T 56: Beyond the Standard Model (Theorie)

Zeit: Dienstag 16:45–19:00 Raum: VMP8 SR 106

T 56.1 Di 16:45 VMP8 SR 106

Constraining Composite Higgs Models with direct searches — Christoph Niehoff, •Peter Stangl, and David Straub — Excellence Cluster Universe, TUM, Garching, Germany

Composite Higgs Models offer a unified effective description of models with new strong interactions or extra dimensions and are thus of high phenomenological interest. They can naturally account for a light Higgs Boson compatible with LHC data and at the same time are able to give a solution to the hierarchy problem without invoking supersymmetry. In this talk I will present result from a comprehensive analysis of composite Higgs models, where I will focus on constraints due to direct searches.

T 56.2 Di 17:00 VMP8 SR 106

Indirect Constraints on Composite Higgs Models — •Christoph Niehoff, Peter Stangl, and David Straub — Excellence Cluster Universe, München

Models in which the Higgs boson is implemented as a composite pseudo Nambu-Goldstone boson of a new strongly interaction sector provide an elegant solution to the hierarchy problem and the origin of electroweak symmetry breaking. In this talk we present ways to constrain these kinds of models indirectly using flavour observables as well as Higgs physics.

T 56.3 Di 17:15 VMP8 SR 106

Lepton flavour violation in RS models with a brane- or nearly brane-localized Higgs — Martin Beneke[1], •Paul Moch[1,2], and Jürgen Rohrwild[3] — [1]Physik-Department T31, Technische Universität München, James-Franck-Straße 1, 85748 Garching — [2]Theoretische Physik 1, Universität Siegen, Walter-Flex-Straße 3 , 57068 Siegen — [3]Rudolf Peierls Centre for Theoretical Physics, University of Oxford, 1 Keble Road, Oxford OX1 3NP

We perform a comprehensive study of charged lepton flavour violation in Randall-Sundrum (RS) models in a fully 5D quantum-field-theoretical framework. Our calculation provides the first complete result for the flavour-violating electromagnetic dipole operator in Randall-Sundrum models. We study the typical range for the branching fractions of $\mu \to e\gamma$, $\mu \to 3e$, $\mu N \to eN$ as well as $\tau \to \mu\gamma$, $\tau \to 3\mu$ by a numerical scan in both the minimal and the custodial RS model. The combination of $\mu \to e\gamma$ and $\mu N \to eN$ currently provides the most stringent constraint on the parameter space of the model. A typical lower limit on the KK scale T is around 2 TeV in the minimal model (up to 4 TeV in the bulk Higgs case with large Yukawa couplings), and around 4 TeV in the custodially protected model, which corresponds to a mass of about 10 TeV for the first KK excitations, far beyond the lower limit from the non-observation of direct production at the LHC.

T 56.4 Di 17:30 VMP8 SR 106

Unparticle physics constraints from the hydrogen atom — •Michael Florian Wondrak[1,2], Piero Nicolini[1,2], and Marcus Bleicher[1,2] — [1]Frankfurt Institute for Advanced Studies (FIAS), Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität Frankfurt am Main, Frankfurt am Main, Germany

Unparticle stuff has been proposed as an extension of the Standard Model of particle physics by including scale invariant fields. In the framework of effective field theory, it describes the low-energy limit of a so-called Banks-Zaks sector which exhibits scale invariance below an energy scale $\Lambda_{\mathcal{U}}$. Unparticle fields are characterized by a non-integer canonical scaling dimension $d_{\mathcal{U}}$, which leads to unusual properties like resembling a fractional number of (un)particles. The existence of unparticle stuff may be detected experimentally through the interaction with conventional matter.

After a review on the unparticle theory and the static potential due to virtual unparticle exchange, we focus on its impact on hydrogen atom energy levels. We obtain the energy shift of the ground state by using Rayleigh-Schrödinger perturbation theory and compare it with experimental data. In this way, bounds on the energy scale $\Lambda_{\mathcal{U}}$ as a function of $d_{\mathcal{U}}$ are derived.

Finally, we offer a comparison with existing constraints in literature like the lepton magnetic anomaly. For some parameter regimes, the hydrogen bound provides competitive results.

T 56.5 Di 17:45 VMP8 SR 106

A Simplified Model of Top-Flavoured Dark Matter — •Simon Kast and Monika Blanke — Karlsruher Institut für Technologie, Karlsruhe, Germany

We present the phenomenology of a new physics simplified model of top-flavoured dark matter. The dark matter particle is the lightest Dirac fermion of a new flavour-triplet coupling to the SM up-triplet via a new scalar mediator. The coupling is left general, following Dark Minimal Flavour Violation introduced in arXiv:1405.6709, and therefore is a new source of flavour violation. We study the impact of constraints from both flavour experiments, relic abundance and direct detection constraints, as well as collider bounds.

T 56.6 Di 18:00 VMP8 SR 106

Low Scale Unification @ LHC — Pavel Fileviez Perez, •Sebastian Ohmer, and Hiren H. Patel — Max-Planck-Institut fuer Kernphysik

I will introduce new particles called "leptobaryons" and investigate low scale unification of the Standard Model gauge couplings in four dimensions. Finally, I will discuss how the LHC can search for the leptobaryons and point out the implications for dark matter. This talk is based on:

P. Fileviez Perez, S. Ohmer and H. H. Patel, "Minimal Theory for Lepto-Baryons", Phys.Lett. B735 (2014) 283-287, [arXiv: 1403.8029]

P. Fileviez Perez and S. Ohmer, "Low Scale Unification of Gauge Interactions", Phys.Rev. D90 (2014) 3, 037701, [arXiv: 1405.1199]

S. Ohmer and H. H. Patel, "Leptobaryons as Majorana Dark Matter", Phys.Rev. D92 (2015) 5, 055020, [arXiv: 1506.00954]

T 56.7 Di 18:15 VMP8 SR 106

One-Loop Corrections to the Fermion Masses and Flavour Symmetries — Walter Grimus[1], Patrick Ludl[2], and •Maximilian Löschner[1] — [1]Particle Physics Group, University of Vienna — [2]SHEP, University of South Hampton

Extensions of the Standard Model which explain non-vanishing neutrino masses and some of the peculiar features of the lepton mixing matrix by flavour symmetries always lead to a proliferation of scalars in the model. Then, the relation between Yukawa couplings and fermions in general involves several vacuum expectation values. It is therefore expedient to devise a renormalization procedure which is adapted to this situation.

In this talk, we will present first results of an ongoing PhD project on one-loop corrections to fermion masses in a toy model featuring an arbitrary number of Majorana or Dirac fermions and scalar fields, testing the stability of tree level predictions and keeping focus on the renormalization of the vacuum expectation values. This can serve as a preliminary study of the radiative generation of the neutrino masses in explicit physical models, like the so called Scotogenic Model which will also be discussed in this talk.

T 56.8 Di 18:30 VMP8 SR 106

Minimal conformal model — •Alexander Helmboldt, Pascal Humbert, Manfred Lindner, and Juri Smirnov — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

The gauge hierarchy problem is one of the crucial drawbacks of the standard model of particle physics (SM) and thus has triggered model building over the last decades. Its most famous solution is the introduction of low-scale supersymmetry. However, without any significant signs of supersymmetric particles at the LHC to date, it makes sense to devise alternative mechanisms to remedy the hierarchy problem. One such mechanism is based on classically scale-invariant extensions of the SM, in which both the electroweak symmetry and the (anomalous) scale symmetry are broken radiatively via the Coleman-Weinberg mechanism.

Apart from giving an introduction to classically scale-invariant models, the talk will present our results on obtaining a theoretically consistent minimal extension of the SM, which reproduces the correct low-scale phenomenology.

T 56.9 Di 18:45 VMP8 SR 106

Exceptional Dark Matter — •Jakob Schwichtenberg — Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology, Engesserstraße 7, D-76131 Karlsruhe, Germany

We discuss fermionic dark matter candidates in non-supersymmetric E_6 Grand Unification. The exceptional group E_6 is perfectly suited for such a study, because of its unique status among the viable groups and because of the fact that we do not need to add anything by hand: dark matter candidates are contained in the fundamental representation of E_6 which contains at the same time the standard model fermions. The stability of the candidates is guaranteed by a remnant discrete symmetry that originates when the E_6 gauge symmetry is broken spontaneously. By restricting to the lowest-dimensional Higgs representations that couple to fermions and minimal fine-tuning, we end up with a viable candidate that can be produced with the correct relic abundance and could be detected in the near future.