Annual report (XXXV cycle)

Name and surname: Simone Caletti
Supervisor: Prof. Simone Marzani
Ph.D. cycle: XXXV
Year: third

Research activity

My research activity is focused on theoretical aspects of Quantum Field Theories and High Energy Physics (HEP) calculations oriented to LHC phenomenology. In particular I am interested in hadronic jet physics and their substructure.

During the first part of the third year I continued to work to jet angularities extending what we did in my first paper also to dijet production at the LHC and applying jet angularities to the problem of quark/gluon jet discrimination, so jet flavor tagging.

In the second part I deepened the topic of jet flavor working on different jet flavor definitions which satisfy IRC safety, hence well-defined from a theoretical viewpoint. This topic would be particularly relevant in the field of heavy quark and there is a lot of interest also from the experimental community.

In the last part of the year I started to work on Quantum Computing and related application to HEP collaborating with people in Genoa and outside.

Courses and exams

I passed the following exams:

- Ads/CFT (A. Amoretti)
- Black Holes thermodynamics (S. Giusto)

finishing all the exams I had to achieve during my PhD course.

Publications

- Tagging the initial state gluon, S. Caletti, O. Fedkevych, S. Marzani, D. Reichelt, 2108.10024 [hep-ph], Eur.Phys.J.C 81 (2021) 9, 844.

- Tagging the initial state gluon in the Z+jet process, S. Caletti, 2110.09337 [hep-ph], PoS LHCP2021 (2021) 185.

- Phenomenology of jet angularities at the LHC, S. Caletti, O. Fedkevych, S. Marzani, G. Soyez, S. Shumann, D. Reichelt,
  2112.09545 [hep-ph], *JHEP* 03 (2022) 131.

- Practical jet flavour through NNLO, S. Caletti, A. J. Larkoski, S. Marzani, D. Reichelt,
   2205.01109 [hep-ph], Eur.Phys.J.C 82 (2022) 7, 632, Eur.Phys.J.C 82 (2022) 632.

- A Fragmentation Approach to Jet Flavor, S. Caletti, A. J. Larkoski, S. Marzani, D. Reichelt,
  2205.01117 [hep-ph].

Posters and seminars

- Presenter for the "Jet Angularities at the LHC" seminar at Milan Christmas Meeting 2021, in person workshop, December 2021.

- Presenter for the "Flavour Tagging with Jet Substructure" seminar at the Young Scientist Forum at SM@LHC2022 CERN, in person conference, April 2022.

- Presenter for the "Flavour Tagging with Jet Substructure" poster at DIS 2022, in person conference, May 2022.

- Presenter for the "Recent Developments on Jet Flavour" seminar upon inviation from the ATLAS PDF Forum, Online seminar, May 2022

Conferences and schools

I joined the following schools/conference during this year:

- Milan Christmas Meeting (at Università degli Studi di Milano),
      in person workshop, Dec. 2021.

- Standard Model at the LHC (CERN),
      in person conference, Apr. 2022.

- DIS 2022 in Santiago de Compostela,
      in person conference, May 2022.

- Machine Learning Crash Course 2022 (MaLGa),
      in person school, June/July 2022.

- SQMS/GGI School on Quantum Simulation of Field Theories,
      in person school, July 2021

Extra activities

During November 2021 and March 2022 I visited the Institute of Particle Physics Phenomenology (IPPP) in Durham (UK) to collaborate with Dr. D. Reichelt and Prof. M. Spannowsky.

I also followed the project of Morgan Cassidy as an INFN visiting student during the period of July/August 2022.