

Ph.D. position:

**Exploring New Physics with ATLAS
via Machine Learning-Based Anomaly Detection
at Clermont-Ferrand University**

We invite applications for a Ph.D. position in experimental particle physics, with a focus on research within the ATLAS experiment at the CERN Large Hadron Collider. The successful candidate will be based at the Laboratoire de Physique de Clermont-Auvergne (LPCA) in France, working as a member of the ATLAS group <http://cern.ch/atlas-clermont/>, which is actively involved in both data analysis and detector development.

Research project

The selected candidate will contribute to the development of advanced statistical and machine learning techniques aimed at the discovery of new physics phenomena. Building on recent studies demonstrating the power of neural networks in identifying signatures of new particles across complex parameter spaces, the student will implement and apply such methods to data collected by the ATLAS experiment at the LHC. The focus of the thesis will be on the exploration of hadronic jets, which are abundantly produced in proton-proton collisions, with the goal of identifying those exhibiting anomalous features. These unusual jets could signal the presence of physics beyond the Standard Model, as predicted by a variety of theoretical frameworks. By employing anomaly detection strategies, the project will enable a broad and model-agnostic search, capable of capturing a wide range of potential new physics signatures in a unified analysis framework.

Scientific environment

The ATLAS team at Clermont is a founding member of the ATLAS collaboration and has played a leading role in both detector development and physics analysis. The group has made long-standing and substantial contributions to the scintillating Tile hadronic calorimeter (TileCal), and has been actively involved in its upgrade for the High-Luminosity LHC (HL-LHC) Phase 2. Since 2018, the team has also contributed to the development of the High Granularity Timing Detector (HGTD).

On the physics side, the team has a strong and sustained focus on top-quark-related analyses. It has been a pioneer in searches for new physics in final states involving one or more top quarks, including heavy resonances decaying to top-antitop or top-bottom pairs. Notably, the team initiated the search for four-top-quark production within ATLAS in 2011—a process first observed in 2020. Since 2013, the team has made major contributions to the observation of the associated production of a Higgs boson with a top-quark pair (ttH), which was confirmed in 2018, and is now involved in the search for Higgs boson pair production (di-Higgs).

In addition, the team has developed strong expertise in the application of artificial intelligence to particle physics, including the design and implementation of machine learning algorithms for data analysis and anomaly detection.

How to apply

Interested candidates are invited to submit a complete application package including a curriculum vitae, copies of academic transcripts and degrees, a statement outlining their research experience and interests, and to arrange for two letters of recommendation to be sent on their behalf. Applications will be reviewed on a rolling basis, and the position will remain open until a highly qualified candidate is selected.

For this project, a solid background in experimental particle physics is essential. The ideal candidate will also possess strong programming skills and have some experience with modern machine learning techniques. Proficiency in English is required. While knowledge of French is not mandatory, free French language courses will be offered to facilitate integration.

The Ph.D. position is fully funded by the [MIAI Cluster](#) (*Multidisciplinary Institute in Artificial Intelligence*), as part of its support for research at the interface of AI and fundamental science.

Inquiries about the position and completed applications should be sent by email to: [julien.donini AT cern.ch](mailto:julien.donini@cern.ch), and [scalvet AT cern.ch](mailto:scalvet@cern.ch).

The appointment is for three years, starting October 1st 2025, and is located at Clermont-Ferrand, France, with the possibility for regular trips to CERN.