T 20: Beyond the Standard Model (Theorie) 1

Convenor: A. Kulesza, H. Rzehak

Zeit: Montag 16:45–19:00 Raum: VSH 19

T 20.1 Mo 16:45 VSH 19

Kaluza-Klein spectrum and altered dispersion relations of fermions in asymmetrically warped five dimensional spacetimes — •Dominik Döring — Technische Universität Dortmund, Germany

Warped extra dimensions have been a powerful tool for model builders to solve the hierarchy problem since the late 1990's.
We studied properties of SM singlet fermions in a compactified and asymmetrically warped extra dimensional spacetime, such as the Kaluza-Klein (KK) mass spectrum and the alteration of the dispersion relation (ADR) on the visible 3-brane. These ADRs induce new phenomenology on neutrino oscillations between active brane neutrinos and sterile bulk neutrinos.
An analytical analysis showed that the KK mass spectrum of such a model does not differ from symmetrically warped models, although the dispersion relation on the 3-brane is altered by operators that arise from KK decomposition. We were able to show that the effect on active-sterile neutrino oscillation bears resemblance with matter effects on active neutrino oscillation.

T 20.2 Mo 17:00 VSH 19

Prospects for three-body Higgs decays into extra light scalars — •Alexander Helmboldt and Manfred Lindner — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Within models containing a very light scalar particle coupled to the 125 GeV Higgs boson, I will present the first study of Higgs decays into *three* of these light scalars. I will introduce model-independent conditions which the scalar sector after electroweak symmetry breaking has to satisfy in order for the three-body channel to become relevant. Using a specific model – the real scalar singlet-extension of the Standard Model (SM) – we have identified scenarios, where the rates of scalar three-body Higgs decays are comparable to or even exceed those of the well-studied two-body channel. All those scenarios were shown to be compatible with current experimental and theoretical constraints. I will finally argue that scalar three-body Higgs decays lead to exciting new collider signatures with *six* SM fermions in the final state. In particular, I will demonstrate that e.g. six-muon or six-tau final states may be in reach of dedicated searches at the LHC or ILC experiments.

T 20.3 Mo 17:15 VSH 19

Extrapolation of LEP limits to non-SM Higgs couplings for a future lepton collider with high luminosity — •Peter Drechsel[1], Gudrid Moortgat-Pick[1,2], and Georg Weiglein[1] — [1]DESY, Notkestraße 85, D-22607 Hamburg, Germany — [2]II. Institute for Theoretical Physics, University of Hamburg, Luruper Chaussee 149, D-22761 Hamburg, Germany

The particle discovered in the Higgs boson searches at the LHC with a mass of about 125 GeV can be identified with one neutral Higgs boson in a variety of Beyond the Standard Model (BSM) theories with an extended Higgs sector. Limits on the couplings between additional Higgs fields to the electroweak gauge-bosons in such theories can be obtained by model-independent Higgs searches at lepton colliders. We present an extrapolation of the limits obtained at LEP for a future lepton collider. In a second step, we apply the extrapolated limits on different BSM models with an extended Higgs-sector.

T 20.4 Mo 17:30 VSH 19

CP-odd invariants for multi-Higgs models: applications with discrete symmetry — •Thomas Neder — Instituto de Física Corpuscular, C.S.I.C./Universitat de València, Valencia, Spain

CP-odd invariants provide a basis independent way of studying the CP properties of Lagrangians. We propose powerful methods for constructing basis invariants and determining whether they are CP-odd or CP-even, then systematically construct all of the simplest CP-odd invariants up to a given order, finding many new ones. The CP-odd invariants are valid for general potentials when expressed in a standard form. We then apply our results to scalar potentials involving three (or six) Higgs fields which form irreducible triplets under a discrete symmetry, including invariants for both explicit as well as spontaneous CP violation. The considered cases include one triplet of Standard Model (SM) gauge singlet scalars, one triplet of SM Higgs doublets, two triplets of SM singlets, and two triplets of SM Higgs doublets. For each case we study the potential symmetric under one of the simplest discrete symmetries with irreducible triplet representations, namely A_4, S_4, $\Delta(27)$ or $\Delta(54)$, as well as the infinite classes of discrete symmetries $\Delta(3n^2)$ or $\Delta(6n^2)$.

T 20.5 Mo 17:45 VSH 19

Lepton-flavour violation in a Pati-Salam model with gauged flavour symmetry — Thorsten Feldmann, Christoph Luhn, and •Paul Moch — Theoretische Physik 1, Uni Siegen,Walter-Flex-Straße 3, 57068 Siegen

Combining Pati-Salam (PS) and flavour symmetries in a renormalisable setup, we devise a scenario which produces realistic masses for the charged leptons. Flavour-symmetry breaking scalar fields in the adjoint representations of the PS gauge group are responsible for generating different flavour structures for up- and down-type quarks as well as for leptons. The model is characterised by new heavy fermions which mix with the Standard Model quarks and leptons. In particular, the partners for the third fermion generation induce sizeable sources of flavour violation. Focusing on the charged-lepton sector, we scrutinise the model with respect to its implications for lepton-flavour violating processes such as $\mu \to e\gamma$, $\mu \to 3e$ and muon conversion in nuclei.

T 20.6 Mo 18:00 VSH 19

Lepton flavour violation and the muon anomalous magnetic moment — Manfred Lindner, •Moritz Platscher, and Farinaldo S. Queiroz — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany

In the quest for the UV completion of the Standard Model, one should study not only direct collider signatures of new physics, but also the effects which currently inaccessible physics might have on low-energy observables. Lepton flavour violating decays and measurements of the leptonic magnetic moments offer gripping tests for new physics from low to high energies. In this talk the interplay between both signatures is described in a model-independent way and their usefulness is highlighted for several specific UV completions of the Standard Model. We stress that the potential excess observed in the measurement of the muon magnetic moment over the Standard Model prediction in recent experiments could be testable in the near future through lepton flavour violation.

T 20.7 Mo 18:15 VSH 19

Partial Unification and Local Baryon Number — Pavel Fileviez Pérez[1] and •Sebastian Ohmer[2] — [1]Case Western Reserve University, Cleveland — [2]Max-Planck-Institut für Kernphysik, Heidelberg

We investigate the possibility to find an ultraviolet completion of the simple extensions of the Standard Model where baryon number is a local symmetry. A simple theory based on $SU(4)_C \otimes SU(3)_L \otimes SU(3)_R$ where baryon number is embedded in a non-Abelian gauge symmetry is introduced. We discuss the main features of the theory and the possible implications for experiments.

T 20.8 Mo 18:30 VSH 19

Predictions from a flavour-GUT model combined with a SUSY breaking sector — •Christian Hohl[1] and Stefan Antusch[1,2] — [1]University of Basel, Switzerland — [2]Max-Planck-Institut für Physik, München, Germany

We discuss how flavour GUT models in the context of supergravity can be completed with a simple SUSY breaking sector, such that the flavour-dependent (non-universal) soft breaking terms can be calculated. As an example, we discuss a model based on an SU(5) GUT symmetry and A_4 family symmetry, plus additional discrete "shaping symmetries" and an $\mathbb{Z}_4^R$ symmetry. We calculate the soft-terms and identify the relevant high scale input parameters, and investigate the resulting predictions for the low scale observables, such as e.g. for flavour processes, the sparticle spectrum and for the dark matter relic density.

T 20.9 Mo 18:45 VSH 19

Domestic Axion — Gia Dvali[1,2,3] and •Lena Funcke[1,2] —

[1]Arnold Sommerfeld Center, Ludwig-Maximilians-Universität, Theresienstraße 37, 80333 München, Germany — [2]Max-Planck-Institut für Physik, Föhringer Ring 6, 80805 München, Germany — [3]Center for Cosmology and Particle Physics, Department of Physics, New York University, 4 Washington Place, New York, NY 10003, USA

We attempt to identify a phenomenologically viable solution to the strong CP problem in which the axion is composed entirely out of Standard Model fermion species. The axion consists predominantly of the η' meson with a minuscule admixture of a pseudoscalar bilinear composite of neutrinos, η_ν. The Peccei-Quinn symmetry is an axial symmetry that acts on the up quark and the neutrino species and is spontaneously broken by the QCD condensate of quarks as well as the condensate of neutrinos triggered by chiral gravitational anomaly. The up-quark mass is spontaneously generated by the neutrino condensate which plays the role of an additional composite Higgs doublet with the compositeness scale of the order of the neutrino masses. Such a scenario is highly economical: it solves the strong CP problem, generates the up-quark and neutrino masses from fermion condensates and simultaneously protects the axion shift symmetry against gravitational anomaly. The phenomenology is different from the standard hidden axion case. One of the experimental signatures is the existence of a gravity-competing isotope-dependent attractive force among nucleons at (sub)micron distances.