T 84: Theorie: BSM II

Zeit: Donnerstag 16:30–18:50 Raum: Z6 - SR 1.010

T 84.1 Do 16:30 Z6 - SR 1.010

Automatic calculations of effective Lagrangians in the path integral approach — Michael Kraemer, Alexander Voigt, and •Benjamin Summ — RWTH Aachen University, Aachen, Germany

Effective field theory (EFT) has become a major tool for studying extensions of the Standard Model. Unfortunately, the EFT approach requires the calculation of the effective action and higher dimensional operators, which in general is a model dependent task. Recently, a method based on the path integral formalism was introduced, which at one-loop reduces this calculation to transformations of the original Lagrangian and insertion into a master formula. We present this method and extend it to include the treatment of epsilon scalars, which become important when switching from a supersymmetric theory to an EFT without supersymmetry. We further discuss the possibility of automatizing the calculation of the effective action based on this method.

T 84.2 Do 16:45 Z6 - SR 1.010

Constraining BSM Scalar Sectors through Vacuum Stability — Georg Weiglein, Wolfgang G. Hollik, and •Jonas Wittbrodt — DESY, Notkestraße 85, 22607 Hamburg

Since the LHC has not provided us with any hints towards new physics, it is ever more interesting to constrain BSM theories from purely theoretical considerations. Requiring that the electroweak vacuum in any BSM model is at least metastable can lead to stringent constraints on the parameter space of the model. Many popular extensions of the SM, such as supersymmetry, feature greatly extended scalar sectors. In the resulting high dimensional scalar potential, vacuum decay can happen in many different field directions. Constraints from vacuum decay thus rely on finding all minima of multidimensional scalar potentials which is a nontrivial task even at tree-level. We present results on the vacuum stability in supersymmetric models from a new code aiming to provide an efficient and reliable check of vacuum stability for use in BSM parameter scans.

T 84.3 Do 17:00 Z6 - SR 1.010

Phenomenology of a unified model containing leptoquarks — •Thomas Faber — Julius-Maximilians-Universität Würzburg

For various ratios of different B-meson branching fractions (R_K, R_{K^*}, R_D and R_{D^*}) deviations between measurements and theoretical predictions have been observed. It is already known that leptoquarks can explain these deviations in simple extensions of the SM, e.g. simply putting a leptoquark field to the SM lagrangian. A natural question is if these leptoquarks can emerge from consistent unified models. We investigate a model based on the group $SU(4) \times SU(2)_L \times U(1)_R$ in the regions of parameter space, where the above mentioned deviations can be explained. In addition we take into account bounds from direct leptoquark searches at the LHC as well as other flavor observables e.g. $\mu \to 3e$. Moreover we investigate the observability of the leptoquarks as well as other new particles at the LHC.

T 84.4 Do 17:15 Z6 - SR 1.010

Consistent Simplified Descriptions of Dark Matter — •Valentin Tenorth[1,2], Florian Goertz[1], Tommi Alanne[1], Martin Bauer[2], and Martin Klassen[2] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Deutschland — [2]Institut für Theoretische Physik, Universität Heidelberg Philosophenweg 16, 69120 Heidelberg, Germany

The overwhelming evidence for the existence of particle dark matter is a clear hint towards physics beyond the Standard Model and searching for it is a major topic of particle physics in these days. In collider searches simplified models (and effective theories) are widely used as they are a powerful tool to calculate mono-X signatures in a general and mostly model independent way. In addition these approaches allow comparisons with results from direct and indirect detection experiments.

However, for the high energies reached by the LHC those models feature inherent limitations and might miss relevant features of more complex mediated dark sectors. In this talk I will present attempts to extend the used frameworks to be able to consistently describe more phenomena and cover a wide range of theories with more complex dark (or scalar) sectors.

T 84.5 Do 17:30 Z6 - SR 1.010

Beschränkungen an EDMs für flavourdiagonale CP-Verletzung — •Dimitrios Skodras — TU Dortmund, Deutschland

Die Entdeckung des Higgs Bosons hat ein neues Fenster geöffnet für die Suche nach neuer Physik im Bereich der elektroschwachen Symmetriebrechung. Beispielsweise können erhebliche CP-verletzende Beiträge zur Top-Yukawakopplung wesentlich für elektroschwache Baryogenese sein.

Niederenergetische Präzisionsobservablen wie das elektrische Dipolmoment (EDM) setzen strikte Grenzen an diese Kopplung. Um jedoch mögliche Aufhebungen untereinander miteinzubeziehen, müssen die Beiträge aller Yukawakopplungen berechnet werden. Nach einer kurzen Einführung zu EDMs als Untersuchsobjekt neuer Physik, werden die Berechnungen der verschiedenen Beiträge erklärt und erste Ergebnisse präsentiert.

T 84.6 Do 17:45 Z6 - SR 1.010

Solving the Strong CP Problem in a Grand-Unified Nelson-Barr Model — •Jakob Schwichtenberg[1], Paul Tremper[1], and Robert Ziegler[2] — [1]Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]Theoretical Physics Department, CERN, Geneva, Switzerland

We investigate if the Nelson-Barr mechanism can be realized, in a phenomenologically viable way, in an E_6 GUT. We find the answer in the affirmative and argue that the combination of the Nelson-Barr mechanism and E_6 unification leads to predictions that can be tested in the near future. In this sense, we do not provide any novel solution for the strong CP problem, but rather use the experimental fact $\bar{\theta} < 10^{-10}$ as a guide for GUT model building. While neither the Nelson-Barr mechanism, nor Grand Unification lead to definite predictions, we argue that a combination of these ideas does.

T 84.7 Do 18:00 Z6 - SR 1.010

Electroweak Phase Transition in the N2HDM — •Jonas Müller, Margarete Mühlleitner, and Philipp Basler — Karlsruher Institut für Technologie, ITP, Karlsruhe, Deutschland

While in the Standard Model (SM) it is not possible to generate the observed matter-antimatter asymmetry of the universe through baryogenesis, extended Higgs sectors are more promising in this respect. We investigate the prospects for a strong first order electroweak phase transition (PT) in the Next-to-Two-Higgs Doublet Model (N2HDM) where the CP-conserving Two-Higgs-Doublet Model is extended by an additional real singlet. We consider the N2HDM type I and II where one of the three neutral CP-even Higgs bosons can be the SM-like Higgs boson. By taking into account all relevant theoretical and experimental constraints, we investigate the implications of the requirement of a strong PT for LHC phenomenology. We find preferred mass configurations for the non SM-like Higgs bosons and show the implications on the signal rates of the SM-like Higgs boson. We furthermore highlight the interplay between the strong PT and the size of the trilinear Higgs self-couplings.

Gruppenbericht T 84.8 Do 18:15 Z6 - SR 1.010

Hunting Higgs Inflation in the NMSSM — •Wolfgang G. Hollik[1], Stefan Liebler[2], Gudrid Moortgat-Pick[1,3], Sebastian Passehr[4], and Georg Weiglein[1] — [1]DESY, Hamburg, Germany — [2]ITP KIT, Karlsruhe, Germany — [3]UHH, Hamburg, Germany — [4]LPTHE, Paris, France

Most cosmological models of inflation are far away from providing a smoking gun at low energies. A model of Higgs inflation in the Next-to Minimal Supersymmetric Standard Model, however, changes the NMSSM phenomenology drastically and may be well distinguished from the pure NMSSM or MSSM at a future linear collider.

We point out certain differences of the inflationary model to the ordinary NMSSM and discuss the Higgs and Neutralino/Chargino sector in particular to identify the smoking gun of inflation at electroweak energies.

T 84.9 Do 18:35 Z6 - SR 1.010

Observational consequences of the braneworld scenario with two parallel 3-branes of the DGP type — •Max Warkentin — Ludwig-Maximilians-Universität Fakultät für Physik Theoretische Physik Lehrstuhl Prof. Dvali Theresienstr. 37 80333 München

In theories with large extra dimensions it is possible to lower the fundamental Planck scale and hence resolve the hierarchy problem. As a consequence, in those theories, graviton production rates and other experimental signatures differ from those where large extra dimensions are absent. Although so far no experimental evidence has been found for the reality of the investigated models, the prediction of a fundamental Planck scale, which is in our observational reach, remains tempting. In order to further sharpen the predictive power of those models, we study a particular braneworld scenario with two parallel 3-branes, embedded in a 4+1 dimensional spacetime. The setup is of the type of the Dvali-Gabadadze-Porrati (DGP) model, in which a kinetic term for gravity is induced on the branes by the matter fields localized on them. We investigate the gravitational exchange between the matter fields localized on their respective branes. In particular, the distance between the branes influences which modes of the lower dimensional mode decomposition of the 5-dimensional graviton are being exchanged predominantly. Since in this configuration our universe is one of those branes with the standard model particles localized on it, we can deduce experimental signatures for the existence of the parallel brane. This investigation strengthens the possibility to observe the existence of large extra dimensions.