T 15: Beyond the Standard Model (Theorie) 1

Convenor: Jürgen Reuter

Zeit: Montag 16:45–19:00 Raum: VG 3.102

T 15.1 Mo 16:45 VG 3.102

Supersymmetric cascade decays at NLO — •Eva Popenda[1], Margarete Mühlleitner[1], Christian Hangst[1], Michael Krämer[2], and Michael Spira[3] — [1]KIT, Institut für Theoretische Physik — [2]RWTH Aachen University, Institut für Theoretische Teilchenphysik und Kosmologie — [3]Paul Scherrer Institut, Theory Group LTP

The search for supersymmetric particles and determination of their properties is a major task at the LHC and is based on the analysis of the cascade decay chains in which SUSY particles are produced. This project aims at improving predictions for SUSY cascade decays through the inclusion of higher-order corrections in the production and decay processes and by embedding them in a fully flexible Monte Carlo program. In this talk we report on the progress of the implementation of squark pair production followed by the decay into a quark and the lightest neutralino including supersymmetric QCD corrections at next-to-leading order in a completely differential form.

T 15.2 Mo 17:00 VG 3.102

Implementation of $\tilde{q}\tilde{q}$-production in the POWHEG-BOX — •Christian Hangst[1], Michael Krämer[2], Margarete Mühlleitner[1], Eva Popenda[1], and Michael Spira[3] — [1]KIT - Institut für Theoretische Physik — [2]RWTH Aachen University - Institut für Theoretische Teilchenphysik und Kosmologie — [3]Paul Scherrer Institut - Theory Group LTP

Precise predictions for the production of SUSY-particles at the LHC in the framework of the MSSM make the combination of fixed-order NLO-calculations and parton-showers indispensable. The POWHEG-method is one of several existing possibilities to avoid in this step of the simulation the occurrence of the so called double-counting problem. I present the implementation of $\tilde{q}\tilde{q}$-production into the existing program POWHEG-BOX, which provides the process-independent steps of this method automatically.

T 15.3 Mo 17:15 VG 3.102

Same-Sign Top Quark Production within the Flavour Violating MSSM — •Yasmin Anstruther, Michael Rauch, and Dieter Zeppenfeld — Institute for Theoretical Physics, KIT, Karlsruhe

In the MSSM, soft-susy breaking terms allow for the possibility of so-called non-minimal flavour violation (NMFV), which results in additional flavour mixing beyond the CKM matrix. This induces new contributions to squark pair production via t-channel gluino exchange and same-sign squark decays into top quarks become possible. The signal contains two b-jets and two same-sign leptons as well as missing transverse energy. We perform a Monte Carlo analysis of this signal and its corresponding backgrounds at the LHC, taking experimental constraints on the mixing parameters, e.g. from B-Physics, into account.

T 15.4 Mo 17:30 VG 3.102

$\sqrt{\hat{s}}_{\mathbf{min}}$ resurrected — •Tania Robens — IKTP, TU Dresden

We discuss the use of the variable $\sqrt{\hat{s}}_{\mathrm{min}}$, which has been proposed in order to measure the hard scale of a multi parton final state event using inclusive quantities only, on a SUSY data sample for a 14 TeV LHC. In its original version, where this variable was proposed on calorimeter level, the direct correlation to the hard scattering scale does not survive when soft physics is taken into account. We here show that when using reconstructed objects instead of calorimeter energy and momenta as input, we manage to actually recover this correlation within our sample. We furthermore discuss the effect of including W + jets and t tbar+jets background in our analysis and the use of $\sqrt{\hat{s}}_{\mathrm{min}}$ for the suppression of SM induced background in new physics searches.

T 15.5 Mo 17:45 VG 3.102

Distorted Mass Edges at LHC — •Daniel Wiesler and Juergen Reuter — DESY Theorie, Notkestr. 85, 22607 Hamburg

Measuring mass and spin of new particles is of crucial importance for the understanding of general new physics models. We present two scenarios in which determination methods suffer from large uncertainties: the introduction of exotic particle content in B(MS)SM models as well as broadening effects due to off-shell contributions give rise to the distortion of kinematic distributions in an LHC environment.

Consequently, this may not only affect determination of model parameters, but it can also impose a confusion with combinatorical effects of the underlying analysis. A correct treatment and modeling of these effects is thus indispensable for the ability to disentangle between different alternative BSM scenarios.

T 15.6 Mo 18:00 VG 3.102

Spin effects in the antler topology at hadron colliders — •Lisa Edelhäuser — RWTH Aachen

If new physics is discovered at the LHC, it will be a crucial task to determine the spin of the new particles, as this is necessary in order to pin down the underlying theoretical model. We focus here on processes with very short decay chains such as dilepton production plus missing energy. We do not restrict ourselves to any specific model, but perform our analysis in a model-independent fashion which includes e.g. Sleptons in Susy or KK-Leptons in UED as special cases. We investigate to which extent variables that were proposed in the literature can discriminate between different spin scenarios. We then examine how different mass and coupling scenarios can influence the discrimination power of those variables.

T 15.7 Mo 18:15 VG 3.102

Long-lived staus in a simplified model approach at the LHC — •Jan Heisig, Joern Kersten, and Boris Panes — II. Institute for Theoretical Physics, University of Hamburg, Germany

We present the phenomenology of the gravitino dark matter scenario at the LHC. We consider the case that the next-to-lightest supersymmetric particle (NLSP) is the lighter stau. For a wide range of gravitino masses the lighter stau is stable on the scale of a detector. Such a particle will give rise to a prominent signature as a *slow muon*. The dominant production channel of staus depends strongly on the hierarchy of the mass spectrum. However, due to the directly detectable stau one is not forced to rely solely on the observation of highly energetic standard model (SM) particles coming either from decay chains or from initial state radiation. This is why in a long-lived stau scenario there are fewer regions in parameter space where the theory is hidden from observation, compared to the neutralino LSP scenario where compressed spectra as well as highly stretched spectra effectively hide from observation. We study the LHC sensitivity and examine its dependence on the spectrum with an emphasis on the strong production and decay. Unlike most existing studies we don't restrict ourselves to specific supersymmetry breaking models and benchmark points but aim for a model-independent analysis along the lines of the so-called simplified models.

T 15.8 Mo 18:30 VG 3.102

Anomalous Top Couplings in Whizard 2 — •Fabian Bach and Thorsten Ohl — Institut für Theoretische Physik und Astrophysik, Uni Würzburg

The origin of the quark mass hierarchy within the Standard Model (SM) is still unclear. The top quark is particularly interesting because of its natural Yukawa coupling strength and corresponding large mass. The latter has made it hard to access experimentally so far. At the LHC, however, large abundances of top quarks are being produced over the next years, providing the statistics necessary to measure various properties of the top quark with high precision. Using effective field theory, it is possible to parameterize any new physics contributing to top interactions via anomalous top quark–gauge boson couplings $tt\gamma$, ttZ, tbW and ttg, while contact terms (e. g. $ttgg$) have to be included in general to ensure gauge invariance. The full gauge-invariant set of operators leading to anomalous trilinear top couplings has been implemented into the parton-level Monte Carlo generator WHIZARD 2 to provide a consistent tool for MC studies of the complete hard scattering amplitudes including decays of top quarks and heavy gauge bosons as well as all irreducible backgrounds. We show results in the anomalous tbW sector, focussing on the influence of off-shell interactions required by the completeness of the operator basis, and finally discuss sensitive kinematic distributions to discriminate different operator contributions.

T 15.9 Mo 18:45 VG 3.102

A generalized Narrow-Width Approximation for interference effects in the MSSM — •Elina Fuchs[1,2], Georg Weiglein[1], and Silja Brensing[1] — [1]DESY Hamburg — [2]Georg-August-Universität Göttingen

The "Narrow-Width Approximation" is a convenient tool for the factorisation of a more complicated process into production and subsequent decay of a particle with a small width compared to its mass.

However, this approximation cannot be applied in the case of sizable interferences between propagator contributions of different particles that are close to their mass shell. The spectrum of the MSSM may contain particles with a mass difference of the order of their decay widths. In order to deal with such a situation, a generalisation of the usual Narrow-Width Approximation is analysed which allows for a consistent treatment of interference effects between such nearly mass-degenerate particles.

The phenomenological consequences will be discussed for the example process of Higgs boson production and subsequent decay from the decay of a heavy neutralino. Vertex corrections are included at the one-loop level in an on-shell renormalisation of the neutralino sector.