

## Annual report (XXXV cycle)

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

### Research activity

My research activity is focused on theoretical aspects of Quantum Field Theories and High Energy Physics calculations interesting for LHC phenomenology.

I spent the first two months of my first year developing the necessary tools to start my research activity under the supervision of S. Marzani. After the GGI School which lasted throughout, more or less, the month of January I actively started working at the 'Jet Angularities in Z+jet at the LHC' project. Jet angularities are a class of observables of interest for LHC phenomenology, in fact we worked in touch with part of the CMS collaborations in order to provide them the best theory predictions to compare with their analysis. My role was to provide analytic calculations for jet angularities and to compare my results with numerical results provided by other members of the collaboration. Such activity has continued for all the summer up to now in conjunction with courses and others academic activity.

### Courses and exams

I attended the following courses:

- Gauge Theories (N. Maggiore, S. Marzani)
- Foundation of Quantum Mechanics with Applications (N. Zanghì, P. Solinas)
- Renormalization in QFT (G. Ridolfi)
- Classic and Quantum Phase Transition (N. Magnoli)
- Effective Field Theory (I. Steward, online EdX course)

I gave the exams in form of seminars for the following courses:

- Gauge Theories  
Seminar: Anomalies in QFT and the BRS symmetry
- Foundation of Quantum Mechanics with Applications  
Seminar: Number Theory, RSA cryptosystem and the Shor's algorithm
- Renormalization in QFT  
Seminar: Renormalons in QFT

## Publications

- Jet Angularities in Z+jet at the LHC (provisory name), in course of publication  
Authors: S. Marzani, S. Caletti, G. Soyez, O. Fedkevych, S. Shumann, D. Reichelt, V. Theeuwes

## Conference and schools

I joined the followign schools/conference during my first year:

- Special Lectures Series in LHC Phenomenology  
Università degli Studi di Torino (Turin), 30 September – 4 October 2019
- Tif-Lab Meeting  
Università degli Studi di Milano (Milan), 19-20 december 2019
- GGI 2020 School (Lectures on the Theory of Fundamental Interactions)  
Galileo Galilei Institute for Theoretical Physics (Florence), 7-24 January 2020
- Reconnect 2020 (online conference)  
IPPP Durham, 25-29 May 2020
- Strings 2020 (online conference)  
29 June – 3 July 2020
- BOOST 2020 (online conference)  
20-24 August 2020

## Comments and notes

In addition to my research activity, this year I have studied several aspect of QFT that I have not had a chance to cover during my previous studies: during courses/conferences and school but also by myself.

I want to underline that the Covid-19 emergency situation obviously made collaborating more complicated and reduced by much the possibilities of exchange with my colleagues.