Martin Murin, PhD

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Doctoral researcher in experimental particle physics at CERN with a distinctive skill set that combines programming in Python and C++, machine learning and advanced statistics, and distributed high-performance computing. Developed and optimised machine learning models for classification of Monte Carlo simulated dataset. Passionate about producing innovative models and deriving data-driven insights and solutions to complex business problems.

EDUCATION

PhD in Particle Physics — **University of Manchester and CERN** 　　　　Manchester, UK — 2019 - 2023

– Member of the ATLAS Collaboration at CERN since 2019, earning authorship in 2020

– Engaged in a year-long attachment at CERN, contributing to the operation of the ATLAS experiment

MPHYS Physics with Astrophysics (1st class) — **University of Manchester**　　　Manchester, UK — 2015 - 2019

– 2017 Richard Davis Prize: Awarded for the best laboratory work in the 2nd year (92%)

Education abroad programme — **University of California Los Angeles**　　　Los Angeles, USA — 2017 - 2018

– One year exchange programme. GPA: 3.56/4.00.

International Baccalaureate — **Gymnázium Jura Hronca**　　　Bratislava, Slovakia — 2011 - 2015

– IB Diploma: 41/45. National Olympiad: top 5 in Astronomy, top 10 in Physics, top 30 in Mathematics

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RESEARCH EXPERIENCE

Doctoral Researcher — **ATLAS Experiment at CERN**　　　Manchester, UK — 2019 - 2023

⋆ Implemented and optimized a Boosted Decision Tree model for binary classification, designing 37 input variables, hyper-parameter tuning, and GPU-accelerated performance studies ([link to repository](#))

⋆ Corrected mismodelling of background with a data-driven method allowing extraction of a rare signal (5%) paving the way to statistically significant evidence of the four top quark process ([arxiv:2106.11683](#))

⋆ Validated the impact of 4 setups on fit stability by conducting profile likelihood fits with over 300 nuisance parameters, written internal documentation

⋆ Configured and processed large data sets (100s TB) on the CERN's high performance computing cluster, extended existing software frameworks for DNN and ANN performance calibration to provide scale factors

Graduate Researcher — **Jodrell Bank Centre for Astrophysics**　　　Manchester, UK — 2018 - 2019

⋆ Analysed multidimensional data from MACSIS cosmological simulation to identify galactic cluster substructures, directly contributing to the most [comprehensive study](#) of the rotational Sunayev-Zeldovich effect

⋆ Evaluated the potential of current and future telescopes to detect cluster substructures using the kinematic Sunayev-Zeldovich effect as a function of 4 characterising properties

Summer Intern — **Department of Nuclear Physics**　　　Bratislava, Slovakia — June 2018

⋆ Assembled a vacuum apparatus for the 4 MeV tandem electrostatic proton/alpha accelerator

⋆ Identified 21 isotopes, using peak identification method, that constituted irreducible background in the spectrum produced by the proton beam interaction with the experimental assembly

Summer Intern — **National Oceanography Centre**　　　Southampton, UK — June - August 2017

⋆ Reconstructed climate and geomagnetic change information preserved in 120 meters of marine sediments by analysing signal from magnetic susceptibility and x-ray fluorescence measurements

⋆ Developed and validated a signal deconvolution technique for magnetic susceptibility measurements in MATLAB, achieving nearly 100% signal recovery; employed a bootstrap method to rigorously estimate uncertainty

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PROFESSIONAL EXPERIENCE

Doctoral Researcher — **ATLAS Collaboration**   Manchester, UK — 2019 - 2023

- ⋆ Integrated new functionality into large frameworks and co-developed packages with team members using Git
- ⋆ Presented research at UK-wide collaboration meetings and LHC Physics conference, moderated discussion at a collaboration workshop
- ⋆ Mentored a junior student, providing guidance on project methodologies and objectives
- ⋆ Exemplified creativity, autonomy, and resilience while concurrently managing multiple projects, collaborating with both local and remote teams

ATLAS Run Control shifter — **CERN**   Geneva, Switzerland — 2022

- ⋆ Served 88 hours of shifts in the ATLAS control room as Run Control and Trigger System shifter, contributing to the detector operation
- ⋆ Configured detector setup as required for subsystem tests and resolved problems with a team of experts
- ⋆ Wrote event logs and bug reports, communicated ongoing situation at the end of the shift

Teaching Assistant — **University of Manchester**   Manchester, UK — 2019 - 2020

- ⋆ Conducted over 60 workshops in C++ and Python programming, explaining object-oriented programming or gradient descent method and assisted resolving code, compiler or dependency-related errors
- ⋆ Graded assignments, semestral projects, and final exams of 100s of students providing detailed feedback

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TECHNICAL SKILLS

Programming	Python, C++, algorithmic and object-oriented, Bash/Linux
Data Analysis	numpy, scipy, pandas, MATLAB, SQL, Excel, hierarchical data format (hdf5, json)
Machine Learning	Boosted Decision Tree with XGBoost, Keras, PyTorch, scikit-learn, hyperparameter tuning, efficiency calibration of deep and adversarial neural network classifiers
Natural Language Processing	Prompt-engineering, LLM inference, summarization using Huggingface models
Statistics	Chi-square tests, template likelihood fits, profile likelihood fits for hypothesis testing and significance estimation, fit stability tests
High-Performance Computing	Configuring and processing large data sets on HPC cluster, interfacing with distributed computing resources, training BDT on HTC cluster
Monte Carlo simulation	MadGraph, Pythia8, Delphes, event generation and particle-jet reconstruction
Web front-end	React, Django, Vercel serverless functions, Bootstrap, see martin-murin.github.io
Quantum Computing	Pennylane, Quirk, participated in QHack2024, QHack2023 and Pennylane code camp solving over 60 challenges
Visualization	Matplotlib, Seaborn, Mathematica, Adobe Illustrator for vector graphics, MS/Libre Office, LaTeX and Markdown for presentations and documentation
Code Collaboration	Experience in collaborative software development, Git, CI/CD
Languages	English (professional), Slovak (native), French and German (conversational)

PERSONAL INTERESTS

- **Astronomy:** Led Astronomy Society at the University, organised public stargazings in Manchester and Bratislava, embarked on two expeditions to observe total solar eclipse in Argentina (2020) and Texas (2024)
- **Traveling:** Avid traveler visiting 31 countries with recent solo adventures across Southeast Asia and India, and gaining diverse cultural experiences from living and studying in the UK, USA, Switzerland and Slovakia