

# SUSY search for stop

*Project title:* **Improving the SUSY search for direct stop production in the one-lepton channel using multi-variate analysis techniques**

*Description:*

The Large Hadron Collider (LHC) at CERN leads the energy frontier of particle physics.

With its unprecedented high collision energy, the LHC can probe and discover SUSY particles

up to a few TeV over the next years. Today's most stringent limits for Supersymmetry (SUSY) squarks and gluinos come from the 2010 and 2011 LHC data. By summer 2012, the dataset is expected to be significantly larger ( $\sim 4$ ). This will be an exciting time to search for the rare process of direct top squark (stop) production. The stop search is one of the hottest particle physics topics these days, because of its connection to naturalness arguments.

The goal of this project is to improve the the SUSY stop search in the one lepton channel by using multi-variate analysis (MVA) techniques. The search for direct stop production is an ideal analysis to introduce an MVA. This is because it is a dedicated search for a specific signal process, hence the expected signal characteristics are well known. Secondly, in the case of a stop mass close to the top mass the search is challenging and can significantly profit from advanced analysis techniques.

The student will participate in these studies as part of the SUSY analysis team that is running the existing ATLAS stop search. In a first stage, we will systematically study discriminating variables and compare the performance of different MVAs with respect to the baseline cut-and-count analysis. The Toolkit for Multivariate Analysis (TMVA) package will facilitate the usage of MVAs in the analysis. In a second stage, one robust and performant MVA is chosen and used to compare data and simulated background processes in various control regions. The project will be a key contribution to the forthcoming ATLAS SUSY stop search effort.

The supervisors have already the full analysis infrastructure setup - including all the relevant Monte Carlo datasets, the know-how of retrieving and processing data, and the analysis computing framework. Furthermore, the supervisor has extensive expertise with the TMVA package. This will make it easy for a bright student to contribute early on.