T 104: Jenseits des Standardmodells (Theorie) 3

Zeit: Donnerstag 16:45–19:00 Raum: P6

T 104.1 Do 16:45 P6

Introduction to Models with a Small and Warped Extra Dimension — Juliane Hahn, •Clara Hörner, Raoul Malm, Matthias Neubert, Kristiane Novotny, and Christoph Schmell — PRISMA Cluster of Excellence & Mainz Institute for Theoretical Physics, Johannes Gutenberg University, 55099 Mainz, Germany

After the discovery of the Higgs boson in July 2012, a solution to the hierarchy problem - the question why the electroweak scale is so low compared to the Planck scale - is more required than ever. Models, which were first formulated by L. Randall and R. Sundrum in 1998, extending the Standard Model of Particle Physics (SM) by a Planck-lengths small and warped extra dimension offer a promising approach. Moreover, these models allow an explanation of the quark flavor structure of the SM in a natural way. All SM fields except the Higgs boson are assumed to spread out in the extra dimension and Kaluza-Klein-particles are predicted as additional particles with higher masses. Predictions for present accelerator experiments can be calculated within this setup, e.g. the loop-mediated decay of the Higgs boson into two photons, where virtual KK-particles could lead to sizeable contributions. The setup of a Minimal RS model and an extended model with a Custodial symmetry, predicting additional five-dimensional fields to better handle with the electroweak T-parameter, will be presented in this talk. It will form an introduction for following presentations of the Higgs to two photons decay within the RS setup.

T 104.2 Do 17:00 P6

Higgs Phenomenology in Warped Extra Dimensions — •Raoul Malm, Christoph Schmell, and Matthias Neubert — Mainz Institute for Theoretical Physics, Johannes Gutenberg University, Mainz, Germany

Precise measurements of the Higgs-like boson couplings provide a test of the electroweak symmetry breaking sector and allow to search for physics beyond the Standard Model (SM). One of the promising theories, capable of explaining the gauge hierarchy problem and the flavor puzzle of the SM, is the Randall-Sundrum (RS) Model that extends space-time by one small, compact and strongly curved extra-dimension.

This talk presents a description of the Higgs couplings to SM quarks and bosons in RS models with a Higgs sector localized on or near the infra-red (IR) brane. The analytic results for all relevant Higgs couplings including the loop-induced couplings to gluons and photons are summarized, where it is distinguished between the minimal and the custodial, as well as the brane-Higgs and narrow bulk-Higgs scenario.

T 104.3 Do 17:15 P6

Higgs Decay into two Photons at the Boundary of a Warped Extra Dimension — •Juliane Hahn, Clara Hörner, Raoul Malm, Matthias Neubert, Kristiane Novotny, and Christoph Schmell — PRISMA Cluster of Excellence & Mainz Institute for Theoretical Physics, Johannes Gutenberg Universität, 55099 Mainz, Germany

Recently the discovery of the Higgs boson at 125-126 GeV confirmed the existance of the gauge hierarchy problem. Extradimensional models like the 5D Randall-Sundrum model, in which the Standard model is embedded in a slice of anti-de Sitter space while the Higgs field is localized on or close to the boundary of the extra dimension, provide a solution to this problem. In this context a five dimensional calculation of the loop induced Higgs decay to two photons in different setups of the RS model is presented, where the gauge invariance of the amplitude in R_ξ-gauge is discussed. Furthermore an exact expression for the amplitude in terms of the 5D W-boson propagator, including the propagation of heavy Kaluza Klein particles in the loop, is obtained.

T 104.4 Do 17:30 P6

Bounds on the Transistions Scale in Asymptotic Safe Gravity for the Diphoton Channel at the LHC — •Magdalena Zenglein — TU Dortmund

The LHC allows to probe quantum gravity with large extra dimensions. Within the Asymtoptic Safety scenario we present new constraints on the transition scale Λ_T for the diphoton channel. These bounds will be compared with existing bounds from other channels.

T 104.5 Do 17:45 P6

Anomalous magnetic moment of the muon in the Randall-Sundrum model with custodial protection — Martin Beneke[1], •Paul Moch[1], and Jürgen Rohrwild[1,2] — [1]Physik Department T31, Technische Universität München — [2]Rudolf Peierls Centre for Theoretical Physics, University of Oxford

We compute the anomalous magnetic moment of the muon in the Randall-Sundrum model with custodial protection using a brane-localized Higgs. We apply a fully five dimensional (5D) framework to calculate the matching coefficients of the effective field theory at the electroweak scale. The extra contribution to the muon anomalous magnetic moment derived from the model-independent gauge-boson exchange contribution is

$$\Delta a_\mu = 2.94 \cdot 10^{-10} \times (T/1\text{TeV})^2$$

where $1/T$ denotes the location of the Tev brane in conformal coordinates. The parameter T is connected to the mass of the lowest KK excitation of a standard model gauge boson by $m_{kk} \approx 2.5T$.

T 104.6 Do 18:00 P6

Higgs beyond the Standard Model - an EFT approach — •Claudius Krause[1], Gerhard Buchalla[1], and Oscar Catà[1,2,3] — [1]Ludwig-Maximilians-Universität München, Arnold Sommerfeld Center for Theoretical Physics, D-80333 München — [2]Physik Department, TUM, D-85748 Garching — [3]TUM-IAS, Lichtenbergstr. 2a, D-85748 Garching

We consider the Standard Model as a low-energy effective description of a new, strong interaction. This generic interaction breaks the electroweak symmetry dynamically at the scale $\Lambda \gtrsim 4\pi v$ of a few TeV. The Higgs boson arises as a composite pseudo-Nambu-Goldstone boson in these scenarios and is therefore naturally light. We discuss what assumptions are used in the leading order Lagrangian, which is in general non-renormalizable. Also, we explain what systematics governs the effective expansion. We develop a power-counting formula and show its relation to naive dimensional analysis (NDA) and to the counting of chiral dimensions. Afterwards, we derive all the operators at next-to-leading order ($\mathcal{O}(v^2/\Lambda^2) \simeq \mathcal{O}(1/16\pi^2)$) in the effective expansion. Some applications of this framework are also discussed.

T 104.7 Do 18:15 P6

Effective field theory analysis of new physics in $e^+e^- \to W^+W^-$ — Gerhard Buchalla[1], Oscar Catà[1,2,3], •Rudi Rahn[1,4], and Matthias Schlaffer[1,5] — [1]Ludwig-Maximilians-Universität München — [2]Technische Universität München, Garching — [3]TUM-IAS, Garching — [4]University of Oxford, Oxford, UK — [5]DESY, Hamburg

We use a model-independent electroweak chiral Lagrangian to describe electroweak symmetry breaking, and include the next-to-leading order (NLO) effective operators arising as counterterms to describe new physics at the TeV scale. This Lagrangian is used to compute the NLO corrections to polarised $e^+e^- \to W^+W^-$ scattering. We find that only a subset of the available operators contributes corrections to the cross sections at all, and only a smaller subset contributes to leading order in a large-s expansion. An explanation by the Goldstone equivalence theorem is provided. Finally we discuss the absence of effects due to the physical Higgs scalar and present one possible UV theory as an example.

T 104.8 Do 18:30 P6

Beyond Standard Model Theories in Light of the IceCube Search for Dark Matter Annihilations in the Sun — •Pavel Gretskov[1], Martin Bissok[1], Jan Blumenthal[1], Michael Krämer[2], and Christopher Wiebusch[1] for the IceCube-Collaboration — [1]III. Physikalisches Institut, RWTH Aachen, D-52056 Aachen — [2]Institut für Theoretische Teilchenphysik und Kosmologie, RWTH Aachen, D-52056 Aachen

Recently, the IceCube Collaboration has published the results of their search for Dark Matter (DM) annihilations in the Sun. The analysis makes use of the fact that Dark Matter scattering off nuclei in the Sun could become gravitationally bound and subsequently self-annihilate into final states containing neutrinos. Assuming capture and annihilation rates are in equilibrium, upper bounds on the spin-independent (SI) and spin-dependent (SD) DM-Nucleus scattering cross sections

have been derived. The bounds on the SD cross section are the most stringent to date, lowering previous bounds by up to one order of magnitude for DM masses larger than $\sim$ 100GeV. In this talk we explore the implications for theories beyond the Standard Model using the effective field theory approach. This approach allows us to compare the results with searches at the Large Hadron Collider and show the complementarity of these detection methods.

T 104.9 Do 18:45 P6

Electroweak and Conformal Symmetry Breaking by a Strongly Coupled Hidden Sector — Martin Holthausen[1], Jisuke Kubo[2], •Kher Sham Lim[1], and Manfred Lindner[1] — [1]Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany — [2]Institute for Theoretical Physics, Kanazawa University, Kanazawa, Japan

The LHC and other experiments show so far no sign of new physics and long-held belief about naturalness should be critically reexamined. We discuss therefore in this paper a model with a combined breaking of conformal and electroweak symmetry by a strongly coupled hidden sector. Even though the conformal symmetry is anomalous, this may still provide an explanation of the smallness of electroweak scale compared to the Planck scale. Specifically we start from a classically conformal model, in which a strongly coupled hidden sector undergoes spontaneous chiral symmetry breaking. A coupling via a real scalar field transmits the breaking scale to the SM Higgs and triggers electroweak symmetry breaking. The model contains dark matter candidates in the form of dark pions, whose stability is being guaranteed by the flavor symmetry of hidden quark sector. We study its relic abundance and direct detection prospects with the Nambu-Jona-Lasinio method and discuss the phase transition in the dark sector as well as in the electroweak sector.