

## T 17: Beyond the Standard Model (Theorie) 4

Convenor: Andreas Weiler

Zeit: Mittwoch 16:45–18:45

Raum: WIL-A124

T 17.1 Mi 16:45 WIL-A124

**Squark Pair Production at NLO** — MICHAEL KRÄMER<sup>1</sup>, MATHIEU PELLEN<sup>1</sup>, CHRISTIAN HANGST<sup>2</sup>, MARGARETHE MÜHLLEITNER<sup>2</sup>, EVA POPENDA<sup>3</sup>, and MICHAEL SPIRA<sup>3</sup> — <sup>1</sup>RWTH Aachen University, Institut für Theoretische Teilchenphysik und Kosmologie — <sup>2</sup>KIT, Institut für Theoretische Physik — <sup>3</sup>PSI, Theory Group LTP

A lot of effort is and will be put in the search for supersymmetric particles at the LHC. For the interpretation of the experimental data precise theoretical predictions are crucial. The work presented in the talk contributes to this effort by providing NLO corrections to the pair production of squarks of the first two generations in a flexible partonic Monte Carlo program. In contrast to previous works no assumptions regarding the squark masses have been made and the different subchannels have been treated independently. The Monte Carlo framework allows investigating the impact of the supersymmetric QCD corrections at NLO on arbitrary distributions.

T 17.2 Mi 17:00 WIL-A124

**Combining squark production and decay at NLO QCD** — WOLFGANG HOLLIK, JONAS LINDERT, and DAVIDE PAGANI — Max-Planck-Institut für Physik, München, Germany

In this talk I discuss new precision calculations for combined squark production and decay in next-to-leading order QCD at the LHC. On the one hand, an analysis of the signature  $2j + \cancel{E}_T(+X)$  via squark-squark production and direct decays into the lightest neutralino is presented. Resulting differential distributions are compared with leading-order approximations rescaled by a flat K-factor and a possible impact on cut-and-count searches for supersymmetry at the LHC is examined. On the other hand, the signature  $2j+2l+\cancel{E}_T(+X)$  from squark-squark production and decay into a lightest and a second lightest neutralino, with a subsequent EW decay chain via an on-shell slepton, is investigated. The impact of NLO corrections on resulting invariant mass distributions is highlighted. Such distributions can be important for future determination of SUSY parameters.

T 17.3 Mi 17:15 WIL-A124

**Supersymmetric cascade decays at next to leading order: Squark decay** — MATHIEU PELLEN<sup>1</sup>, RYAN GAVIN<sup>2</sup>, CHRISTIAN HANGST<sup>3</sup>, MICHAEL KRÄMER<sup>1</sup>, MARGARETHE MÜHLLEITNER<sup>3</sup>, EVA POPENDA<sup>2</sup>, and MICHAEL SPIRA<sup>2</sup> — <sup>1</sup>RWTH Aachen University - Institute for Theoretical Particle Physics and Cosmology, Aachen, Germany — <sup>2</sup>Paul Scherrer Institut - Theory Group LTP, Villigen, Switzerland — <sup>3</sup>KIT - Institut für Theoretische Physik, Karlsruhe, Germany

The search for a supersymmetric version of the standard model is a central task of the Large Hadron Collider. The interpretation of the experimental data requires accurate and flexible theoretical predictions. We present a new calculation of the next-to-leading order supersymmetric-QCD corrections to the production and the decay of supersymmetric particles. In particular, we provide fully differential cross sections in a partonic Monte Carlo program. We will focus our discussion on the production of squarks which then directly decay into the lightest supersymmetric particle and jets. The methods used and some exemplary results will be presented.

T 17.4 Mi 17:30 WIL-A124

**$\tilde{q}\tilde{q}$ -production at NLO merged with parton-shower** — CHRISTIAN HANGST<sup>1</sup>, MICHAEL KRÄMER<sup>2</sup>, MARGARETHE MÜHLLEITNER<sup>1</sup>, EVA POPENDA<sup>3</sup>, and MICHAEL SPIRA<sup>3</sup> — <sup>1</sup>KIT - Institut für Theoretische Physik — <sup>2</sup>RWTH Aachen University - Institut für Theoretische Teilchenphysik und Kosmologie — <sup>3</sup>Paul Scherrer Institut - Theory Group LTP

Precise predictions for the production of SUSY-particles at the LHC require the combination of fixed-order NLO-calculations and parton-showers. This so-called merging can be achieved via the POWHEG-method. I present some results obtained with this method for  $\tilde{q}\tilde{q}$ -production, based on the implementation of this process in the program-package POWHEG-BOX.

T 17.5 Mi 17:45 WIL-A124

**Slepton Pair Production in the POWHEG BOX** — BARA

JÄGER, ANDREAS VON MANTEUFFEL, and STEPHAN THIER — PRISMA Cluster of Excellence, Institute of Physics (THEP), Johannes Gutenberg University, 55099 Mainz, Germany

We present an implementation for slepton pair production at hadron colliders in the POWHEG BOX, a framework for combining next-to-leading order QCD calculations with parton-shower Monte-Carlo programs. Our code provides a SUSY Les Houches Accord interface for setting the supersymmetric input parameters. Decays of the sleptons and parton-shower effects are simulated with PYTHIA. Our Monte-Carlo program allows the generation of events, and thus of arbitrary distributions with appropriate selection cuts. Kinematic distributions of experimentally observable quantities are shown for a representative point in the supersymmetric parameter space.

T 17.6 Mi 18:00 WIL-A124

**Resummation predictions for supersymmetric electroweak particles** — BENJAMIN FUKS<sup>1</sup>, MICHAEL KLASSEN<sup>2</sup>, DAVID R. LAMPREA<sup>2</sup>, and MARCEL ROTHERING<sup>2</sup> — <sup>1</sup>Institut Pluridisciplinaire Hubert Curien/Département Recherches Subatomiques, Université de Strasbourg — <sup>2</sup>Institut für Theoretische Physik, Westfälische Wilhelms-Universität Münster

Since the discovery of a particle consistent with the properties of the Standard Model Higgs the experimentalists' effort of ATLAS and CMS at the LHC has been shifted towards the production of electroweak supersymmetric particles.

In our work we have updated the resummation results for gauginos and sleptons with next-to-leading logarithmic accuracy matched to next-to-leading order computations for a center of mass energy of 8 TeV. We have used benchmark points for minimal supergravity breaking scenarios which are recently adopted by the experimental collaborations and motivated by the magnetic moment of the muon. Tables of total cross sections including scale and parton distribution function uncertainties are presented together with invariant mass and transverse momentum distributions. As expected, the resummation results reduce the scale dependence and ensure the convergence in the small transverse momentum region. The production of the lightest chargino with the next-to-lightest neutralino leads to the largest cross section of  $\mathcal{O}(10\text{ fb})$  for masses of a few hundred GeV. Due to the considered mixing in the third generation of sleptons the  $\tilde{\tau}_1\tilde{\tau}_1^*$  production cross section can also reach the fb-region for the same benchmark point. The gauginos would give rise to the largest cross section and are probably soon accessible at the LHC being the first detected supersymmetric particles.

T 17.7 Mi 18:15 WIL-A124

**Relic abundance calculation for generic neutralino LSP dark matter including Sommerfeld enhancements** — MARTIN BENEKE<sup>1</sup>, CHARLOTTE HELLMANN<sup>1</sup>, and PEDRO RUIZ-FEMENIA<sup>2</sup> — <sup>1</sup>TU Muenchen — <sup>2</sup>IFIC Valencia

We set up a non-relativistic effective field theory for a set of slowly moving, nearly mass-degenerate but generically composed TeV scale neutralinos and charginos in the MSSM, providing a systematic expansion in the small velocities and mass-differences of the involved non-relativistic particles. In this framework we calculate Sommerfeld enhanced (co-)annihilation cross sections, that enter the thermal relic abundance calculation for a TeV scale neutralino LSP as promising cold dark matter candidate in the MSSM. Our approach includes the previously unknown off-diagonal annihilation matrix entries for a generic MSSM parameter space point and allows for the study of Sommerfeld enhanced  $P$ - and next-to-next-to leading order  $S$ -wave annihilations including terms proportional to mass-differences of the annihilating particles. We discuss the EFT setup as well as its application to the dark matter relic abundance calculation.

T 17.8 Mi 18:30 WIL-A124

**SUSY-QCD corrections to (co)annihilation and their impact on the relic density** — JULIA HARZ<sup>1</sup>, BJÖRN HERRMANN<sup>2</sup>, MICHAEL KLASSEN<sup>3</sup>, KAROL KOVARIK<sup>4</sup>, and QUENTIN LE BOULCH<sup>5</sup> — <sup>1</sup>Deutsches Elektronen-Synchrotron, Hamburg, Germany — <sup>2</sup>Laboratoire d'Annecy de Physique Théorique, Annecy-le-Vieux, France — <sup>3</sup>Institute for Theoretical Physics, University of Münster,

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Germany — <sup>4</sup>Karlsruhe Institute of Technology, Karlsruhe, Germany  
— <sup>5</sup>Laboratoire de Physique Subatomique et de Cosmologie, Grenoble,  
France

We computed the full  $O(\alpha_s)$  supersymmetric QCD corrections for neutralino-stop co-annihilation in the Minimal Supersymmetric Standard Model (MSSM). It will be shown that these annihilation channels are phenomenologically relevant within the so-called phenomenologi-

cal MSSM, in particular in the light of the observation of a Higgs-like particle with a mass of about 126 GeV at the LHC. Numerical results for the co-annihilation cross sections and the predicted neutralino relic density are presented. It will be demonstrated that the impact of including these corrections on the cosmologically preferred region of parameter space is larger than the current experimental uncertainty from WMAP data.