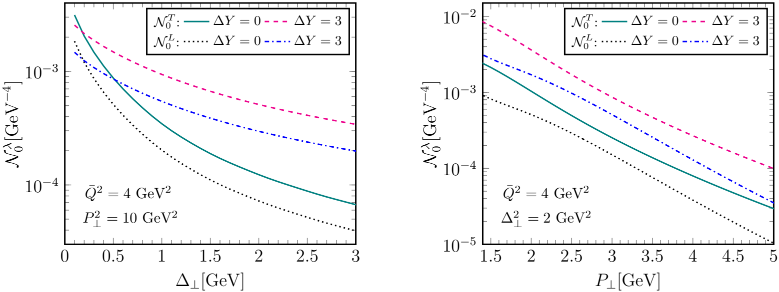


Analytic estimates in MV model for $\Delta_\perp \gg Q_s$ and $\Delta_\perp \sim Q_s$

$$\mathcal{G}_D^{(+)} \simeq \frac{2Q_A^4}{\Delta_\perp^2} \ln \frac{\Delta_\perp^2}{\Lambda^2}, \qquad \mathcal{G}_D^{(-)} \simeq \frac{Q_A^6}{3\Delta_\perp^4}, \qquad \mathcal{G}_D^{(1)} \simeq \frac{Q_A^4}{\Delta_\perp^2} \ln \frac{\Delta_\perp^2}{\Lambda^2}, \qquad \mathcal{G}_D^{(2)} \simeq \frac{2Q_A^4}{\Delta_\perp^2}$$

$$\mathcal{G}_D^{(+)} \sim Q_s^2\,, \qquad \mathcal{G}_D^{(-)} \sim \frac{Q_s^2}{\rho_A^2}\,, \qquad \mathcal{G}_D^{(1)} \sim \frac{Q_s^2}{\rho_A}\,, \qquad \mathcal{G}_D^{(2)} \sim \frac{Q_s^2}{\rho_A^2}$$

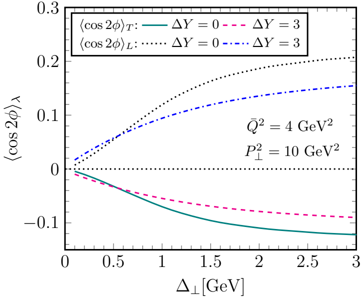
Overall $\mathcal{G}_D^{(+)} > \mathcal{G}_D^{(1)} \gg \mathcal{G}_D^{(2)}$, while $\mathcal{G}_D^{(-)}$ may be neglected

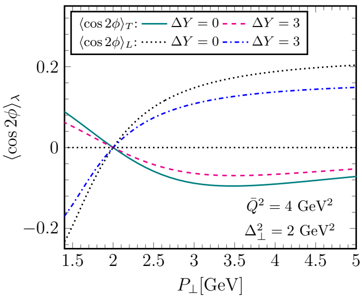


$$\frac{\mathrm{d}\sigma_{\mathrm{D}}^{\gamma_\lambda^* A\to q\bar{q}X}}{\mathrm{d}\vartheta_1 \mathrm{d}\vartheta_2 \mathrm{d}^2\boldsymbol{P}\mathrm{d}^2\boldsymbol{\Delta}} \propto \frac{\alpha_{\mathrm{em}} S_\perp}{N_c}\frac{1}{P_\perp^6}\frac{Q_s^4}{\Delta_\perp^2}$$

- If $\Delta_\perp \sim Q_s$, double suppression $1/N_c^2 \times Q_s^2/P_\perp^2$ w.r.t. inclusive

Angular Correlation $\langle \cos 2\phi \rangle$

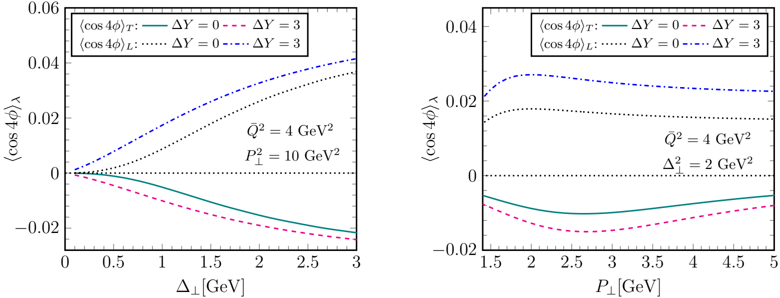




$$\langle \cos 2\phi \rangle_T \simeq \frac{2\bar{Q}^2(\bar{Q}^2 - P_\perp^2)}{3\bar{Q}^4 + P_\perp^4} \frac{\mathcal{G}_{\rm D}^{(1)}(\Delta_\perp)}{\mathcal{G}_{\rm D}^{(+)}(\Delta_\perp)}, \quad \langle \cos 2\phi \rangle_L \simeq \frac{4P_\perp^2(P_\perp^2 - \bar{Q}^2)}{\bar{Q}^4 - 2\bar{Q}^2 P_\perp^2 + 5P_\perp^4} \frac{\mathcal{G}_{\rm D}^{(1)}(\Delta_\perp)}{\mathcal{G}_{\rm D}^{(+)}(\Delta_\perp)}$$

- Saturation leads to suppression of anisotropy
- Both T and L vanish at $P_\perp = \bar{Q}$

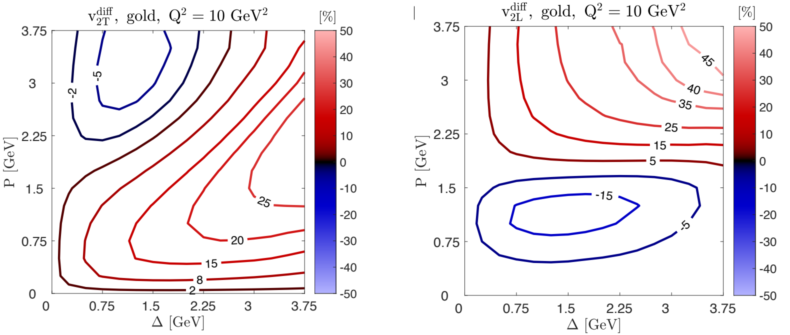
Angular Correlation $\langle\cos 4\phi\rangle$



$$\langle\cos 4\phi\rangle_T \simeq -\frac{\bar{Q}^2 P_\perp^2}{3\bar{Q}^4 + P_\perp^4}\,\frac{\mathcal{G}_{\rm D}^{(2)}(\Delta_\perp)}{\mathcal{G}_{\rm D}^{(+)}(\Delta_\perp)}, \quad \langle\cos 4\phi\rangle_L \simeq \frac{2P_\perp^4}{\bar{Q}^4 - 2\bar{Q}^2 P_\perp^2 + 5P_\perp^4}\,\frac{\mathcal{G}_{\rm D}^{(2)}(\Delta_\perp)}{\mathcal{G}_{\rm D}^{(+)}(\Delta_\perp)}$$

- Saturation leads to suppression of anisotropy
- Same twist as $\langle\cos 2\phi\rangle$, suppressed semi-hard factor

Exact numerical solution in for arbitrary $P_\perp, \Delta_\perp$ and Q_s (Mäntysaari et al)



- Very good agreement in longitudinal sector
- Puzzling in the transverse sector:
  - zero not at $P_\perp = \bar{Q}$
  - for fixed $P_\perp > \bar{Q}$, minimum as a function of $\Delta_\perp$

Kinematic and "Genuine" Saturation Corrections

Three scales, classify corrections (Altinoluk, Boussarie, Fujii, Kotko, Marquet, Mehtar-Tani, Watanabe...)

- Genuine saturation twists $(Q_s^2/P_\perp^2)^n$: numerical implementation
- Kinematic twists $(\Delta_\perp^2/P_\perp^2)^n$: resummation $\rightsquigarrow$ improved TMD
  Done for inclusive dijets (Boussarie, Mäntysaari, Salazar, Schenke)

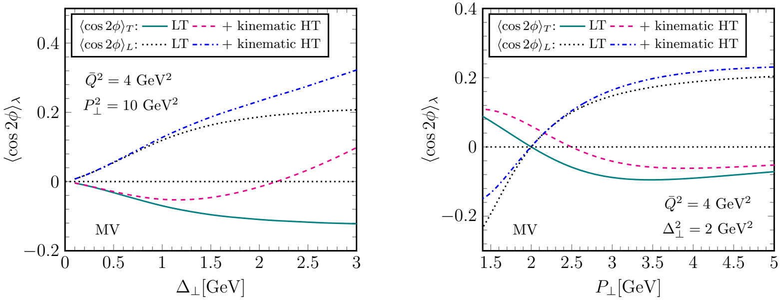
Calculate just first kinematic twist

$$\delta\left|\mathcal{A}_{\rm D}^{T}\right|^2 = \frac{1}{6}\, H_T^{ikmns}(\boldsymbol{P},\bar{Q})\, H_T^{jls*}(\boldsymbol{P},\bar{Q})\, \mathcal{G}_{\rm D}^{ij,klmn}(\boldsymbol{\Delta})$$

$$\mathcal{G}_{\rm D}^{ij,klmn}(\boldsymbol{\Delta}) = \int \frac{{\rm d}^2\boldsymbol{B}}{2\pi}\, e^{-i\boldsymbol{\Delta}\cdot\boldsymbol{B}}\, \Phi((\mathcal{S}_g(B))[\partial^i\partial^j \ln\mathcal{S}_g(B)][\partial^k\partial^l\partial^m\partial^n \ln\mathcal{S}_g(B)]$$

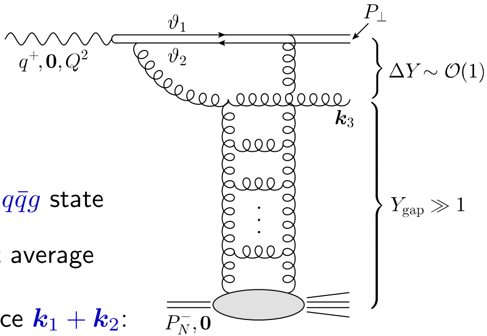
- leading twist $\mathcal{W}_{\rm D} \sim r^4\, \partial^2 \ln\mathcal{S}\, \partial^2 \ln\mathcal{S} \sim r^4 Q_A^4$
- NL kin twist $\delta\mathcal{W}_{\rm D} \sim r^6\, \partial^2 \ln\mathcal{S}\, \partial^4 \ln\mathcal{S} \sim r^6 Q_A^4/B^2$
- $\delta\mathcal{W}_{\rm D}/\mathcal{W}_{\rm D} \sim r^2/B^2 \sim \Delta_\perp^2/P_\perp^2$ ✓

$\langle \cos 2\phi \rangle$ with NL Kinematic Twist



- No qualitative change in longitudinal sector ✓
- New features in transverse sector
  - for fixed $P_\perp$, minimum as a function of $\Delta_\perp$ ✓
  - sign change at $P_\perp$ value which increases with $\Delta_\perp$ ✓

"2+1" Jets Contribution (produced after dinner)



- Diffractive projection to $q\bar{q}g$ state
- Connected part in target average

Two sources for dijet imbalance $\boldsymbol{k}_1 + \boldsymbol{k}_2$:

- Momentum transfer from nucleus
- Kick due to gluon emission $\boldsymbol{k}_3$

If $k_{3\perp} \ll P_\perp$, then gluon dipole configuration scatters

Keep $1/N_c^2$ piece of $\langle T_g T_g \rangle$ (Kovchegov, Wertepny)

Dominance of $q\bar{q}g$ Contribution (produced after dinner)

- Simple, but illustrative case: $P_\perp \gg k_{3\perp} \gg \Delta_\perp, Q_s$

  $\langle T_g T_g \rangle$ simplifies, analytical calculation

$$\frac{\mathrm{d}\sigma_{\mathrm{D}}^{\gamma_T^* A \to q\bar{q}gX}}{\mathrm{d}^2\boldsymbol{P}\mathrm{d}^2\boldsymbol{\Delta}\mathrm{d}^2\boldsymbol{k}_3} \propto \frac{1}{P_\perp^4}\,\frac{Q_s^4}{\Delta_\perp^2}\,\frac{1}{k_{3\perp}^4}$$

- Gluon integration dominated by lower limit

  Eventually exact integration should be determined by $k_{3\perp} \sim \Delta_\perp$

$$\boxed{\frac{\mathrm{d}\sigma_{\mathrm{D}}^{\gamma_T^* A \to q\bar{q}gX}}{\mathrm{d}^2\boldsymbol{P}\mathrm{d}^2\boldsymbol{\Delta}} \propto \frac{1}{P_\perp^4}\,\frac{Q_s^4}{\Delta_\perp^4}}$$

  Larger than $q\bar{q}$ component

Thanks to everybody for the lively participation