



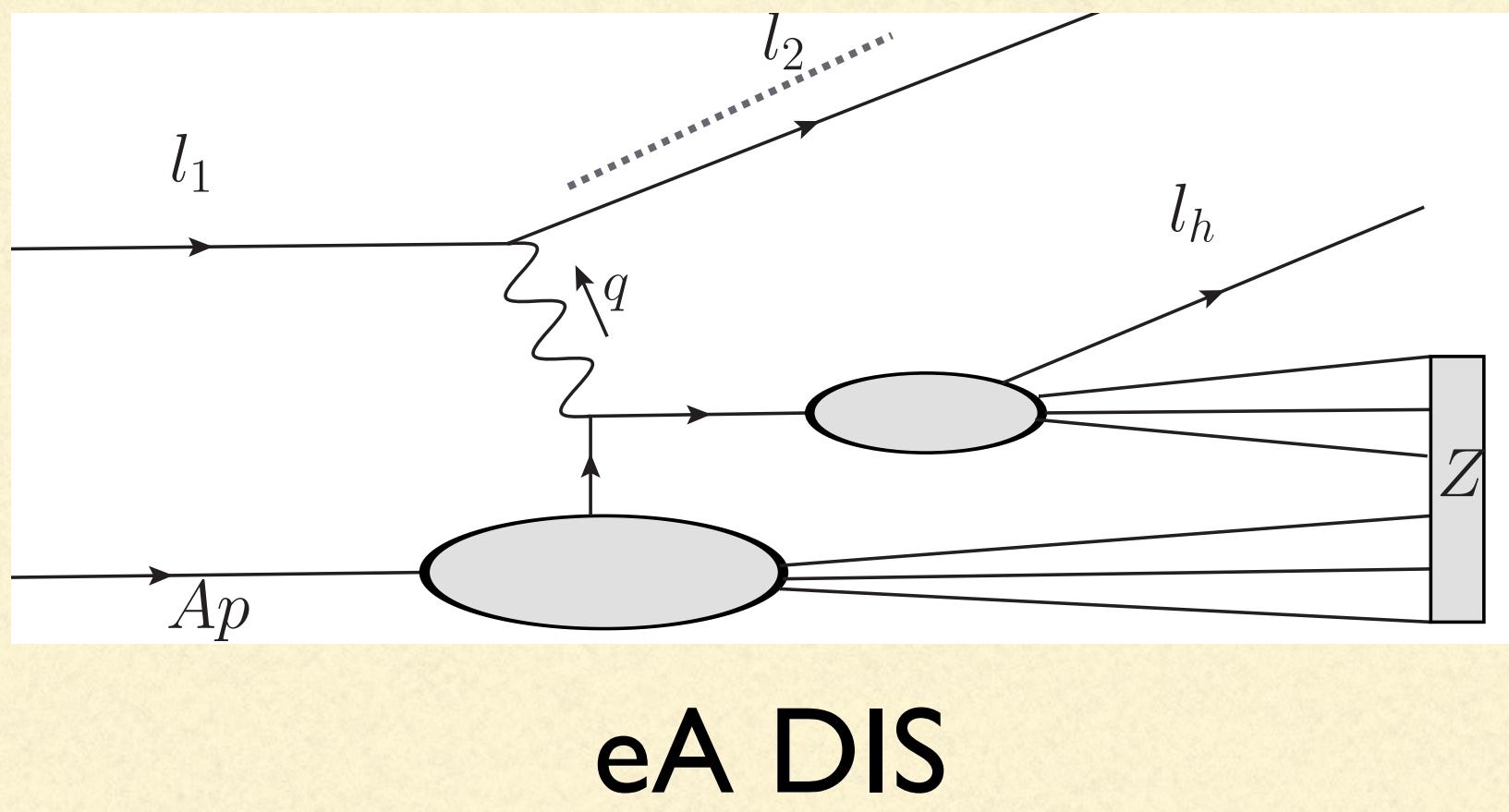
# PARTON ENERGY LOSS & GENERALIZED JET TRANSPORT COEFFICIENT



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# Improved High Twist approach

radiative parton energy loss in cold nuclei

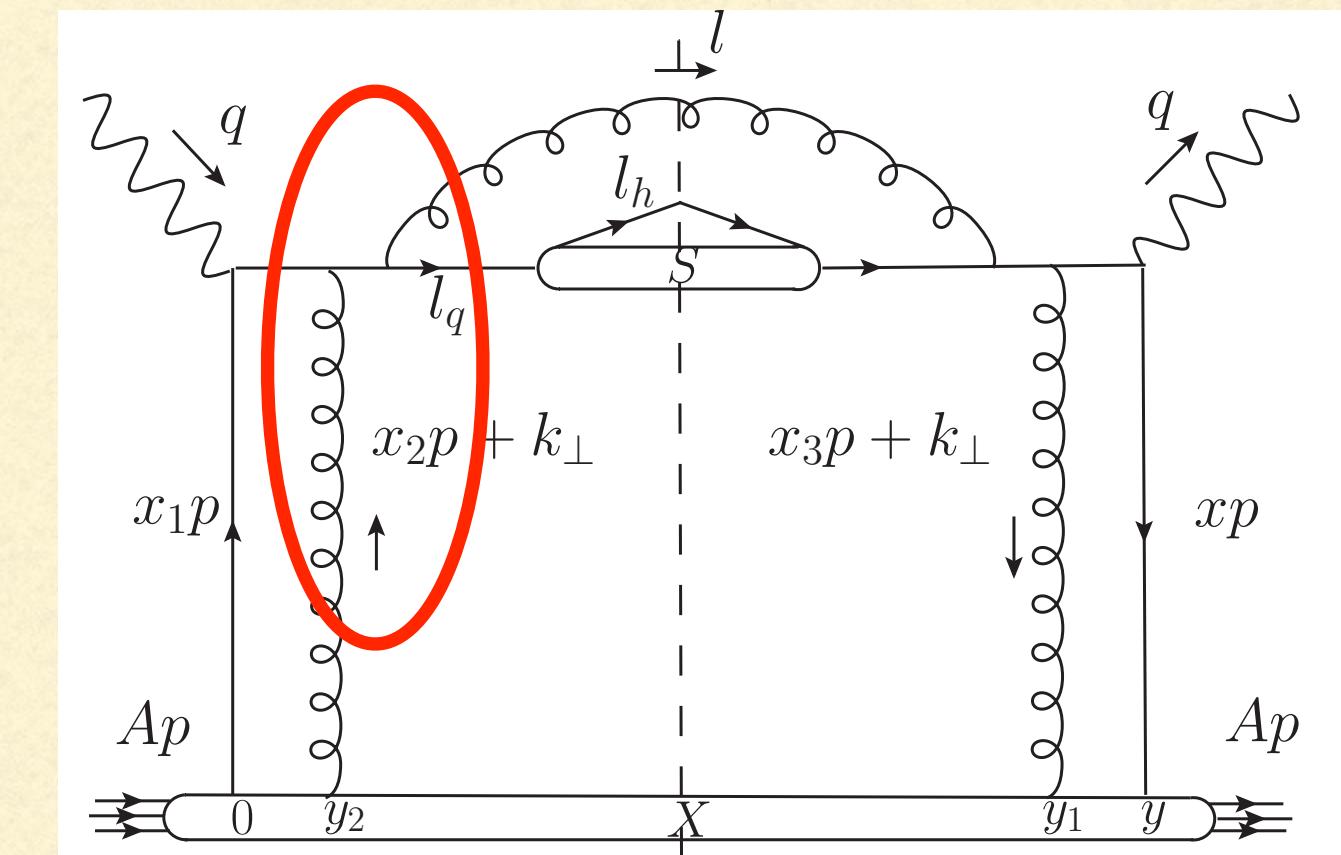


eA DIS

## High-Twist approach

- Collinear approximation  $\vec{k}_\perp \ll \vec{l}_\perp$

twist expansion for hard scattering part of  $W^{\mu\nu}$



medium induced radiation

## Improved approach

- Go beyond collinear approximation

# Generalized Jet transport coefficient $\hat{q}(\vec{k}_\perp)$

Generic factorized  $W^{\mu\nu}$

$$W^{\mu\nu} = \mathcal{F}(N_c, \vec{l}_\perp, \vec{k}_\perp) * P_{qg}(z) \otimes H_{(0)}^{\mu\nu}(x)$$

$$\otimes \frac{D_{q \rightarrow h}}{z} (z_h/z) \otimes T_{qg}^A(x, x_1, x_2)$$

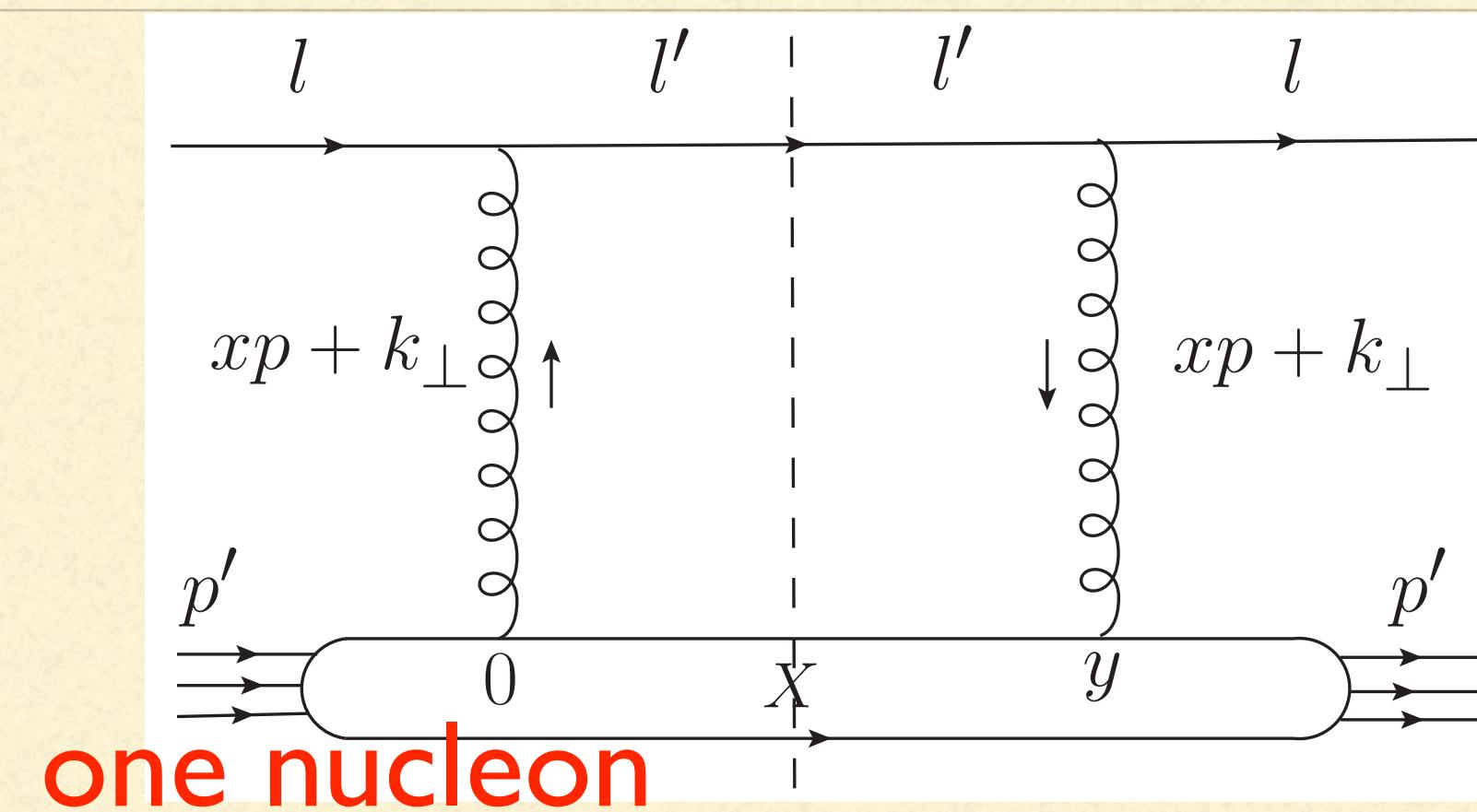
$$T_{qg}^A(x, x_1, x_2) \approx C * \rho(y_1^-, y_\perp) \otimes f_q^A(x) \otimes \frac{\phi(x_2, \vec{k}_\perp)}{k_\perp^2}$$

approximately factorize

$\hat{q}(\vec{k}_\perp) \leftrightarrow \phi(x, \vec{k}_\perp)$  non-perturbative quantity (what we want to probe!)

special case  $\phi(0, \vec{k}_\perp)$  calculated by static potential model

$$\frac{\phi(0, \vec{k}_\perp)}{k_\perp^2} = C_2(T) \frac{4\alpha_s}{(k_\perp^2 + \mu_D^2)^2}$$



$$\hat{q} = \rho \int dk_\perp^2 \frac{\langle d\sigma \rangle}{dk_\perp^2} k_\perp^2$$

$$\hat{q} \equiv \int \frac{d^2 k_\perp}{(2\pi)^2} \hat{q}(\vec{k}_\perp)$$

$$= \int \frac{d^2 k_\perp}{(2\pi)^2} \int dx \delta(x - \frac{k_\perp^2}{2p^+ l^-}) \frac{4\pi\alpha_s C_2(R)}{N_c^2 - 1} \rho(y) \phi(x, \vec{k}_\perp)$$

# Gluon spectrum under approximations

$W^{\mu\nu} \rightarrow \frac{dN_g}{dl_{\perp}^2 dz}$  : radiated gluon spectrum { static scattering center (no energy transfer)  
soft radiative gluon ( $z \rightarrow 0$ )

$$\frac{dN_g^{static+soft}}{dl_{\perp}^2 dz} = 8\pi\alpha_s^3 \frac{C_2(T)C_A}{N_c} P_{qg}(z) \int \frac{d^2 k_{\perp}}{(2\pi)^2} \int dy_1^- \rho_A(y_1^-, \vec{y}_{\perp}) \\ \times \frac{\vec{k}_{\perp} \cdot \vec{l}_{\perp}}{l_{\perp}^2 (\vec{l}_{\perp} - \vec{k}_{\perp})^2} \left(1 - \cos[(x_L + \frac{x_D}{1-z}) p^+ y_1^-]\right) \frac{1}{(k_{\perp}^2 + \mu_D^2)^2}$$

agree with GLV result (same approximation)

## Plot scaled gluon spectrum

$$\mathcal{N}_g^{static+soft} = \int \frac{d\varphi}{2\pi} \frac{2\vec{k}_{\perp} \cdot \vec{l}_{\perp}}{(\vec{l}_{\perp} - \vec{k}_{\perp})^2} \left(1 - \cos[(x_L + \frac{x_D}{1-z}) p^+ y_1^-]\right)$$

with  $\mathcal{N}_g^{static}$  at  $z=0.1, 0.2, 0.3$

