Collinear matching relations for quark and gluon TMDs

Alessio Carmelo Alvaro
University of Pavia
Supervisors: B. Pasquini, S. Rodini
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TMDs and Matching Relations

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Description of processes at low transverse momentum

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No first principles derivation

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Constraints on TMD functional form

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Constraints on TMD functional form

$$f_j(x,b) \propto \sum_i \mathcal{C}(x,b) \otimes f_{j/i}(x)$$

Features of the technique

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It correctly reproduces known results

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Mass corrections to the TMDs $\sim x^2 M^2 b^2$

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Independent from spin, twist and quark/gluon

Two examples for NLP quark TMDs

$$f_{\oplus,T} = T(x_{1,2,3}) + \sum_{n=1}^{\infty} \frac{1}{(n-1)!(n+1)!} \left(\frac{x_3^2 M^2 b^2}{4}\right)^n \mathcal{C}\left[(\bar{u} + u(k+u)) \left(\frac{\bar{u}}{u}\right)^{n-1} T(y_{1,2,3})\right]$$

$$f^{\perp}_{\oplus,L} = x_3 \int [dy] \int_0^1 du u^2 \delta(x_1 - u y_1) \delta(x_2 - u y_2) T(y_{1,2,3})$$

The actual project: gluon TMDs

Distribution	Tw2	Tw3	Accuracy
f_1^g	f_g	-	$\mathrm{N^3LO}$
$h_1^{\perp g}$	f_g	-	$\mathrm{N^2LO}$
g_{1L}^g	Δf_g		NLO
g_{1T}^g			
$f_{1T}^{\perp g}$	-		
h_{1T}^g	-		
$h_{1L}^{\perp g}$			
$h_{1T}^{\perp g}$			

Table 2.4 of R. Boussarie et al., *TMD Handbook*, 2304.03302

References

Description of the technique and application to quark twist-2 TMDs:
V. Moos, A. Vladimirov, *Calculation of transverse momentum dependent distributions beyond the leading power,*
2008.01744 [hep-ph]

Extension to quark twist-3 TMDs:
S. Rodini, A. C. Alvaro and B. Pasquini, *Collinear matching for next-to-leading power transverse-momentum distributions,*
2306.15052 [hep-ph]