T 15: Beyond the Standard Model (Theorie) I

Zeit: Montag 16:45–19:15 Raum: KGI-HS 1021

T 15.1 Mo 16:45 KGI-HS 1021

Running bottom quark mass at the GUT scale — Luminita Mihaila, •Jens Salomon, and Matthias Steinhauser — Institut für Theoretische Teilchenphysik (TTP), 76128 Karlsruhe, Germany

In the framework of the Minimal Supersymmetric Standard Model (MSSM) we establish the relation between the bottom quark mass m_b at the electroweak and the GUT scale. We describe in detail the transition from the $\overline{\rm MS}$ to the $\overline{\rm DR}$ scheme, the matching between QCD and the MSSM, and the running both in the effective and full theory. Our set-up allows for a consistent analysis of $m_b(\mu_{\rm GUT})$ up to three loops which signifantly reduces the dependence on the matching scale between QCD and the MSSM.

T 15.2 Mo 17:00 KGI-HS 1021

Große Vereinheitlichung in supersymmetrischen Theorien — •Nicolai Braschos und Robert Harlander — Fachbereich C, Bergische Universität Wuppertal, 42097 Wuppertal

Die Energieabhängigkeit der elektromagnetischen, schwachen und starken Kopplungskonstanten im Standardmodell legt die Möglichkeit nahe, dass die Eichgruppe des Standardmodells durch Symmetriebrechung bei einer sehr hohen Energieskala aus einer einfachen, übergeordneten Gruppe hervorgeht. Die Verknüpfung der Kopplung in dieser sogenannten Großen Vereinheitlichten Theorie mit den Kopplungen des Standardmodells erfordert die konsistente Berücksichtigung von höheren Ordnungen in den β-Funktionen und den Matching-Relationen an Teilchenschwellen.

Im Standardmodell selbst ist eine Große Vereinheitlichung bereits ausgeschlossen. In supersymmetrischen Theorien hängt sie von den bislang unbekannten Parametern ab. Wir untersuchen diese Abhängigkeit auf systematische Art und Weise, um dadurch mehr oder weniger bevorzugte Parameterbereiche zu identifizieren.

T 15.3 Mo 17:15 KGI-HS 1021

Electroweak Contributions to Squark Pair Production — •Sascha Bornhauser, Manuel Drees, Herbi Dreiner, and Jong Soo Kim — Physikalisches Institut, Universität Bonn, Nussallee 12, D53115 Bonn

If supersymmetry exists, the production of squark pairs is expected to play an important role at the Large Hadron Collider. Therefore, accurate predictions for their cross section are obviously of great interest. We computed the complete leading order contributions to squark pair production including electroweak s–,t– and u–channel diagrams. We show that the dominant new contributions are from the interference between electroweak and QCD interactions. These contributions can amount up to 10 to 20% for typical mSUGRA scenarios and the production of $SU(2)$ doublet squarks. The size of the corrections lies between -40 and +55% for more general scenarios, depending on size and sign of the SU(2) gaugino mass.

The electroweak contributions can give rise to a rapidity region into which no QCD radiation is emitted. The reason for this is that electroweak interactions can produce a squark pair without any color connection between the squarks. These supersymmetric rapidity gap events might be detectable at the Large Hadron Collider.

T 15.4 Mo 17:30 KGI-HS 1021

Resonant single slepton production with a stau LSP — Herbi Dreiner[1], •Sebastian Grab[1], and Maike Trenkel[2] — [1]Physikalisches Institut, Bonn, Germany — [2]MPI für Physik, München, Germany

Minimal supergravity (mSUGRA) models for the MSSM provide a scalar tau beside a neutralino as lightest supersymmetric particle (LSP) canditate. For cosmological reasons, a stable LSP has to be be electrically and color neutral. Therefore, the region with a stau LSP is excluded. If R-Parity is violated, the stau will decay into SM particles and does not contribute to dark matter anymore. That reopens the stau LSP parameter space.

We assume mSUGRA models with a stau LSP with only one lepton number violating operator at the GUT scale. This operator will generate additional R-Parity violating couplings at the electroweak scale, violating the same lepton number. We discuss the phenomenology of resonant single slepton production at the LHC within mSUGRA scenarios with a stau LSP. We point out that the production and the decay of the slepton can be driven by different R-Parity violating operators. We classify possible signatures and give signal rates for like sign muon events.

T 15.5 Mo 17:45 KGI-HS 1021

Sneutrino LSPs in R-Parity violating minimal supergravity models — Markus Bernhardt, Siba Das, Herbi Dreiner, and •Sebastian Grab — Physikalisches Institut, Bonn, Germany

We consider the minimal supergravity model (mSUGRA) with one additional R-Parity violating operator at the GUT scale. This alters the standard mSUGRA mass spectrum due to the additional R-Parity violating terms in the renormalization group equations.

We show that a lepton number violating operator at the GUT scale can lead to a sneutrino as the lightest supersymmetric particle (LSP). We investigate in detail the conditions leading to a sneutrino LSP. We take into account restrictions from precision measurements like the anomalous magnetic moment of the muon. We also give examples for collider signatures at the Tevatron and at the LHC. Resonant single sneutrino and slepton production and typical hadronic sneutrino decays will lead to characteristic event signatures at colliders.

T 15.6 Mo 18:00 KGI-HS 1021

Vector boson production as background in SUSY searches at the LHC — •Altan Cakir[1], Wim de Boer[2], Daniel Daeuwel[3], Martin Niegel[4], Valery Zhukov[5], and Eva Ziebarth[6] — [1]Institute Experimentelle Kernphysik , KIT — [2]Institute Experimentelle Kernphysik , KIT — [3]Institute Experimentelle Kernphysik , KIT — [4]Institute Experimentelle Kernphysik , KIT — [5]Institute Experimentelle Kernphysik , KIT — [6]Institute Experimentelle Kernphysik , KIT

With the start of LHC data taking the detector performance and the realistic estimation of the Standard Model (SM) background are important to search for new physics discovery channels.Our interest is focused on the scenario, suggested by the interpretation of the EGRET excess of diffuse Galactic gamma rays as a signal of dark matter annihilation. The prime signatures distinguishing gluino productions from the SM background are jet multiplicity and missing transverse energy. In this talk the background studies based on the differences of vector boson production with Alpgen,Sherpa and Pythia generators, are compared in view of possible effects for the SUSY searches.

T 15.7 Mo 18:15 KGI-HS 1021

Mass Factorization in Dimensional Reduction — •Lisa Edelhäuser and Werner Porod — Institut für Theoretische Physik und Astrophysik, Universität Würzburg

Within the MSSM we study NLO corrections to stop production at the LHC using the dimensional reduction scheme. We demonstrate explicitly that mass factorization works in this scheme by using a recently proposed method which treats the so-called epsilon scalars as particles of its own.

T 15.8 Mo 18:30 KGI-HS 1021

NLO electroweak corrections to $\tilde{g}\tilde{g}$ production at the LHC — •Edoardo Mirabella and Wolfgang Hollik — Max-Planck-Institut für Physik, München

At the LHC colored particles can be searched for most efficiently. Thus supersymmetry can be discovered looking at squarks and gluinos production processes. One of the most promising channel is the production of a pair of gluinos. In this talk the full $O(\alpha_s^2\alpha)$ corrections to this process will be presented

T 15.9 Mo 18:45 KGI-HS 1021

Mass determination of invisibly decaying sneutrinos at the ILC — •Tania Robens[1], Wolfgang Kilian[2], and Juergen Reuter[3] — [1]RWTH Aachen, Institut fuer Theoretische Physik E — [2]Universitaet Siegen, Theoretische Physik 1 — [3]Universitaet Freiburg, Physikalisches Institut

For points in SUSY parameter space where the sneutrino is the NLSP, direct mass determination from pair production is impossible since they decay invisibly. For such a scenario, we investigate the precision of the sneutrino mass determination by the means of three particle

decays in chargino pair production at the ILC. The SM and SUSY backgrounds are included in our study using full matrix elements from the event generator WHIZARD, as well as smearing effects from ISR and beamstrahlung. Especially, off-shell intermediate states lead to a shift in the mass edge distributions from which the sneutrino and chargino mass are determined.

T 15.10 Mo 19:00 KGI-HS 1021

Tau polarisation as sensitive probe for CP violation in chargino production at the ILC — •Anja Marold — Physikalisches Institut der Universität Bonn

The Minimal Supersymmetric Standard Model offers additional sources for CP-violating phases. In the chargino sector, this is the phase of the Higgsino mass parameter μ.

We study chargino production $e^+e^- \to \tilde{\chi}_i^+ \tilde{\chi}_j^-$ with longitudinally polarised beams and the ensuing two-body decay of one of the charginos into a tau $\tilde{\chi}_i^+ \to \tau^+ \tilde{\nu}_\tau$. We show that the transverse tau polarisation is highly sensitive to the phase of μ and define CP-asymmetries which probe the transverse tau-polarisation.

We present numerical results of the asymmetries which can be as large as 60% and discuss the importance of initial beam polarisations.