T 17: Beyond the Standard Model (Theorie) I

Convenor: Margarete Mühlleitner

Zeit: Montag 16:45–19:15   Raum: HG XIV

T 17.1 Mo 16:45 HG XIV

Relation between dimensional reduction and dimensional regularization to two loops — •Jonas Kleine — TTP Karlsruhe

Within supersymmetric theories one uses in general dimensional reduction (DRED) in order to regularize the occurring divergences. However, quite often it is convenient to apply dimensional regularization (DREG) for the practical evaluation of the Feynman integrals. Afterwards the transition to DRED is achieved by finite shifts of the parameters. In this talk we discuss for various couplings and masses the relation between DREG and DRED within supersymmetric QCD.

T 17.2 Mo 17:00 HG XIV

Schwellenkorrekturen in Großen Vereinheitlichten Theorien — •Waldemar Martens, Luminita Mihaila, and Matthias Steinhauser — Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology

Im MSSM liefert das Treffen der Eichkopplungen bei einer Energieskala von ca. 10^{17} GeV, neben zahlreichen anderen theoretischen Gründen, einen wichtigen Hinweis auf die mögliche Existenz einer einfachen Eichgruppe bei hohen Energien. Ist eine solche Eichgruppe (bspw. SU(5) oder SO(10)) mit einer einzigen Eichkopplung in der Natur realisiert, so lässt sich dies Überprüfen, indem man die durch diese Einschränkung vorhergesagten Werte der Eichkopplungen bei der elektroschwachen Skala mit den experimentellen Werten vergleicht. Dafür ist es unter anderem notwendig, sogenannte Schwellenkorrekturen an der GUT-Skala im Laufen der Eichkopplungen zu berücksichtigen. Diese "Sprünge" in den Eichkopplungen werden durch das Ausintegrieren der schweren Freiheitsgrade der GUT-Theorie verursacht und sind bisher zur Ein-Schleifen-Näherung bekannt. Um die theoretische Unsicherheit dieser Vorhersage weiter zu reduzieren und mit der experimentellen Unsicherheit zu konkurrieren, sollen diese Schwellenkorrekturen für die Eichkopplungen möglichst modellunabhängig in Zwei-Schleifen-Näherung berechnet werden.

T 17.3 Mo 17:15 HG XIV

On the calculation of threshold corrections in the constrained exceptional supersymmetric standard model (cE$_6$SSM) — •Alexander Voigt — Institut für Kern- und Teilchenphysik, Technische Universität Dresden

The constrained exceptional supersymmetric standard model (cE$_6$SSM) is an extension of the MSSM based on an E$_6$ gauge group, motivated by Grand Unification and the μ problem.

In this talk the calculation of threshold corrections in the cE$_6$SSM is presented. The results are combined with known 2-loop renormalization group equations and are incorporated into a particle spectrum generation program to obtain a more precise prediction of particle masses in the cE$_6$SSM.

T 17.4 Mo 17:30 HG XIV

Production of squarks and gluinos at the LHC: The electroweak contributions — •Jan Germer[1], Wolfgang Hollik[1], Edoardo Mirabella[2], and Maike Trenkel-Lenz[3] — [1]Max-Planck-Institut für Physik, 80805 München, Deutschland — [2]Institut de Physique Théorique, CEA/Saclay, 91191 Gif-sur-Yvette-Cedex, France — [3]University of Wisconsin, Madison, WI, 53706, USA

If supersymmetry (SUSY) is realized at the TeV scale color–charged SUSY particles will be produced at high rate at the LHC, since the dominant production mechanisms are QCD mediated. While the LO and NLO contributions to the cross sections are well known, also electroweak (EW) contributions have to be taken into account for a reliable prediction. We first give an short overview over the class of processes and then focus on the tree-level and NLO EW contributions to squark and gluino production at the LHC. Even though EW contributions are typically small in the inclusive cross section, they can become important for specific subprocesses and in kinematic distributions. Numerical results for the different production processes will be presented.

T 17.5 Mo 17:45 HG XIV

Gluino pair production close to threshold — •Matthias Kauth, Johann H. Kühn, Peter Marquard, and Matthias Steinhauser — Karlsruher Institut für Technologie

Supersymmetry (SUSY) is one of the most promising candidates for physics beyond the Standard Model. If SUSY exists and if it appears at the TeV scale, we will observe pair production of gluinos at the LHC. Although the production cross section, including higher oder corrections, is known, binding effects between the two particles have to be included into the analysis of hadroproduction. Attractive colour representations for the bound states of two gluinos enhance the cross section in particular below threshold if the decay rate of a single gluino is smaller than the level spacing between the resonance peaks. Next-to-leading order corrections for the various subprocesses are presented in analytic form together with numerical results for the production cross sections.

T 17.6 Mo 18:00 HG XIV

Soft-gluon resummation for squark and gluino hadroproduction — Wim Beenakker[1], •Silja Brensing[2], Michael Krämer[2], Anna Kulesza[2], Eric Laenen[3,4,5], and Irene Niessen[1] — [1]Theoretical High Energy Physics, Radboud University Nijmegen, Nijmegen, The Netherlands — [2]Institut für Theoretische Physik, RWTH Aachen University, Aachen, Germany — [3]IFTA, University of Amsterdam, Amsterdam, The Netherlands — [4]ITF, Utrecht University, Utrecht, The Netherlands — [5]Nikhef Theory Group, Amsterdam, The Netherlands

We consider the resummation of soft gluon emission for squark and gluino hadroproduction at next-to-leading-logarithmic (NLL) accuracy in the framework of the minimal supersymmetric standard model. We present analytical results for squark-squark and squark-gluino production and provide numerical predictions for all squark and gluino pair-production processes at the Tevatron and at the LHC. Moreover we present analytical and numerical results for top-squark pair-production. The size of the soft-gluon corrections and the reduction in the scale uncertainty are most significant for processes involving gluino production. At the LHC, where the sensitivity to squark and gluino masses ranges up to 3 TeV, the corrections due to NLL resummation over and above the NLO predictions can be as high as 35% in the case of gluino-pair production, whereas at the Tevatron, the NLL corrections are close to 40% for squark-gluino final states with sparticle masses around 500 GeV.

T 17.7 Mo 18:15 HG XIV

NNLO SUSY-QCD corrections to production and decay of Higgs-bosons at LHC — •Nikolai Zerf and Matthias Steinhauser — TTP Karlsruhe

The gluon fusion process is often described within the framework of an effective theory where all heavy particles are integrated out. We consider NNLO supersymmetric QCD corrections to the effective Higgs-gluon coupling for various hierarchies of the squark, topquark and gluino masses. Numerical results are discussed for typical supersymmetric scenarios.

T 17.8 Mo 18:30 HG XIV

Higgs coupling to bottom quarks: SUSY QCD corrections at NNLO — Luminita Mihaila and •Christoph Reisser — Institut für Theoretische Teilchenphysik (TTP), Karlsruhe Institute of Technology (KIT)

The coupling of a neutral Higgs boson in the Minimal Supersymmetric Standard Model to bottom quarks is studied. Using a low energy theorem for Higgs interactions we compute two-loop corrections induced by Quantum Chromodynamics that involve supersymmetric particles. A discussion of the reduced renormalization scale uncertainty and the numerical effects of the results is given.

T 17.9 Mo 18:45 HG XIV

$\Gamma(Z \to b\bar{b})$ **to NNLO in the MSSM** — •Ralf Paulig — TTP Karlsruhe

The inclusive decay rate of a Z boson into bottom quarks is computed in the framework of supersymmetric QCD to NNLO accuracy. We apply asymptotic expansion to obtain analytical results for different hierarchies in the supersymmetric particle specturm. The numerical implications are briefly discussed for the SPS benchmark points.

T 17.10 Mo 19:00 HG XIV

The strong coupling constant beyond the SUSY scale — Lu-
minita Mihaila, •Jens Salomon, and Matthias Steinhauser —
Institut für Theoretische Teilchenphysik, Karlsruhe, Deutschland

Given the value of the strong coupling constant at the electroweak
scale, we determine its precise value beyond the SUSY scale in the
framework of the Minimal Supersymmetric Standard Model (MSSM).
Therefore, we evaluate its matching coefficient connecting the Stan-
dard Model and the MSSM at two-loop order considering contributions
involving Yukawa couplings and the strong coupling constant. This al-
lows for a consistent and phenomenologically viable evaluation of the
strong gauge coupling at three-loop order up to high energy scales.