T 19: Beyond the Standard Model (Theorie) IV

Convenor: Werner Porod

Zeit: Freitag 14:00–16:00 Raum: 30.23: 6-1

T 19.1 Fr 14:00 30.23: 6-1

Impuls Rekonstruktion zur Untersuchung der CP-Verletzung im $\tilde{t_1}$-Kanal am LHC — Philip Bechtle[1], •Björn Gosdzik[1], Gudrid Moortgat-Pick[2], Krzysztof Rolbiecki[1] und Jamie Tattersall[3] — [1]DESY, Hamburg — [2]Universität Hamburg — [3]Universität Bonn

Die CP-Verletzung welche im Standard Model im K und B System gemessen wurde reicht nicht aus, um die Baryonen-Asymmetrie im Universum zu erklären. Daher werden weitere Ursachen für die Baryonen-Asymmetrie benötigt. Ein guter Kandidat ist CP-Verletzung in der supersymmetrischen Erweiterung des Standard Models.

In dieser Studie wird die Möglichkeit erforscht CP-verletzende Effekte in SUSY $\tilde{t_1}$ Zerfallsketten am LHC zu entdecken. Dabei wird ausgenutzt, dass Asymmetrien der Triple Produkte aller Teilchen aus dem Endzustand sensitiv auf CP-Verletzung sind. Dabei muss angenommen werden, dass die Massen aller am Zerfall beteiligten Teilchen aus anderen Messuing am LHC bekannt ist.

Insbesondere wurde der Zerfall $\tilde{t_1} \to t\chi_2^0$ untersucht, wobei das top quark zu 100% in ein bottom quark und ein W boson zerfällt, während das χ_2^0 weiter zerfällt zu $\chi_2^0 \to l\tilde{l}$ und weiter zu $\tilde{l} \to \chi_1^0 l$. Die Studie wurde für 500 fb^{-1} bei einer Schwerpunktsenergie von 14 TeV durchgeführt.

T 19.2 Fr 14:15 30.23: 6-1

Light Stop Decay in the MSSM with Minimal Flavor Violation — •Eva Popenda and Margarete Muhlleitner — ITP, Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany

The framework of minimal flavor violation provides a suitable solution to the New Physics Flavor Puzzle: All flavor changing transitions are governed by the CKM matrix. In particular there are no FCNC processes at tree level.

Accordingly the flavor changing neutral current (FCNC) decay $\tilde{t}_1 \to c + \tilde{\chi}_1^0$ is forbidden at tree level in this framework and goes through one-loop diagrams with charged particles in the loops. For a light stop, when its decays to third generation squarks are kinematically closed, this is the leading decay mode. We present a complete calculation of this process at the one loop level in the MSSM characterized by MFV at a scale μ_{MFV}.

However, the MFV assumption holds only at the scale μ_{MFV} and is violated by radiative corrections, leading to FCNC transitions at a scale $\mu \neq \mu_{MFV}$. These induced FCNC mixings follow from renormalization group equations (RGE) of the MSSM, which also take into account resummation effects. We investigate and compare the numerical impact of the results in the one-loop and the RGE approach.

T 19.3 Fr 14:30 30.23: 6-1

Discovering gravitino-stau scenarios at the LHC — •Jan Heisig and Jörn Kersten — University of Hamburg, II. Institute for Theoretical Physics, Hamburg, Germany

We present the phenomenology of the gravitino dark matter scenario at the large hadron collider (LHC) experiment. 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, the direct production (via the Drell-Yan process) is always present and independent of the remaining spectrum and thus sets a lower bound on the discovery potential of this scenario. In a careful analysis we show that this scenario will be found in the long-term LHC run for almost all reasonable assumptions for the mass spectrum including very high mass spectra as motivated from big bang nucleosynthesis (BBN) constraints.

T 19.4 Fr 14:45 30.23: 6-1

Precision Gauge Unification from Extra Yukawa Couplings — •Ivan Donkin[1] and Arthur Hebecker[2] — [1]Institut fuer Theoretische Physik, Universitaet Heidelberg, Philosophenweg 19, D-69120 Heidelberg, Germany — [2]Institut fuer Theoretische Physik, Universitaet Heidelberg, Philosophenweg 19, D-69120 Heidelberg, Germany

We investigate the impact of extra vector-like GUT multiplets on the predicted value of the strong coupling. We find in particular that Yukawa couplings between such extra multiplets and the MSSM Higgs doublets can resolve the familiar two-loop discrepancy between the SUSY GUT prediction and the measured value of alpha_3. Our analysis highlights the advantages of the holomorphic scheme, where the perturbative running of gauge couplings is saturated at one loop and further corrections are conveniently described in terms of wavefunction renormalization factors. If the gauge couplings as well as the extra Yukawas are of O(1) at the unification scale, the relevant two-loop correction can be obtained analytically. However, the effect persists also in the weakly-coupled domain, where possible non-perturbative corrections at the GUT scale are under better control.

T 19.5 Fr 15:00 30.23: 6-1

Three-loop anomalous dimensions for SUSY QCD — •Thomas Hermann, Luminita Mihaila, and Matthias Steinhauser — TTP Karlsruhe

In this talk the calculation of the three-loop $\overline{DR}$ renormalization constants for the top quark mass, the top squark masses and the corresponding mixing angle are discussed in the framework of SUSY QCD. We introduce the general framework and describe in detail the reconstruction of the exact mass-dependence of the dimension-two scalar correlators. From the renormalization constants the results for the corresponing anomalous dimensions is extracted.

T 19.6 Fr 15:15 30.23: 6-1

Minimal Supersymmetric SU(5) and Gauge Coupling Unification at Three Loops — Waldemar Martens, Luminita Mihaila, •Jens Salomon, and Matthias Steinhauser — Institut für Theoretische Teilchenphysik, Karlsruher Institut für Technologie, Karlsruhe

We consider the relations between the gauge couplings at the electroweak scale and the high scale where unification of the three gauge couplings is expected. Threshold corrections are incorporated both at the supersymmetric and at the grand unified scale and, where available three-loop running and two-loop decoupling are employed. We study the impact of the current experimental uncertainties of the coupling constants and the supersymmetric mass spectrum on the prediction of the super-heavy masses within the so-called minimal supersymmetric SU(5). We find that only a three-loop analysis leads to theoretical uncertainties smaller than the experimental ones.

T 19.7 Fr 15:30 30.23: 6-1

Two-Loop Matching of Gauge Couplings in Grand Unified Theories — •Waldemar Martens, Luminita Mihaila, and Matthias Steinhauser — Karlsruhe Institut of Technology (KIT)

As experimental accuracy on the gauge couplings is increasing, also higher order corrections in the gauge coupling unification analysis become more and more important. We calculate the two-loop matching corrections for the gauge couplings at the Grand Unification scale in a general framework that aims at making as few assumptions on the underlying Grand Unified Theory (GUT) as possible. In this talk we present an intermediate result that is general enough to be applied to the Georgi-Glashow SU(5) as a "toy model". The numerical effects in this theory are found to be larger than the current experimental uncertainty on $\alpha_s(M_Z)$. The technical issues that have been solved for this calculation are useful preparative work for the extension of the result to supersymmetric GUTs.

T 19.8 Fr 15:45 30.23: 6-1

Flavored Orbifold GUT – an SO(10) x S4 Model — •Adisorn Adulpravitchai[1] and Michael A. Schmidt[2] — [1]Max Planck Institut für Kernphysik, Heidelberg, Germany — [2]Institute for Particle Physics Phenomenology, University of Durham, Durham, United Kingdom

Orbifold grand unified theories (GUTs) solve several problems in GUT model building. Therefore, it is intriguing to investigate similar constructions in the flavor context. Here, we propose that a flavor symmetry might emerge due to orbifold compactification of one orbifold and broken by boundary conditions of another orbifold. The combination of the orbifold parities in gauge and flavor space determines the zero

modes. We demonstrate the construction in a supersymmetric (SUSY) SO(10) x S4 orbifold GUT model, which predicts the tribimaximal mixing at leading order in the lepton sector as well as the Cabibbo angle in the quark sector.