# Niccolò **Laurenti**


PH.D. GRADUATE IN PARTICLE PHYSICS · SOFTWARE DEVELOPER

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## Summary


Ph.D. graduate in theoretical particle physics specialised in applying artificial intelligence to investigate proton structure. I have experience working with different programming languages, in particular with `C++` and `Python`. I have hands-on experience with various machine learning tools like `Keras` and `Tensorflow`. Passionate about the field of computer science and eager to learn new things to further improve my skills.


## Personal Informations

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| **Birth** | 1997, Rome, Italy |
| **Citizenship** | Italian |
| **Languages** | Italian (native language), English (fluent) |

## Experience

### Software Developer

*Rome, Italy*

SOFTWARE DEVELOPER AT NEXT INGEGNERIA DEI SISTEMI S.P.A. *Oct. 2024 - Current*

- Worked for **Next Ingegneria dei Sistemi** as a consultant software developer for **MBDA** Italy, contributing to a complex defense-related project.
- Translated high-level system requirements into detailed low-level software specifications, developed software components written mainly in `C++`, `Java` and `Ada` and then designed and performed corresponding test procedures.
- Participated in system integration activities, interfacing and validating multiple software components across subsystems.
- Collaborated within a large, multi-company team, ensuring cross-organizational alignment and timely delivery of project milestones.

**Technologies**: C++, Java, Ada, Qt Creator, Apache NetBeans, Gnat Studio, Bash, XML, IBM RTC, IMB Doors, Wireshark, Linux, Windows, Microsoft Office

### Ph.D. Researcher

*Milan, Italy*

RESEARCHER IN THEORETICAL PARTICLE PHYSICS AT THE UNIVERSITY OF MILAN AND INFN *Oct. 2021 - Sept. 2024*

- Worked under the supervision of Prof. Stefano Forte in the **NNPDF** collaboration as a developer of the `NNPDF` code.
- Developed techniques and computational programs that utilize artificial intelligence to investigate the internal structure of the proton analysing experimental data collected at **CERN**.
- Developed programs for solving the so-called DGLAP equations, a linear system of integro-differential equations, with numerical techniques.
- Published research results in various papers and presented them in conferences.

**Technologies**: Python, Numpy, Scipy, Matplotlib, Keras, Tensorflow, Numba, Fortran, Bash, Git, Github, Slurm, PBS, Wolfram Mathematica, Linux, MacOS, VS Code, Vim, Latex, SQLite

### Undergraduate Researcher

*Rome, Italy*

RESEARCHER IN THEORETICAL PARTICLE PHYSICS AT THE UNIVERSITY OF ROME "LA SAPIENZA" *Mar. 2021 - Oct. 2021*

- Worked under the supervision of Dr. Marco Bonvini to develop theoretical methods and computational programs for producing high-precision theoretical predictions in particle physics.
- Focused on describing experimental data of electron-proton collisions, collected at the particle accelerators **HERA** and **SLAC**.
- Wrote from zero the `C++` library `Adani`, with the `Python` bindings available in the PyPI and in conda-forge, resulting in a published paper and presentations at conferences.

**Technologies**: C++, GSL, Wolfram Mathematica, Linux, Bash, CMake, Emacs, Latex

## Skills

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| **Programming** | C, C++, Python, Java, Ada, Fortran, Bash, XML, CMake |
| **Operating systems** | Linux, MacOS, Windows |
| **Code editors** | VS Code, Qt Creator, Apache NetBeans, Gnat Studio, Emacs, Vim, Nano |
| **Version control sysytems** | Git, Github, Gitlab, Bitbucket, IBM RTC |
| **C++ libraries** | STL, GSL, Pybind11, Boost |
| **Python packages** | Numpy, Scipy, Matplotlib, Multiprocessing, Numba, Pandas, Keras, Tensorflow, SQLite |
| **Jobs schedulers** | Slurm, PBS |
| **Scientific programs** | Matlab, Wolfram Mathematica |
| **Writing** | Latex, Markdown, Microsoft Office |

# Education

### Ph.D. in Physics

*Milan, Italy*

University of Milan — *Oct. 2021 - Nov. 2024*

- Field of study: Theoretical Particle Physics, Computational Physics.
- Thesis: *Advancements in PDFs determination: Incorporation of QED effects and new theoretical improvements in a modern deep learning fitting framework*. **link**

### M.S. in Physics

*Rome, Italy*

University of Rome "La Sapienza" — *Sep. 2019 - Oct. 2021*

- Field of study: Theoretical Particle Physics.
- Grade: 110/110 (cum laude).
- Thesis: *Construction of a next-to-next-to-next-to-leading order approximation for heavy flavour production in deep inelastic scattering with quark masses*. **Inspire**

### B.S. in Physics

*Rome, Italy*

University of Rome "La Sapienza" — *Sep. 2016 - Nov. 2019*

- Grade: 110/110 (cum laude).
- Thesis: *Particle identification with the time of flight method and applications to the CMS experiment.*

# Publications

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| 2024 | **LO, NLO, and NNLO Parton Distributions for LHC Event Generators**, J. Cruz-Martinez, S. Forte, N. Laurenti, T. R. Rabemananjara, J. Rojo, *JHEP* | **Inspire** |
| 2024 | **NNPDF4.0 aN$^3$LO PDFs with QED corrections**, A. Barontini, N. Laurenti, J. Rojo, *Contribution to DIS2024* | **Inspire** |
| 2024 | **The Path to N$^3$LO Parton Distributions**, The NNPDF Collaboration, R. D. Ball et al., *Eur. Phys. J. C* | **Inspire** |
| 2024 | **Determination of the theory uncertainties from missing higher orders on NNLO parton distributions with percent accuracy**, The NNPDF Collaboration, R. D. Ball et al., *Eur. Phys. J. C* | **Inspire** |
| 2024 | **Photons in the proton: implications for the LHC**, The NNPDF Collaboration, R. D. Ball et al., *Eur. Phys. J. C* | **Inspire** |
| 2023 | **Inclusion of QED corrections in PDFs fits**, N. Laurenti, *Nucl. Part. Phys. Proc.* | **Inspire** |
| 2022 | **Approximating missing higher-orders in transverse momentum distributions using resummations**, N. Laurenti, T. R. Rabemananjara, and R. Stegeman, *Contribution to DIS2022* | **Inspire** |

# Talks

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|---|---|---|
| 2024 | **The inclusion of QED corrections in the NNPDF4.0 fitting framework**, Prague, Czech Republic | *ICHEP2024* |
| 2024 | **The inclusion of QED corrections in the NNPDF4.0 fitting framework**, National Laboratory of Frascati, Italy | *IRN Terascale@LNF* |
| 2023 | **Evidence of intrinsic charm quarks in the proton**, Mainz, Germany | *MENU23* |
| 2023 | **Including QED corrections in PDF fits: The NNPDF4.0QED PDF set**, Durham, UK | *QCD@LHC23* |
| 2023 | **Inclusion of QED corrections in PDFs: The NNPDF4.0QED PDF set**, Montpellier, France | *QCD23* |
| 2021 | **Construction of a third order approximation for heavy flavour production in deep inelastic scattering**, Milan, Italy | *MCM 2021* |

# Teaching activity

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| 2024 | **Co-supervisor of a Bachelor thesis**, Thesis title: *On the fitting scale dependence of the Parton Distributions* | *University of Milan* |
| 2024 | **TA for the course of Quantum Physics I**, Introduction to Quantum Mechanics | *University of Milan* |
| 2024 | **TA for the course of Physics**, Basics of Classical Mechanics and Thermodynamics | *University of Milan* |
| 2024 | **TA for the course of Quantum Physics II**, Advanced course on Quantum Mechanics | *University of Milan* |
| 2023 | **TA for the course of Theoretical Physics I**, Introduction to Quantum Field Theory | *University of Milan* |
| 2023 | **TA for the course of Physics**, Basics of Classical Mechanics and Thermodynamics | *University of Milan* |
| 2023 | **TA for the course of Quantum Physics II**, Advanced course on Quantum Mechanics | *University of Milan* |
| 2023 | **Exercise classes for the course of Quantum Physics II**, Advanced course on Quantum Mechanics | *University of Milan* |
| 2022 | **TA for the course of Quantum Physics I**, Introduction to Quantum Mechanics | *University of Milan* |
| 2021 | **Student collaboration scholarship**, TA for the Laboratory courses of the first three years | *University of Rome "La Sapienza"* |