T 32: Jenseits des Standardmodells 1 (Theorie)

Zeit: Montag 16:45–19:00 Raum: K.12.23 (K1)

T 32.1 Mo 16:45 K.12.23 (K1)

Next-to-leading order accuracy and spin effects for squark-gluino production and decay — •Mathieu Pellen[1], Ryan Gavin[2], Christian Hangst[3], Michael Kraemer[1], Margarete Muehlleitner[3], Eva Popenda[2], Michael Spira[2], and Alexander Wlotzka[3] — [1]RWTH Aachen, Institut fuer Theoretische Teilchenphysik und Kosmologie — [2]Paul Scherrer Institut, Theory Group LTP — [3]KIT, Institut fuer Theoretische Physik

The search for supersymmetry 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 decay of squarks and gluinos. In particular, we provide fully differential cross sections. We will focus our discussion on the production and decay of squarks and gluinos. Gluinos decay into squarks and jets while squarks directly decay into the lightest supersymmetric particle and jets. In this process, the spin of the gluino can have a substantial effect. The methods used and some exemplary results will be presented.

T 32.2 Mo 17:00 K.12.23 (K1)

Threshold Resummation for Squark and Gluino Production at the LHC — Wim Beenakker[1], •Christoph Borschensky[2], Michael Krämer[3], Anna Kulesza[2], Eric Laenen[4], Vincent Theeuwes[2], and Silja Thewes[5] — [1]Theoretical High Energy Physics, IMAPP, Radboud University Nijmegen, The Netherlands — [2]Institute for Theoretical Physics, WWU Münster — [3]Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen — [4]Nikhef Theory Group, Amsterdam, The Netherlands — [5]DESY Theory Group, Hamburg

The search for supersymmetry is one of the main tasks of the Large Hadron Collider (LHC). Precise theoretical calculations of production cross sections are very important for the analysis of experimental data. Beyond leading order in the computation of cross sections, large logarithmic terms arise in certain kinematical regions, endangering the perturbative expansion. Threshold resummation is a method to treat these terms in a systematic manner. It is known to have a significant impact on production cross sections and their theoretical uncertainties.

After a short introduction on threshold resummation, I will present the latest results for squark and gluino production cross sections including soft-gluon corrections up to next-to-next-to-leading logarithmic accuracy, with a particular focus on the production of stops. Additionally, so-called hard-matching coefficients and Coulomb contributions are included. In light of the next LHC run, results for 13 and 14 TeV and higher energies will be shown.

T 32.3 Mo 17:15 K.12.23 (K1)

Limits and Fits from Simplified Models — Lisa Edelhäuser[1], Jan Heisig[1], Michael Krämer[1], Lennart Oymanns[1], •Jory Sonneveld[1], and Wolfgang Waltenberger[2] — [1]Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen, Germany — [2]HEPHY Institute for High Energy Physics, Vienna, Austria

With new results and limits on constrained models of supersymmetry (SUSY) from the ATLAS and CMS collaborations at the LHC, questions arise about what these limits imply for more general models of SUSY or other models for physics beyond the Standard Model. Since SUSY has a vast array of parameters, both collaborations also quantify their search results in terms of simplified models, augmenting the particle spectrum of the standard model with only a very limited set of new, hypothetical particles.

In our work presented here, we focus on all-hadronic (multijet plus missing transverse energy) searches at the LHC and test the usability of simplified models parametrized by the squark and lightest SUSY particle (LSP) masses. By comparing results of these simplified models to more realistic models of squark production, we show that despite some underlying differences it is possible to use simplified models to estimate limits on both SUSY and same-spin BSM models. We also find good agreement between our results and those of SModelS, a tool for interpreting simplified model LHC results. Finally, we use simplified models for fits of supersymmetric models.

T 32.4 Mo 17:30 K.12.23 (K1)

The Simplified Models Approach to Constraining Supersymmetry — •Genessis Perez R[1] and Suchita Kulkarni[2] — [1]Institut für Theoretische Physik, Karlsruher Institut für Technologie (KIT), Wolfgang-Gaede-Str. 1, 76131 Karlsruhe Germany — [2]Laboratoire de Physique Subatomique et de Cosmologie, Université Grenoble Alpes, CNRS IN2P3, 53 Avenue des Martyrs, 38026 Grenoble France

The interpretation of the experimental results at the LHC are model dependent, which implies that the searches provide limited constraints on scenarios such as supersymmetry (SUSY). The Simplified Models Spectra (SMS) framework used by ATLAS and CMS collaborations is useful to overcome this limitation. SMS framework involves a small number of parameters (all the properties are reduced to the mass spectrum, the production cross section and the branching ratio) and hence is more generic than presenting results in terms of soft parameters.

In our work, the SMS framework was used to test Natural SUSY (NSUSY) scenario. To accomplish this task, two automated tools (SModelS and Fastlim) were used to decompose the NSUSY parameter space in terms of simplified models and confront the theoretical predictions against the experimental results. The achievement of both, just as the strengths and limitations, are here expressed for the NSUSY scenario.

T 32.5 Mo 17:45 K.12.23 (K1)

Killing the CMSSM softly — Philip Bechtle[1], Klaus Desch[1], Herbert K. Dreiner[1,2], Matthias Hamer[3], Michael Krämer[4,5], Ben O'Leary[6], Werner Porod[6], •Björn Sarrazin[1], Tim Stefaniak[7], Mathias Uhlenbrock[1], and Peter Wienemann[1] — [1]Physikalisches Institut, University of Bonn, Germany — [2]Bethe Center for Theoretical Physics, University of Bonn, Germany — [3]Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil — [4]Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen, Germany — [5]SLAC National Accelerator Laboratory, Stanford University, USA — [6]Institut für Theoretische Physik und Astrophysik, University of Würzburg, Germany — [7]Santa Cruz Institute for Particle Physics, University of California, Santa Cruz, USA

Because of its simplicity the CMSSM is one of the best studied and most popular supersymmetric models. The non-observation of convincing hints of new physics at the LHC, however, becomes challenging for this model once constraints from low energy observables are taken into account. While this is well known, it has so far been an open question what that means quantitatively for the validity of the model. We will present the first systematic investigation of this question, using global toy fits to calculate p-values for the CMSSM. We combine constraints from low-energy and astrophysical observables, Higgs boson mass and rate measurements as well as the non-observation of new physics in searches for supersymmetry at the LHC. Using the framework Fittino, we perform global fits of the CMSSM to the toy data.

T 32.6 Mo 18:00 K.12.23 (K1)

$(g-2)_\mu$ in the MSSM with $\tan\beta \to \infty$ — •Markus Bach[1], Jaehyeon Park[2], Dominik Stöckinger[1], and Hyejung Stöckinger-Kim[1] — [1]Institut für Kern- und Teilchenphysik, TU Dresden — [2]Departament de Física Teòrica and IFIC, Universitat de València-CSIC

We investigate the MSSM for the exotic scenario $\tan\beta \to \infty$ where one of the Higgs doublets does not obtain a vacuum expectation value. This leads to the masses of the down-type fermions being created completely on loop level. The one-loop results for the self energies can be used to calculate the Yukawa couplings which is explicitly done for the muon and utilized to compute the supersymmetric contributions to its anomalous magnetic moment.

We identify the parameter regions in which these contributions are capable of explaining the discrepancy between Standard Model prediction and experimental result. Compared to the usual MSSM, this is possible with higher SUSY masses at the expense of a large muon Yukawa coupling. Other constraints like the metastability of the electroweak vacuum are considered as well.

T 32.7 Mo 18:15 K.12.23 (K1)

Unstable vacua in the MSSM — Markus Bobrowski[1], Guillaume Chalons[2], •Wolfgang G. Hollik[1], and Ulrich Nierste[1] — [1]Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]LPSC, Grenoble, France

The discovery of the lightest Higgs boson allows to set the stage for the MSSM Higgs sector. In the MSSM, however, $m_h \approx 126\,\mathrm{GeV}$ has to be accomplished for the cost of large parameters: sufficiently heavy stop masses and/or large left right mixing (A_t or μ which are known to destabilize the electroweak vacuum. An analysis of the one-loop effective potential shows yet undescribed constraints from the formation of a deeper minimum at the SUSY scale. This type of deeper minima only shows up at the loop-level and also in a regime which is free of charge and colour breaking minima at the tree-level.

Building a phenomenological viable effective potential, we take care of the right Higgs mass and show exclusions on $\mu \tan\beta$ where A_t is fixed by m_h. We also show a sample point at the border between stable and instable configurations. The transition into the deeper minima would occur instantaneously, therefore the exclusion bounds are strict.

T 32.8 Mo 18:30 K.12.23 (K1)

N=1 Supersymmetric Yang-Mills theory on the lattice — •Stefano Piemonte — WWU Münster

The N=1 Super Yang-Mills theory is the supersymmetric extension of the pure gauge sector of QCD. The theory describes the strong interactions between gluons and gluinos, the gauge bosons and their fermion superpartners respectively. Effective models have been proposed to describe the bound spectrum of the theory. The expectation value of many observables can be computed exactly, providing important predictions that can be eventually extended to QCD. Lattice investigations can provide a closer insight to these results, but unfortunately a finite lattice spacing breaks SUSY explicitly. Recent results demonstrate the restoration of SUSY in the continuum limit and will be presented during the talk.

T 32.9 Mo 18:45 K.12.23 (K1)

Leading hadronic contributions to the leptons $(g-2)$, α_{QED} and $\sin^2(\theta_W)$ from twisted mass LQCD — •Grit Hotzel[1], Florian Burger[1], Karl Jansen[2], and Marcus Petschlies[3] — [1]Humboldt-Universität zu Berlin, Institut für Physik, Newtonstr. 15, D-12489 Berlin, Germany — [2]John von Neumann Institute for Computing (NIC), DESY, Platanenallee 6, D-15738 Zeuthen, Germany — [3]The Cyprus Institute, P.O. Box 27456, 1645 Nicosia, Cyprus

We present our results for the leading-order hadronic contributions to the electron, the muon, and the tau anomalous magnetic moments obtained with four dynamical quarks. Performing the continuum limit and an analysis of systematic effects, full agreement with phenomenological results is found. To estimate the impact of omitting the quark-disconnected contributions to the hadronic vacuum polarization we investigate them on one of the four-flavour ensembles. Additionally, the light quark contributions on the four-flavour sea are compared to the values obtained for $N_f = 2$ physically light quarks. Furthermore, the correspondig results for the leading hadronic contribution to the running of the finestructure constant and the weak mixing angle in the low-momentum region will be provided.