T 41: Theorie: Beyond the Standard Model

Zeit: Dienstag 16:00–18:15 Raum: S16

T 41.1 Di 16:00 S16

Sterile Neutrinos with Altered Dispersion Relations as an Explanation for the MiniBooNE, LSND, Gallium and Reactor Anomalies — •Dominik Döring[1], Philipp Sicking[1], Heinrich Päs[1], and Thomas J. Weiler[2] — [1]Technische Universität Dortmund — [2]Vanderbilt University, Nashville

Recently the MiniBooNE Collaboration has reported an anomalous excess in muon to electron (anti-)neutrino oscillation data. Combined with long-standing results from the LSND experiment this amounts to a 6.1 sigma evidence for new physics beyond the Standard Model. We develop a framework with 3 active and 3 sterile neutrinos with altered dispersion relations that can explain these anomalies without being in conflict with the absence of anomalous neutrino disappearance in other neutrino oscillation experiments.

T 41.2 Di 16:15 S16

Gauge Coupling Unification without Supersymmetry — •Jakob Schwichtenberg — TTP Karlsruhe Institut für Technologie, Karlsruhe, Deutschland

We discuss the prospects to achieve unification of the gauge couplings in models without supersymmetry. We restrict our discussion to $SU(5), SO(10)$ and E_6 models that mimic the structure of the Standard Model as much as possible ("conservative models"). One possible reason for the non-unification of the standard model gauge couplings are threshold corrections which are necessary when the masses of the superheavy fields are not exactly degenerate. We calculate the threshold corrections in conservative models with a Grand Desert between the electroweak and the unification scale. We argue that only in conservative E_6 models the corrections can be sufficiently large to explain the mismatch and, at the same time, yield a long-enough proton lifetime. A second possible reason for the mismatch are particles at an intermediate scale. We therefore also study systematically the impact of additional light scalars, gauge bosons and fermions on the running of the gauge coupling. We argue that for each of these possibilities there is a viable scenario with just one intermediate scale.

T 41.3 Di 16:30 S16

Coupling the SM to its dark side — Joscha Duchscherer, Florian Goertz, and •Matias Hersch — MPI Kernphysik, Heidelberg, Germany

We consider a 5d braneworld scenario in a linear dilaton background, coupling the SM to a (dark) mirror SM, with both living on separate 3-branes positioned at opposite ends of the $S^1/\mathbb{Z}_2$ orbifold. The branes interact through dilaton fluctuations of the gravitational field and additional bulk fields. Along the potential to naturally suppress couplings to the dark brane, the dilaton geometry exponentially raises the fundamental 5d planck scale to an effective 4d planck scale on the SM brane posing a solution to the hierarchy problem. This talk discusses motivations, phenomenology and model building aspects of the theory.

T 41.4 Di 16:45 S16

Asymptotic safety and flavour phenomenology from an extended Yukawa sector — •Clara Hormigos Feliu — TU Dortmund, Otto-Hahn-Str. 444227 Dortmund, Germany

Recent works have shown that gauge-Yukawa theories can potentially be rendered UV complete by reaching a weakly interacting fixed point at high energies. This behaviour, known as Asymptotic Safety (AS), is a generalisation of the well-known asymptotically free behaviour of the non-abelian gauge couplings of the Standard Model (SM), and requires the presence of additional Yukawa interactions. In this talk, we explore SU(2)xU(1) extensions of the SM and their potential to deliver AS through Yukawa interactions with the lepton sector. Since the requirement of AS is highly predictive of the BSM couplings once matching to the SM is established, this allows us to test our models through phenomenological constraints. Furthermore, we find that certain scenarios can provide contributions to the muon anomalous magnetic moment which relax its long-standing discrepancy with the SM.

T 41.5 Di 17:00 S16

Phenomenology of the gaugino-sector in the muNMSSM — •Steven Paasch — Deutsches Elektronen-Synchrotron

The Next-to-Minimal Supersymmetric Standard Model (NMSSM) with an additional singlet in the Higgs sector is a well motivated extension to the Minimal Supersymmetric Standard Model (MSSM). The additional singlet in the Higgs sector relaxes constraints within the Higgs sector. It also provides several candidates for cold dark matter. We will discuss the μNMSSM model with an additional parameter which can be embedded consistently into inflation models. We studied the mass spectra in the Higgs and gaugino sector and checked wether the discussed scenarios could be accessible by LHC analysis via applying the programm CheckMATE.

T 41.6 Di 17:15 S16

Phenomenology of the Higgs-sector in the μNMSSM — •Cheng Li and Gudrid Moortgat-Pick — II. Institute for Theoretical Physics-University Hamburg, Hamburg, German

The Next-to-Minimal Supersymmetric Standard Model (NMSSM) with an additional singlet of Higgs sector is a well-motivated extension to the Minimal Supersymmetric Standard Model (MSSM). This additional singlet relaxes constraints within the Higgs sector, and also provides several candidates for cold dark matter. In the talk we also discuss the μNMSSM model which in addition can be embedded consistently into inflation models. Within in the μNMSSM, study the mass spectra in the Higgs and check whether the discussed scenarios may be accessible via LHC analysis via applying the program CheckMATE.

T 41.7 Di 17:30 S16

T_u model unitarization in VBS — •Heiko Schäfer-Siebert — KIT, ITP

Vector Boson Scattering (VBS) at the LHC provides a window on possible effects of physics beyond the SM in electroweak symmetry breaking, which can be described in an effective Lagrangian framework. The use of higher dimension operators leads to a UV incomplete theory, however, that breaks unitarity at high energies. In order to handle this unphysical behavior and to study VBS phenomenologically, the T_u model was developed as a numerical unitarization scheme for off-shell weak boson scattering. I will present the T_u unitarization procedure and its application to dimension eight operators that influence the $VV \to VV$ scattering within the full VBS $VVjj$ production processes. The necessary adaptations when going from same sign WW to $WZjj$ and $W\gamma jj$ production are discussed, including the influence of Higgs boson states on the unitarization results.

T 41.8 Di 17:45 S16

Phenomenology of a unified model containing leptoquarks — •Thomas Faber[1], Werner Porod[1], Yang Liu[1], Matěj Hudec[2], Michal Malinský[2], Florian Staub[3], and Helena Kolešová[4] — [1]Julius-Maximilians-Universität, Würzburg, Germany — [2]Charles-University, Prague — [3]Karlsruhe Insitute of Technology, Germany — [4]University of Stavanger, Norway

We investigate a unified model based on the gauge group $G = SU(4) \times SU(2)_L \times U(1)_R$, which contains scalar leptoquarks as well as other new particles like scalar gluons in the TeV range. First, we studied the impact on low enery observables (e. g. meson decays). This allows to constrain the parameter space. We show that there are allowed sets of parameters which can also explain the measured values for R_K/R_{K^*}. The allowed parameter regions impy rather specific decay properties of the leptoquarks and the scalar gluons. We discuss their phenomenology at the LHC and a prospective 100 TeV pp collider.

T 41.9 Di 18:00 S16

Model building in anomaly free U(1)′ extensions — •Rigo Bause and Gudrun Hiller — TU Dortmund

A crucial feature for a consistent quantum field theory is the cancellation of gauge anomalies, which is present in the SM and also needs to hold for any extension thereof constraining charges of B(SM) fermions.

The concept of asymptotic safety can prevent the rise of a Landau pole and allows for fixed points of the renormalisation group flow in a UV completion.

In this talk, U(1)′ extensions with generation-dependent charges that address present flavour anomalies are examined regarding anomaly cancellation. We discuss the selection process of possible mod-

els and further use the asymptotic safety approach to avoid Landau poles. We analyse interacting fixed points of models with a small number of degrees of freedom and study how the SM can emerge at lower energies through matching.