

SIMONE CALETTI

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OBJECTIVE

I am a postdoctoral researcher in particle physics phenomenology currently at *Università degli Studi di Torino* and my goal is to fill the gap between theory and experiment in high energy physics. In particular, my goal is to improve the accuracy of theory predictions, both in fixed-order and resummed calculations, and to develop new algorithms for hadronic jets. I am also interested in Quantum Computing (QC) and I want to apply QC techniques to high-energy physics.

EXPERIENCE

Università degli Studi di Torino, Dipartimento di Fisica Oct. 2025 - currently
Postdoctoral researcher

Reference: Prof. Silvia Ferrario Ravasio (silvia.ferrarioravasio@unito.it)

ETH Zurich Sept. 2023 - Sept. 2025
Postdoctoral researcher

Reference: Prof. Aude Germann-De Ridder (gaude@ethz.ch)

EDUCATION

University of Amsterdam, Nikhef Feb. 2023 - July 2023
Visiting PhD Student for the Delta ITP programme

- Conducted research activity under the supervision of Prof. Wouter Waalewijn (W.J.Waalewijn@uva.nl)

Università degli Studi di Genova, Dipartimento di Fisica Nov. 2019 - Jan. 2023
PhD in Theoretical High Energy Physics

- Conducted research activity under the supervision of Prof. Simone Marzani (simone.marzani@ge.infn.it)
- PhD Thesis: *Hadronic Jets: Flavour and Substructure* (defended on April 12, 2023)

Università degli Studi di Genova, Dipartimento di Fisica Oct. 2017 - Sept. 2019
Master's Degree in Theoretical Physics (cum laude)

- Master Thesis: *The Energy of a Hadronic Jet after Soft Drop*
- Advisors: Prof. Simone Marzani, Prof. Giovanni Ridolfi

Università degli Studi di Genova, Dipartimento di Fisica Oct. 2014 - Sept. 2017
Bachelor's Degree in Physics (cum laude)

- Thesis: *Coherent States in Quantum Mechanics*
- Advisor: Prof. Lorenzo Mattera

RESEARCH ACTIVITY

During my PhD I worked mainly on High Energy Physics (HEP) phenomenology at colliders, in particular on Quantum Chromodynamics (QCD) and hadronic jets. Jets are ubiquitous at colliders and I dedicated my PhD to study their substructure and how to define the flavour of a jet. Furthermore, I have profound knowledge on analytical and numerical resummation techniques that are required to reach the current target accuracy for the computation of observables at colliders. Beyond that I dedicated part of my PhD studying Quantum Computing (QC) and I developed, together with Prof. P. Solinas, an algorithm to efficiently evaluate derivatives on Quantum Computers. Although particle physics remains my main interest, I think it is imperative to take quantum advantage in HEP application, from field theory simulations to optimization problems, to exploit the possibility given by QC. Currently, as a postdoc researcher at ETH Zurich I am active part of the NNLOJET collaboration where I developed an expertise on fixed-order calculations in QCD. My contribution is to include in the NNLOJET framework processes with identified hadrons in the final state and processes for future lepton colliders.

PUBLICATIONS

a) Published papers

- (a.9) *QCD predictions for vector boson plus hadron production at the LHC*
authors: S. Caletti, A. Gehrmann-De Ridder, A. Huss, A. Rodriguez and G. Stagnitto
published on: J. High Energ. Phys 10 (2024) 027,
preprint: 2405.17540 [hep-ph] 27 May 2024
- (a.8) *A Novel Approach to Reduce Derivative Costs in Variational Quantum Algorithms*
authors: G. Minuto, D. Melegari, S. Caletti and P. Solinas,
published on: J.Phys.A 58 (2025) 18, 185301,
preprint: 2404.02245 [quant-ph] 2 April 2024
- (a.7) *On heavy-flavour jets with Soft Drop*
authors: S. Caletti, A. Ghira and S. Marzani,
published on Eur.Phys.J.C 84 (2024) 2, 212,
preprint: 2312.11623 [hep-ph] 18 Dec. 2023
- (a.6) *Quantum gradient evaluation through quantum non-demolition measurements*
authors: P. Solinas, S. Caletti and G. Minuto,
published on: Eur.Phys.J.D 77 (2023) 5,
preprint: 2301.07128 [quant-ph] 17 Jan. 2023
- (a.5) *A Fragmentation Approach to Jet Flavor*
authors: S. Caletti, A. J. Larkoski, S. Marzani and D. Reichelt,
published on: J. High Energ. Phys 10 (2022) 158,
preprint: 2205.01117 [hep-ph] 04 May 2022
- (a.4) *Practical Jet Flavour Through NNLO*
authors: S. Caletti, A. J. Larkoski, S. Marzani and D. Reichelt,
published on: Eur.Phys.J.C 82 (2022) 632,
preprint: 2205.01109 [hep-ph] 04 May 2022
- (a.3) *Phenomenology of jet angularities at the LHC*
authors: D. Reichelt, S. Caletti, O. Fedkevych, S. Marzani,
S. Schumann and G. Soyez,
published on: J. High Energ. Phys. 03 (2022) 131,
preprint: 2112.09545 [hep-ph] 17 Dec. 2021

- (a.2) *Tagging the initial-state gluon*
 authors: S. Caletti, O. Fedkevych, S. Mamation 2025 workshop (at CERN)rzani and D. Reichelt
 published on: Eur. Phys. J. C, 819 (2021) 844,
 preprint: 2108.10024 [hep-ph] 25 Sept. 2021
- (a.1) *Jet Angularities in Z+jet production at the LHC*
 authors: S. Caletti, O. Fedkevych, S. Marzani, D. Reichelt,
 S. Schumann, G. Soyez and V. Theeuwes,
 published on: J. High Energ. Phys. 07 (2021) 076,
 preprint: 2104.06920 [hep-ph] 13 July 2021
- b) Preprint and ongoing papers**
- (b.3) *NNLO QCD predictions for jet observables in ZH production at electron-positron colliders*
 authors: S. Caletti, A. Gehrmann-De Ridder, M. Marcoli,
 preprint: 2510.20485 [hep-ph]
 status: *in publications on JHEP* 23 Oct. 2025
- (b.2) *Flavoured Jet Algorithms: a comparative study*
 authors: Les Houches 2023 jet flavour working group
 preprint: 2506.13449 [hep-ph],
 status: *under submission to journal* 16 June 2025
- (b.1) *NNLOJET: a parton-level event generator for jet cross sections at NNLO QCD accuracy*
 authors: A. Huss et al.,
 preprint: 2503.22804 [hep-ph],
 status: *under submission to journal* 28 Mar. 2025
- c) Proceedings**
- (c.2) *Les Houches 2023: Physics at TeV Colliders: Standard Model Working Group Report*
 Contribution to: PhysTeV 2023,
 preprint: 2406.00708 [hep-ph] 2 June 2024
- (c.1) *Tagging the initial state gluon in the Z+jet process*
 author: S. Caletti,
 published on: PoS,
 preprint: 2110.09337 [hep-ph] 18 Oct. 2021

ACADEMIC EXPERIENCE

Fundings

- **Comprehensive Multiboson Experiment-Theory Action (COMETA)** Sept. 2023 - currently
 I am an active member of the COMETA working group funded by the COST funding organization (CA22130).

Attended Schools/Conferences

- Milan Christmas Meeting (at Università degli Studi di Milano) 22-23 Dec. 2025
- Parton Shower and Resummation 2025 workshop (at CERN) 14-18 July 2025
- Les Houches PhysTeV 2025 16-25 June 2025
- Fragmentation in the collider precision era 17-19 March 2025
- ZPW2025 workshop 6-8 Jan 2025
- COMETA Workshop on artificial intelligence for multi-boson physics 1-2 Oct. 2024
- BOOST 2024 conference 29 July - 2 Aug. 2024

- Collider Cross Talk at CERN 11 July 2024
- LHCP2024 conference 3-7 June 2024
- COMETA WG3 meeting at CERN 22 April 2024
- ZPW2024 workshop 11-13 Jan. 2024
- First Lund Jet Plane Institute (attended online) 3-7 July 2023
- Les Houches PhysTev 2023 12-21 June 2023
- Milan Christmas Meeting (at Università degli Studi di Milano) 21-23 Dec. 2022
- QCD@LHC2022 at Orsay 28 Nov. - 2 Dec. 2022
- QT4HEP2022 workshop at CERN 01-04 Nov. 2022
- “A Life in Phenomenology” conference in Milano Bicocca 15-16 Sept. 2022
- SQMS/GGI School on Quantum Simulation of Field Theories 25-29 July 2022
- Machine Learning Crash Course 2022 (MLCC@MaLGa) 27 June - 01 July 2022
- DIS 2022 workshop 2-6 May 2022
- Standard Model at the LHC 2022 11-14 Apr. 2022
- Milan Christmas Meeting (at Università degli Studi di Milano) 21-23 Dec. 2021
- MCnet-CTEQ Summer School 2021 Virtual 6-16 Sept. 2021
- BOOST 2021 (online conference) 2-5 Aug. 2021
- MITP Summer School 2021: The Amplitude Games 12-30 July 2021
- LHCP 2021 (online conference) 7-12 June 2021
- Jets and their Substructure from LHC Data (CERN workshop) 31 May - 3 June 2021
- Machine Learning for High Energy Physics (Milano Bicocca course) 3-7 May 2021
- Standard Model at the LHC 2021 (online conference) 16-30 Apr. 2021
- Wolfram Physics Winter School 2021 4-15 Jan. 2021
- LHC-EW Working Group: Jets and EW bosons (online conference) 19, 26 Oct. and 2 Nov. 2020
- BOOST 2020 (online conference) 20-24 July 2020
- Strings 2020 (online conference) 29 June - 3 July 2020
- RECONNECT 2020 (online conference) 25-29 May 2020
- GGI2020 School (Galileo Galilei Institute) 7-24 Jan. 2020
- Milan Christmas Meeting (at Università degli Studi di Milano) 19-20 Dec. 2019
- Special Lecture Series in LHC Phenomenology
(at Università degli Studi di Torino) 30 Sept. - 4 Oct. 2019
- High Accuracy Resummation & Parton Shower (HARPS 2018) 29-31 Oct. 2018

Presentations & Posters

- Presented the talk *Theory aspects of jet and jet flavour definition* upon invitation to the **COMETA Workshop on artificial intelligence for multi-boson physics** in Amsterdam 1 Oct. 2024
- Presented the talk *Heavy-flavour jet substructure with Soft Drop* at **BOOST 2024** conference in Genoa 29 July - 2 Aug. 2024
- Co-presented the chalk-talk *Heavy-flavoured quark production in association with vector bosons at the LHC* upon invitation to the **Collider Cross Talk at CERN** 11 July 2024
- Presented the talk *Jets and Substructure* upon invitation to **LHCP2024** in Boston 3-7 June 2024
- Presented the talk *Theory overview of jet substructure techniques* at **CERN** for the COMETA WG3 meeting 22 April 2024

- Presented the talk *Quantum gradient evaluation through quantum non-demolition measurements* at **CERN QTI-TH Forum** (online) 29 June 2023
- Presented the talk *Hadronic Jets: flavour and substructure* at **Nikhef Theory Day** in Amsterdam 24 Feb. 2023
- Presented the talk *New Flavours of Jet Flavor* at **Milan Christmas Meeting 2022** 23 Dec. 2022
- Presented the talk *New Flavours of Jet Flavor* at **QCD@LHC2022** 30 Nov. 2022
- Presented the poster *Quantum Gradient with Quantum Non-Demolition Measurements* at **QT4HEP2022** 02 Nov. 2022
- Presented the online seminar *Recent Developments on Jet Flavour* upon invitation from the **ATLAS PDF Forum** 20 May 2022
- Presented the poster *Flavour Tagging with Jet Substructure* at **DIS 2022** 03 May 2022
- Presented the talk *Flavour Tagging with Jet Substructure* at **SM@LHC 2022** Young Scientist Forum 12 Apr. 2022
- Presented the talk *Jet Angularities at the LHC* at **Milan Christmas Meeting 2021** 22 Dec. 2021
- Presented *Tagging the initial state gluon in the Z+jet process* video-poster at **LHCP2021** online conference 7-12 June 2021
- Presented the online seminar *Jet Angularities in Z+jet production at the LHC* upon invitation from the **LHC-EW Working Group** 24 May 2021

Academic Courses

- *Renormalization in Quantum Field Theory* by G. Ridolfi
- *Foundations of Quantum Mechanics and Quantum Information* by N. Zanghì, P. Solinas
- *Gauge Theories and the BRS approach* by S. Marzani, N. Maggiore
- *Black Holes Thermodynamics* by S. Giusto
- *Introduction to the AdS/CFT correspondence* by A. Amoretti

I attended and passed all the courses above during my PhD at Università degli Studi di Genova as part of my PhD program.

Other activities

- Conducted paper review as a referee for the Journal of High Energy Physics (JHEP), Physics Review D (PRD) and Scipost journals.
- Visit at the University of Cambridge (UK) DAMTP for a collaboration with Prof. M. Ubiali 9-12 July 2023
- Visit at the IPPP in Durham (UK) for a collaboration with Dr. D. Reichelt and Prof. M. Spannowsky 21-25 Mar. 2022
- Visit at the IPPP in Durham (UK) for a collaboration with Dr. D. Reichelt and Prof. M. Spannowsky 14-28 Nov. 2021
- Attended the following courses on Coursera
 - *Crash Course on Python* Nov. 2020
 - *Introduction to Git and Github* Oct. 2020

LANGUAGE SKILL

Italian native
English C1*

*IELTS overall score 7.0/9.0, TRF 21IT013208CALSO10A

16 Jan. 2022

TEACHING

Proseminar Tutor

- *Proseminar on general relativity*
at ETH Zurich

Feb. 2025 - May 2025

I supervised three students during the preparation of their master level proseminar for the course *Introduction to General Relativity*.

Proseminar Tutor

- *Proseminar on theoretical high energy physics*
at ETH Zurich

Sept. 2024 - Dec. 2024

I supervised two students during the preparation of their master level proseminar for the course *Physics of Electroweak Symmetry Breaking*.

- Moritz Winkler, *Electroweak Symmetry Breaking in The Standard Model*
- Micheal Zeller, *The Production and Decay of the Higgs Boson*

Master thesis co-supervisor

- *Co-supervisor for the Master Thesis project of the student Maxime Jeanfavre* at ETH Zurich

Thesis: Hadronic Higgs decay observables in ZH production for lepton collider

June 2024 - Dec. 2024

Proseminar Tutor

- *Proseminar on theoretical high energy physics*
at ETH Zurich

April 2024 - May 2024

I supervised three students during the preparation of their master level proseminar on Quantum Gravity for the course *Open Questions in Particle Physics and Cosmology*.

- Manuel Berger, *What is the Problem with a Quantum Field Theory of Gravity?*
- Florian Aggias, *String Theory as Candidate of Quantum Gravity*
- Michael Franzke, *Alternatives to String Theory - Loop Quantum Gravity*

Lecturer

- *MATHEMATICA Crash Course for Graduate Students*
at Università degli Studi di Genova

Mar. 2022

Updated version of the Mathematica course I made in 2021.

Open-day tutor

- *Introduction to Special Relativity*
at Università degli Studi di Genova

Feb. 2022

Teaching Assistant

- *General Physics* for Engineering
at Università degli Studi di Genova Sept. 2019 - Jan. 2022

My role was to propose exercises to the students and to stimulate their problem solving skills. I prepared several exercise sheets with solutions. Rearranging the course to stimulate students virtually during the pandemic has been challenging but I learned how to manage a class remotely in an efficient way.

Lecturer

- *MATHEMATICA Crash Course for Graduate Students*
at Università degli Studi di Genova Mar. 2021

Short series of lectures for graduate students who wish to improve their knowledge about Wolfram Mathematica.

Academic Tutor

- *General Physics* for Engineering
at Università degli Studi di Genova Sept. 2018 - July 2019

AWARDS & RECOGNITIONS

Merit award for students enrolled in post-primary years a.a. 2018/2019
Università degli Studi di Genova

Merit award for students enrolled in post-primary years a.a. 2017/2018
Università degli Studi di Genova

I got the first-tier prize for my academic results during my Master degree for two consecutive years.

TECHNICAL STRENGTHS

Computer Languages		MC Tools		Quantum Computing
Python	● ● ● ● ●	Pythia	● ● ● ● ●	Qiskit ● ● ● ● ●
C++	● ● ● ● ●	Sherpa	● ● ● ● ●	QIBO ● ● ● ● ●
FORTTRAN	● ● ● ● ●	Herwig	● ● ● ● ●	
Bash	● ● ● ● ●	Rivet	● ● ● ● ●	
Julia	● ● ● ● ●	MadGraph	● ● ● ● ●	
MATHEMATICA	● ● ● ● ●	EVENT2	● ● ● ● ●	
FORM	● ● ● ● ●	EERAD3	● ● ● ● ●	
L ^A T _E X	● ● ● ● ●	NNLOJET	● ● ● ● ●	
		FLAME	● ● ● ● ●	

I have experience in the development of software for HEP applications. In particular, I am familiar with standard design concepts for Object-Oriented Programming and testing framework like *doctest*, for healthy software development. I used software profiling tools to optimize the FLAME C++ programm, like *perf*, *heaptrack* and I used them interpreting *flamegraphs* and *callgraphs*. I am obviously proficient using revision control tools like *mercurial* and *git*, and I create containers using *docker* for several personal projects, to avoid dependency problems when collaborating with other people.

COMMUNITY SERVICES

Trained volunteer

2018 - 2023

Italian Red Cross

I have been an active volunteer for the Italian Red Cross when I was in Italy. I was operating during the peak of the Covid-19 pandemic.