



UNIVERSITÀ DEGLI STUDI DI MILANO
FACOLTÀ DI SCIENZE E TECNOLOGIE

Bachelor Degree in Physics

**Infrared-Safe NLO Calculations with Massive Quarks: An Extension of
the NSC Subtraction Formalism**

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Abstract

Draft abstract about NLO QCD.

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Introduction

§1.1 Draft

Factorization of hadronic cross-section:

$$\sigma_{h_1, h_2}(P_1, P_2) = \sum_{a, b} \int_{[0, 1]^2} dx_1 dx_2 f_a^{(h_1)}(x_1, \mu_F^2) f_b^{(h_2)}(x_2, \mu_F^2) \hat{\sigma}_{a, b}(x_1 P_1, x_2 P_2, \alpha_s(\mu^2), \mu^2, \mu_F^2)$$

where μ is the renormalization scale and μ_F is the factorization scale.

$$\hat{\sigma}_{a, b}(p_1, p_2) = \sum_{n \in \mathbb{N}_0} \hat{\sigma}_{a, b}^{(n)}(p_1, p_2) \quad (1.1)$$

with $p_i \equiv x_i P_i$, $i = 1, 2$.

$$\hat{\sigma}_{a, b}^{(0)}(p_1, p_2) := \frac{\mathcal{N}_{a, b}}{2\hat{s}} \int d\Phi_n \langle \mathcal{M}_n^{(0)} | \mathcal{M}_n^{(0)} \rangle \mathcal{F}_n \quad (1.2)$$

where \mathcal{F}_n is an n -particle, IR-finite measurement function defining the observable.

$$\hat{\sigma}_{a, b}^{(1)}(p_1, p_2) = \hat{\sigma}_{a, b}^R(p_1, p_2) + \hat{\sigma}_{a, b}^V(p_1, p_2) + \hat{\sigma}_{a, b}^C(p_1, p_2) \quad (1.3)$$

where:

$$\hat{\sigma}_{a, b}^R(p_1, p_2) := \frac{\mathcal{N}_{a, b}}{2\hat{s}} \int d\Phi_{n+1} \langle \mathcal{M}_{n+1}^{(0)} | \mathcal{M}_{n+1}^{(0)} \rangle \mathcal{F}_{n+1} \quad (1.4)$$

$$\hat{\sigma}_{a, b}^V(p_1, p_2) := \frac{\mathcal{N}_{a, b}}{2\hat{s}} \int d\Phi_n 2\Re \langle \mathcal{M}_n^{(0)} | \mathcal{M}_n^{(1)} \rangle \mathcal{F}_n \quad (1.5)$$

$$\hat{\sigma}_{a, b}^C(p_1, p_2) := \frac{\alpha_s(\mu^2)}{2\pi} \frac{1}{\epsilon} \left(\frac{\mu^2}{\mu_F^2} \right)^\epsilon \sum_c \int_0^1 dz \left[\hat{P}_{c, a}^{(0)} \hat{\sigma}_{c, b}^{(0)}(zp_1, p_2) + \hat{P}_{c, b}^{(0)} \hat{\sigma}_{a, c}^{(0)}(p_1, zp_2) \right] \quad (1.6)$$

Appendices

Appendix A

Draft appendix

§A.1 Draft

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Bibliography

- [1] W. Pauli. “The Connection Between Spin and Statistics”. *Phys. Rev.* **58** (1940), pp. 716–722. DOI: [10.1103/PhysRev.58.716](https://doi.org/10.1103/PhysRev.58.716).