

FINITE-QUARK-MASS EFFECTS ON THE HIGGS PRODUCTION CROSS SECTION IN THE GLUON-GLUON FUSION CHANNEL

Dissertation

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Informatik und Naturwissenschaften

Fachbereich Physik der Rheinisch-Westfälischen Technischen Hochschule

vorgelegt von

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Gluon-Gluon Fusion Channel*
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ABSTRACT

This is my Abstract

ZUSAMMENFASSUNG

Dies ist meine Zusammenfassung

ACKNOWLEDGMENTS

Here is where I thank god.

PUBLICATIONS

During my PhD studies, I co-authored the following publications:

- [1] Michał Czakon, Felix Eschment, and Tom Schellenberger. “Revisiting the double-soft asymptotics of one-loop amplitudes in massless QCD.” In: *JHEP* 04 (2023), p. 065. DOI: [10.1007/JHEP04\(2023\)065](https://doi.org/10.1007/JHEP04(2023)065). arXiv: [2211.06465](https://arxiv.org/abs/2211.06465) [hep-ph]
- [2] Michał Czakon, Felix Eschment, and Tom Schellenberger. “Subleading effects in soft-gluon emission at one-loop in massless QCD.” In: *JHEP* 12 (2023), p. 126. DOI: [10.1007/JHEP12\(2023\)126](https://doi.org/10.1007/JHEP12(2023)126). arXiv: [2307.02286](https://arxiv.org/abs/2307.02286) [hep-ph]
- [3] Michał Czakon et al. “Top-Bottom Interference Contribution to Fully Inclusive Higgs Production.” In: *Phys. Rev. Lett.* 132.21 (2024), p. 211902. DOI: [10.1103/PhysRevLett.132.211902](https://doi.org/10.1103/PhysRevLett.132.211902). arXiv: [2312.09896](https://arxiv.org/abs/2312.09896) [hep-ph]
- [4] Michał Czakon et al. “Quark mass effects in Higgs production.” In: *JHEP* 10 (2024), p. 210. DOI: [10.1007/JHEP10\(2024\)210](https://doi.org/10.1007/JHEP10(2024)210). arXiv: [2407.12413](https://arxiv.org/abs/2407.12413) [hep-ph]

Among these, only the last two are directly relevant to this dissertation.

CONTENTS

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NOTATION AND CONVENTIONS

Here I outline my notations and conventions.

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A citation [1]. And another citation [3]

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BIBLIOGRAPHY

- [1] Michał Czakon, Felix Schment, and Tom Schellenberger. “Revisiting the double-soft asymptotics of one-loop amplitudes in massless QCD.” In: *JHEP* 04 (2023), p. 065. DOI: [10.1007/JHEP04\(2023\)065](https://doi.org/10.1007/JHEP04(2023)065). arXiv: [2211.06465](https://arxiv.org/abs/2211.06465) [hep-ph].
- [2] Michał Czakon, Felix Schment, and Tom Schellenberger. “Subleading effects in soft-gluon emission at one-loop in massless QCD.” In: *JHEP* 12 (2023), p. 126. DOI: [10.1007/JHEP12\(2023\)126](https://doi.org/10.1007/JHEP12(2023)126). arXiv: [2307.02286](https://arxiv.org/abs/2307.02286) [hep-ph].
- [3] Michał Czakon et al. “Top-Bottom Interference Contribution to Fully Inclusive Higgs Production.” In: *Phys. Rev. Lett.* 132.21 (2024), p. 211902. DOI: [10.1103/PhysRevLett.132.211902](https://doi.org/10.1103/PhysRevLett.132.211902). arXiv: [2312.09896](https://arxiv.org/abs/2312.09896) [hep-ph].
- [4] Michał Czakon et al. “Quark mass effects in Higgs production.” In: *JHEP* 10 (2024), p. 210. DOI: [10.1007/JHEP10\(2024\)210](https://doi.org/10.1007/JHEP10(2024)210). arXiv: [2407.12413](https://arxiv.org/abs/2407.12413) [hep-ph].