T 11: Search for Supersymmetry I

Time: Monday 16:00–17:45 Location: Tk

T 11.1 Mon 16:00 Tk

Analysis of the viable parameter space in the phenomenological MSSM using clustering algorithms with the ATLAS detector. — •Markus Eck and Jeanette Lorenz — Ludwig-Maximilians-Universität München

Supersymmetry (SUSY) is a theoretical framework extending the Standard Model of particle physics, potentially solving several of its shortcomings. In the search for supersymmetric particles with the ATLAS experiment at the LHC, typically, simplified models are considered, which contain a small number of parameters. These simplified models focus on specific SUSY production scenarios with very specific decays. Therefore, they may fail to capture effects that can result from the large number of competing production and decay processes present in more complete models. To resolve this, efforts are on-going to reinterpret searches for supersymmetric particles in the 19-parameter phenomenological MSSM (pMSSM).

This talk presents an analysis of the part of the pMSSM parameter space sensitive to electroweak supersymmetric particles. Models in this parameter space not excluded by the current ATLAS search program are analysed via clustering methods to find common properties. The gained insight will help to improve the future search program for supersymmetric particles.

T 11.2 Mon 16:15 Tk

Evaluating current LHC results in the pMSSM using MadAnalysis5 — •Malte Mrowietz, Sam Bein, and Peter Schleper — Universität Hamburg, Hamburg, Deutschland

The impact of 13 TeV LHC searches for supersymmetry on the minimal supersymmetric standard model (MSSM) is evaluated using MadAnalaysis5, in the context of the 19-parameter phenomenological MSSM (pMSSM). Complementarity and possible tension between the LHC data and results from dark matter, low energy physics, and implications of fine-tuning are examined.

T 11.3 Mon 16:30 Tk

Impact of fundamental MSSM parameters on the SUSY dark matter contribution — •Marten Berger[1], Sven Heinemeyer[2], Cheng Li[3], Gudrid Moortgat-Pick[1,3], Christian Schappacher[4,5], and Georg Weiglein[1,3] — [1]II. Institute of Theoretical Physics, University of Hamburg, Germany — [2]Instituto de Fisica Teorica, Madrid, Spain — [3]DESY, Hamburg, Germany — [4]Karlsruhe University, Karlsruhe, Germany — [5]KIT, Karlsruhe, Germany

The Minimal Supersymmetric Standard Model (MSSM) is one of the best motivated extensions of the Standard Model (SM): it is of high predictive power and can explain the main open questions of the SM. For instance, it offers a well-motivated cold dark matter candidate. A crucial question is therefore whether parameter sets within this model can explain the correct amount of relic density with its cold dark matter candidate. Since the mixing character can rapidly change depending on the actual parameter point and consequently has immediate influence on the relic density contribution it is necessary to include one-loop corrections in the calculations of the dark matter observables. In this talk we will discuss two classes of possible scenarios and the impact of the fundamental SUSY parameters on the resulting relic density.

T 11.4 Mon 16:45 Tk

Modelling Pair Production of Top Squarks with Decays via Tau Sleptons in the pMSSM — •Christoph Ames and Alexander Mann — Ludwig-Maximilians-Universität, Munich, Germany

The phenomenological Minimal Supersymmetric Standard Model (pMSSM) is a simplified supersymmetric model that allows for a systematic probing of its parameter space due to its heavily reduced number of parameters. This work focuses on the comparison of three simplified models in the context of the pMSSM, in which a stop decays via either a stau or a tau-sneutrino. The lightest supersymmetric particle is either a gravitino or a neutralino. These models are used to get an understanding of how different particle decays are influenced by the parameters of the pMSSM, and to find the boundaries for each model's phase space. Decay modes that compete with the simplified models are also studied to determine how to suppress them. These comparisons are performed using random samples of model points, which are configurations of particle masses and decay modes uniquely defined by sets of pMSSM parameter values. The phase space of the model generation has been adjusted to increase the likelihood that the model points will contain the simplified models, whilst still allowing for an uncompromising study.

T 11.5 Mon 17:00 Tk

Search for the production of a pair of stops in the all-hadronic tt+MET channel using the ATLAS detector — •Alvaro Lopez Solis — DESY-Zeuthen

Supersymmetry (SUSY) is an extension of the Standard Model associating to every fermion and boson known by now a scalar or fermion partner respectively, called superpartners. There are several phenomenological motivations of this extension, amongst which it is useful to cite three: it provides a natural solution to the Higgs mass hierarchy problem, whose diverging diagrams caused by fermionic loops are cancelled out by their corresponding superpartner-mediated loops; the provision of a cold dark matter candidate; and the gauge coupling unification at high energies.

Amongst all the versions of SUSY, I will focus on the one providing a minimal extension of the Standard Model, also called MSSM. In this theory, the top superpartner is crucial to the cancellation of the top corrections to the Higgs mass. In addition, naturalness arguments suggest that the superpartners of the third-generation quarks may present a mass of the order of TeV, meaning that they might be accessible by LHC collisions. In consequence, top partner search is a key point in the SUSY searches in ATLAS.

In this talk, I will present search for the production of a pair of top superpartners performed inside the ATLAS collaboration in the tt+MET channel. This search is focused on the all-hadronic decays of the top-quark, thus requiring no lepton in the final state.

T 11.6 Mon 17:15 Tk

New physics searches in tt+MET final states in pp collisions at 13 TeV with the ATLAS experiment — •Simran Gurdasani — Albert-Ludwigs-Universität Freiburg, Freiburg im Breisgau, Deutschland

This talk will report on preliminary results on a search for SUSY and Dark Matter particles with the ATLAS experiment at the LHC using 139 fb^{-1} of pp data at 13 TeV. The targeted signals are the productions of pairs of SUSY stop quarks and the production of DM candidates in associations with a pair of top quarks via a new scalar or pseudoscalar mediator, as predicted in DM simplified models or in 2HDM+a models. The search focuses on events with either an electron or a muon from the decay of one of the two top quarks. It will expand the reach of a previous similar analysis by adding a new sample of events using single lepton triggers and by deploying neural networks to reconstruct the momenta of the top quarks and to classify the signal and background events. The talk will give an overview of the physics motivation of the search and will report on the ongoing developments of the analysis.

T 11.7 Mon 17:30 Tk

Search for Supersymmetry in Leptonic Final States with the ATLAS Detector — •Marian Rendel, Michael Holzbock, Hubert Kroha, and Sandra Kortner — Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München)

Supersymmetry (SUSY) is one of the best studied extensions of the Standard Model (SM) and as such the search for SUSY is a major part of the ATLAS physics program. A SUSY models with scalar partners of the SM leptons (sleptons) may address the muon g-2 anomaly, as well as provide a viable candidate for Dark matter, and are thus of particular interest. Due to their low production cross section and the high Standard Model (SM) background, the search for sleptons is challenging. This motivates to employ multivariate methods to distinguish between SUSY and the SM background. In this talk a search for sleptons in events with two same-flavor opposite-sign leptons and initial state radiation topology is presented which uses 139 fb^{-1} LHC proton-proton collision data collected by the ATLAS experiment during the years 2015 and 2018.