T 26: Suche nach Supersymmetrie I

Zeit: Dienstag 16:30–19:00 Raum: Philo-HS3

T 26.1 Di 16:30 Philo-HS3

Data-driven background estimatation and application of machine-learning techniques to the search for direct $\tilde{\tau}$-pair production with the ATLAS detector — •Johannes Junggeburth, Zinonas Zinonos, and Hubert Kroha — Max-Planck-Institut für Physik

One of the main goals of the ATLAS experiment at the LHC is the search for physics beyond the Standard Model, in particular for supersymmetric extensions. Searches for the pair production of $\tilde{\tau}$'s, the supersymmetric partners of the τ leptons, have not yet been performed by ATLAS. The existing limits on the $\tilde{\tau}$ mass are still from the LEP experiments. The $\tilde{\tau}$ lepton can for instance decay into a τ-lepton and a $\tilde{\chi}_1^0$. In proton collisions, the identification of the τ leptons in the final-state is challenging due to the large QCD background. This makes it necessary to use multivariate analysis techniques. In this talk the strategy for a search for direct $\tilde{\tau}$ production in the Run-2 data recorded by ATLAS is outlined using data-driven background estimation and machine-learning algorithms to increase the sensitivity.

T 26.2 Di 16:45 Philo-HS3

Study on the expected sensitivity of Higgsino pair production at HL-LHC exploiting final states with missing transverse energy, soft leptons and monojet. — •Peter Tornambè — Albert Ludwigs Universität Freiburg

Supersymmetry (SUSY) is one of the most studied theories to extend the Standard Model (SM) beyond the electroweak scale. The ATLAS Collaboration published several SUSY searches with the 2015-2016 dataset which were able to exclude many different simplified models up to high masses. Supersymmetric particles like squarks and gluinos may be too heavy and not accessible by LHC with the current ongoing analysis. Naturalness arguments imply the existence of light electroweakino particles, when they have an high Higgsino component the mass splitting between them is expected to be really small. Due to this, the final products of the decay chain are very soft and the signals from electroweak Higgsino pair production is tipically overwhelmed by the Standard Model backgrounds. This talk will present the current upgrade study to estimate the exclusion power of High Luminosity LHC (HL-LHC), which will run at an energy in the center of mass of 14 TeV, for the natural mass range of a pure Higgsino scenario. Starting from theorethical proposals [arXiv:1409.7058], final states with two soft leptons, missing transverse energy and monojets from initial state radiation are considered in order to improve the ratio between signal and background.

T 26.3 Di 17:00 Philo-HS3

Search for charginos and neutralinos in events with one lepton, 2 b-jets and missing transverse momentum with the ATLAS detector — •Danijela Bogavac and Jeanette Miriam Lorenz — LMU München Am Coulombwall 1, DE-85748 Garching

This talk focuses on searches for supersymmetric particles in decay modes $\tilde{\chi}_1^{\pm} \to W^{\pm} + \tilde{\chi}_1^0$ and $\tilde{\chi}_2^0 \to h + \tilde{\chi}_1^0$. A final state of one lepton (electron or muon), 2 b-jets from the Higgs boson decay and missing transverse momentum is explored. The search is performed using 36.1 fb^{-1} of proton-proton collision data delivered by the Large Hadron Collider (LHC) and recorded by the ATLAS detector in 2015 and 2016. A significantly larger dataset in the LHC Run II and the increase of the LHC energy from 8 to 13 TeV allow this analysis to exceed the sensitivity of the LHC Run I.
Three statistically orthogonal signal regions are designed to target the wide range of kinematics that can be obtained from the decay of charginos and neutralinos. They are built using the Higgs boson invariant mass as a main discriminating variable between signal and backgrounds. Recent results will be shown and the analysis strategy will be discussed.

T 26.4 Di 17:15 Philo-HS3

Suche nach Topquarkpaarproduktion in Endzuständen mit einem Lepton am ATLAS-Experiment — •Julian Wollrath und Frederik Rühr — Physikalisches Institut, ALU Freiburg

Bei einer Schwerpunktsenergie von $\sqrt{s} = 13\,\text{TeV}$ wurde mit 36,1 fb^{-1} an Daten, aufgenommen mit dem ATLAS-Experiment, nach Topsquarkpaarproduktion in Endzuständen mit einem Lepton gesucht. Unter der Annahme eines hundertprozentigen Verzweigungsverhältnisses von $\tilde{t}_1 \to t^{(*)}\tilde{\chi}_1^0$ wurden für $\tilde{\chi}_1^0$-Massen unter 300 GeV Topsquarks mit Massen unterhalb 900 GeV größtenteils ausgeschlossen. In diesem Vortrag wird das Ergebnis kurz vorgestellt und über die Weiterführung dieser Suchen berichtet.

T 26.5 Di 17:30 Philo-HS3

Interpretation of Long-Lived Gluino and Neutralino Signals in the ATLAS 0L (2-6 jets + MET) SUSY Search — •Veronika Magerl, Fabio Cardillo, Simone Curcio, Peter Tornambe, and Zuzana Rurikova — Universität Freiburg

Many extensions of the Standard Model (SM) include heavy coloured particles, such as the gluinos $\widetilde{g}$ of supersymmetric (SUSY) theories, which could be accessible at the Large Hadron Collider (LHC). Depending on the underlying theoretical SUSY model, the gluinos are assumed to show different characteristics and decay modes.

Within the R-parity conserving (RPC) MSSM, gluinos may decay promptly into final states with multiple jets and missing transverse energy (MET) carried away by the undetected lightest supersymmetric particle (LSP). In Split SUSY models the $\widetilde{g}$ can be a long-lived massive particle which hadronises into R-hadrons before decaying into quarks and the LSP producing signatures very similar to the promptly decaying $\widetilde{g}$. Furthermore, refraining from RPC by increasing the R-parity violating (RPV) couplings, the $\widetilde{g}$ decays promptly but the LSP, typically the lightest neutralino $\widetilde{\chi}_1^0$ decays with finite lifetime, causing again similar multiple jet and MET signatures. Hence, the reinterpretation of long-lived $\widetilde{g}$ and $\widetilde{\chi}_1^0$ signals within the 0L (2-6 jets + MET) SUSY analysis, originally designed for the interpretation of prompt decaying $\widetilde{g}$ in the RPC MSSM is of particular interest.

This talk presents the latest results of these interpretations based on the $\sqrt{s} = 13\ TeV$ dataset corresponding to an integrated luminosity of 36.1 fb^{-1}.

T 26.6 Di 17:45 Philo-HS3

BDT and multi-bin analyses in the context of squark and gluino searches in the 0-lepton final state with the ATLAS experiment. — •Manuel Guth — Albert-Ludwigs Universität, Freiburg, DE

A search for supersymmetric phenomena in final states with multiple jets, missing transverse energy and without leptons, based on 2015+2016 data was presented by the ATLAS collaboration at the conference Moriond 2017. This analysis uses simple cut-and-count methods in the signal regions. In order to test a possible improvement, the use of sophisticated techniques, such as boosted decision trees (BDT) and multi-bin, is being investigated. For the multi-bin analysis, bins in jet multiplicity and effective mass are considered. The single bins are meant to replace the current signal regions and are optimised via a cut-and-count method or BDT. The focus of the study lies on squarks and gluino searches. The performance of these techniques is evaluated using Monte Carlo simulation. The goal is to find a new approach which is both simple but allows for improvement.

T 26.7 Di 18:00 Philo-HS3

Results of the Search for Strong Production of Supersymmetry involving Tau Leptons with the ATLAS Experiment — Philip Bechtle[1], Klaus Desch[1], •Oliver Ricken[1], and Steffen Schaepe[2] — [1]Physikalisches Institut, Universität Bonn — [2]CERN, Genf, Schweiz

The reliably running Large Hadron Collider (LHC) and the ATLAS experiment provide a new and unique discovery potential for physics beyond the Standard Model (SM). One of the most promising extensions to the successful yet incomplete SM is Supersymmetry (SUSY). Due to the quark-gluon composition of the colliding protons, production of new particles via the strong interaction is favoured at the LHC. This fact motivates searches for strongly produced decay chains of SUSY. In addition, it is natural in models of SUSY that tau leptons and their distinct detector signatures are expected to be rather abundant. This talk addresses the searches for hadronic tau final states in different models of strong production of SUSY. The analysis presented is based on 36.1 fb^{-1} of ATLAS data recorded at $\sqrt{s} = 13\,\text{TeV}$. In contrast to the early Run-II analyses, this study exploits the increased amount of data available in various ways: in addition to improved background

estimation approaches, new fitting procedures are utilised to extract results more efficiently. This talk introduces the analysis pursued and presents the latest results available, focussing on the novelties with respect to the first studies of 13 TeV ATLAS data.

T 26.8 Di 18:15 Philo-HS3

Search for physics beyond the standard model with photons, missing transverse momentum and hadronic activity — •Maximilian Knut Kiesel, Christian Autermann, and Lutz Feld — I. Physikalisches Institut B, RWTH Aachen University

A search for physics beyond the standard model in proton-proton collisions with photons in the final state will be presented. Such final states are motivated by gauge mediated supersymmetry breaking models, in which a neutralino decays to an undetectable gravitino and a photon. If the neutralinos are produced through the strong interaction, the jets in the decay cascade lead to a large amount of hadronic activity. This search uses proton-proton collisions at a center-of-mass energy of 13 TeV recorded with the CMS detector in 2016, corresponding to an integrated luminosity of about 36 fb^{-1}. At least one high energetic photon, hadronic activity and missing transverse momentum are required. The contribution of multijet production with real photons or jets identified as photons is estimated using a jet-enriched data control region. The contribution of electrons being reconstructed as photons is estimated using an electron-enriched data control, while the contribution of γW, γZ, and $\gamma t\bar{t}$ events is estimated using simulation. Simultaneous count experiments in several bins with high missing transverse momentum and high hadronic activity are performed to evaluate the presence of physics beyond the standard model. For low neutralino masses, this analysis provides the most stringent exclusion limits for gluino and squark pair production in general gauge mediated supersymmetry models.

T 26.9 Di 18:30 Philo-HS3

Suche nach elektroschwacher Produktion supersymmetrischer Teilchen in Ereignissen mit einem Lepton mit dem ATLAS Detektor am LHC — •Eric Schanet and Jeanette Lorenz — Ludwig-Maximilians-Universität München

Die vorgestellte Studie basiert auf einer publizierten Analyse zur Suche nach der Paarproduktion von Gluinos und Squarks in Ereignissen mit einem Lepton (Elektron oder Myon), hoher fehlender transversaler Energie, sowie Jets mit dem ATLAS Detektor am LHC.

Da bis zum Ende von Run-2 am LHC mindestens 120 fb^{-1} an Daten mit $\sqrt{s} = 13$ TeV produziert werden sollen und bislang noch kein Hinweis auf Supersymmetrie gefunden werden konnte, werden auch Suchen nach elektroschwach produzierten Teilchen immer interessanter. Diese waren bislang aufgrund niedrigerer Wirkungsquerschnitte wegen fehlender Statistik nicht sensitiv auf supersymmetrische Prozesse.

Dieser Vortrag präsentiert eine Erweiterung der publizierten Analyse auf die elektroschwache Produktion. Mit Hilfe von Sensitivitätsstudien wird untersucht, inwiefern diese Analyse sensitiv auf elektroschwache supersymmetrische Signalmodelle ist. Es wird außerdem dargelegt, mit welchen Veränderungen die erreichte Sensitivität auf elektroschwache Signalmodelle erweitert werden kann.

T 26.10 Di 18:45 Philo-HS3

On History and Methodology of Supersymmetric Theories — •Alexander Unzicker — Pestalozzi-Gymnasium München

After about half a century of supersymmetric ideas in physics, it appears worthwhile to have a look at the history of this notable field of theoretical physics. Concrete key developments as well as some general methodological questions are discussed. These considerations should help to interpret future particle accelerator data with respect to fundamental questions.