

# Andrea Ghira

## Third Year PhD Report

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### Research Activity (under supervision of S.Marzani and G.Ridolfi)

My research focuses on high-energy physics and LHC phenomenology, with a particular emphasis on elucidating the role of quark masses within the Standard Model. I have initiated two key projects aimed at investigating how quark masses affect hadronic jet substructures. The objective of this research is to extend the current understanding of high energy physics by incorporating quark mass effects and systematically analyzing the differences between the massive and massless cases. Our studies have examined the impact of these mass effects on differential distributions that are presently being measured at the LHC.

In addition to this, I have undertaken a new collaborative project exploring mass effects in the context of soft gluon resummation. Building on our previous work, where we developed a novel formalism to consistently bridge two different calculation frameworks, we have refined the theoretical predictions for charm quark fragmentation processes. This advancement has allowed for a more accurate description of experimental data, contributing to a deeper understanding of the role of charm quark mass in hadronic physics.

### Courses and Exams

I passed the following exams:

- Theoretical physics (G. Ridolfi, 3CFU),
- Ads/Cft (A. Amoretti, 3 CFU).

### School and Conferences

I attended the following conferences:

- Speaker at *Boost 2024*, "Mass effects on jet angularities at hadron colliders", Genova, Italy
- Speaker at *Parton shower and resummation 2024*, "Heavy flavour jet substructure", Graz, Austria
- Speaker at *Flavoured jets at the LHC*, "Heavy flavour jet substructure", IPPP, Durham, UK
- Speaker at *Milan Christmas Meeting 2023*, "A consistent resummation of mass and soft logarithms in processes with heavy quarks", Università Milano Statale, Milan, Italy
- Speaker at *Heavy flavours at high pt*, "On heavy-flavour jets with Soft Drop", Higgs Centre, Edinburgh, UK.

and I gave the following seminars:

- Seminar at LPTHE, "A systematic approach to resummation with heavy flavours", Paris, France
- Seminar at IPHT Saclay, "A systematic approach to resummation with heavy flavours", Paris, France

Finally, I attended the following PhD school:

- *Theory challenges in the precision era of LHC 2023* (3 weeks), GGI, Florence, Italy

## Publications

- *On heavy-flavour jets with Soft Drop*, Eur. Phys. J. C 84, 212 (2024). <https://doi.org/10.1140/epjc/s10052-024-12562-7>, Authors: S. Caletti, A. Ghira, S. Marzani
- *Les Houches 2023: Physics at TeV Colliders: Standard Model Working Group Report*, e-Print: 2406.00708
- *An improved description of charm fragmentation data*, published on Eur. Phys. J. C, Authors: M. Cacciari, A. Ghira, S. Marzani, G. Ridolfi
- *Heavy-flavour-jet substructure*, in preparation, Authors: Prasanna Dhani, Oleh Fedkevych, Andrea Ghira, Simone Marzani, Gregory Soyez

## Grants and Awards

- TUM Global Postdoc Fellowship (2 years)
- Dissemination Conference Grant supported by COMETA (CA22130) Cost Action for the conference *Parton shower and resummation 2024*