

Search for New Physics in the Top Quark Sector with the ATLAS Detector

Two Years Postdoctoral Position

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Scientific context and local environnement

The Standard Model (SM) is validated by a large number of experimental results, including the recent Higgs boson discovery. However, the SM is expected to be a low energy approximation of a more fundamental theory, not yet known. Being the heaviest SM particle, the top quark is a favoured sector for new phenomena searches at high energy.

The ATLAS-LPC team is heavily involved in physics analyses related to the top quark, in detector operation and in detector development for the futur high luminosity running period of the LHC (HL-LHC). The physics probed by the team covers the Higgs boson sector via the search for $t\bar{t}H$ production [1] as well as sectors beyond the SM via well-motivated searches in the top quark sector ($W' \rightarrow tb$ [2], $Z' \rightarrow t\bar{t}$ [3], $t\bar{t}t\bar{t}$ and tt production [4] and $t + \cancel{E}_T$ [5]). Jet reconstruction being a key point for top physics, the team plays a leading role in the ATLAS hadronic calorimeter, from the detector operation to a R&D activity dedicated to the extreme HL-LHC data taking conditions.

The proposed project focuses on the search for new physics in final state with same-sign lepton pairs ($\ell^\pm\ell^\pm$) and b-jets, sensitive to $t\bar{t}t\bar{t}$ and tt production among other processes. This analysis allows probing a wide spectrum of new physics-motivated models addressing important open questions of the SM, such as naturalness or possible compositeness of the top quark and the Higgs boson. In addition, this type of search can highly constrain a particular class of models predicting dark matter.

Activities of the successful candidate

The successful candidate is expected to play a leading role in the analysis and interpretation of $\ell^\pm\ell^\pm$ data collected by ATLAS in the context of dark matter search. This project includes a large experimental component (background modeling, sensitivity optimisation, statistical analysis) but also a phenomenological component (study of theoretical models). Depending on the candidate profile and tastes, contributions to the detector R&D is also possible. The position will be based at LPC with frequent trips at CERN.

Interested applicants should have a PhD degree in Particle Physics since less than 3 years. They should submit a Curriculum Vitæ, a brief description of their research experience and interests, and arrange for three letters of recommendation to be sent to atlas.lpc.job@cern.ch. Applications will be reviewed as soon as possible and will be accepted until September 15th. The appointment is for two years, starting in the period between October and December 2015. The position is funded by the “conseil régional d’AUVERGNE” through the “Nouveau Chercheur” program with no nationality restriction.

[1] ATLAS collaboration, [arXiv:1506.05988 \[hep-ex\]](https://arxiv.org/abs/1506.05988), Submitted to PLB (2015)

[2] ATLAS collaboration, [Phys Lett B 743 \(2015\) 235-255](https://arxiv.org/abs/1505.07018)

[3] ATLAS collaboration, [arXiv:1505.07018 \[hep-ex\]](https://arxiv.org/abs/1505.07018), Submitted to JHEP (2015)

[4] ATLAS collaboration, [arXiv:1504.04605 \[hep-ex\]](https://arxiv.org/abs/1504.04605), Submitted to JHEP (2015)

[5] ATLAS collaboration, [Eur. Phys. J. C \(2015\) 75:79](https://arxiv.org/abs/1504.04605)