T 15: Beyond the Standard Model (Theorie) 2

Convenor: Andreas Weiler

Zeit: Montag 16:45–18:45 Raum: WIL-A124

T 15.1 Mo 16:45 WIL-A124

Resummation predictions for new electroweak gauge boson production — •David R. Lamprea[1], Tomas Jezo[2], Michael Klasen[1], Florian Lyonnet[2], and Ingo Schienbein[2] — [1]Institut für Theoretische Physik, Universität Münster, Wilhelm-Klemm-Straße 9, D-48149 Münster, Germany — [2]Université Joseph Fourier/CNRS-IN2P3/INPG, 53 Avenue des Martyrs, F-38026 Grenoble, France

After the discovery of a particle compatible with the SM Higgs boson, it is now necessary to shift the attention towards theories Beyond the Standard Model (BSM) that aim to solve some of the several issues that the the SM presents.

Many promising candidate for BSM physics are based on the enlargement of the SM gauge groups either from a Grand Unification Theory (GUT) point of view (superstring-inspired or not) or with models that address particular issues (e.g. left-right models). One of the properties of these models is the appearance of new gauge bosons (Z' and W').

Resummation is an improvement over fixed-order perturbative QCD in kinematical regions where these predictions become unreliable. It restores the convergence properties in these regions and overall improves the precision of the computations.

In this work we present resummation predictions for new gauge bosons Z' and W' for several GUT and non-GUT models in the context of general phenomenological frameworks that allow the analysis of a wide range of theoretical possibilities.

T 15.2 Mo 17:00 WIL-A124

Effective direct and indirect top constraints — Maikel De Vries, Thomas Konstandin, •Matthias Schlaffer, and Andreas Weiler — DESY, Hamburg, Germany

We use an effective field theory approach to study in a systematic way the effects of anomalous top couplings. We focus in particular on CP-violating operators and find constraints on them from direct and indirect measurements. This has important implications for new physics models and the search for their signatures at the LHC.

T 15.3 Mo 17:15 WIL-A124

Anomalous Top Couplings in WHIZARD — •Fabian Bach and Thorsten Ohl — Institut für Theoretische Physik und Astrophysik, Universität Würzburg

Because of its natural Yukawa coupling strength and corresponding large mass, the top quark plays a special role not only in the SM, but also as a window to new physics in many of its extensions. At the LHC, large abundances of top quarks are being produced, providing the statistics necessary to measure various properties of the top quark with high precision. Using effective field theory, it is possible to parameterize any new physics contributing to top interactions via anomalous top quark-gauge boson couplings $tt\gamma$, ttZ, tbW and ttg, while contact terms (e. g. $ttgg$) have to be included in general to ensure gauge invariance. The full gauge-invariant set of operators leading to anomalous trilinear top couplings has been implemented into the parton-level Monte Carlo generator Whizard to provide a comprehensive tool for MC studies of the complete hard scattering amplitudes including decays of top quarks and heavy gauge bosons as well as all irreducible backgrounds. We show results for single top production with anomalous tbW couplings, and argue that it is necessary to go to full matrix elements including anomalous top decays to properly account for the coupling dependence of the cross sections at detector level.

T 15.4 Mo 17:30 WIL-A124

Little Higgs models in light of the 126 GeV discovery at the LHC — •Marco Tonini and Jürgen Reuter — DESY, Hamburg, Germany

The discovery of a 126 GeV resonance at the LHC has opened a new era of particle physics. In light of this discovery, it has become of central importance a deeper understanding of the underlying mechanism of electroweak symmetry breaking associated to the observed resonance. An appealing alternative to the common Supersymmetric extension of the SM, is the idea that the Higgs is a pseudo-Goldstone boson: Little Higgs models provide plausible realizations of this scenario with the feature that they cancel all quadratically divergent contributions to the Higgs mass at one-loop. In this talk we are going to present the updated allowed contours in the parameter space of different Little Higgs models in light of the 7+8 TeV LHC data collected in 2011-2012.

T 15.5 Mo 17:45 WIL-A124

Corrections to Higgs boson masses in the MSSM — •Sebastian Passehr — Max-Planck-Institut für Physik, München, Deutschland

The LHC has discovered a Higgs-like particle with a mass of ≈ 126GeV. This particle, if interpreted as a Higgs, is compatible with one of the neutral CP-even Higgs bosons of the MSSM.

The experimental accuracy of the mass of that Higgs-like particle is better than 0.5GeV. On the theory side, it has been shown a long time ago, that radiative corrections to the tree-level masses of Higgs bosons are sizeable and hence very important to know. To be competitive with the measurement, two-loop calculations become important. Furthermore, also phases in the case of complex parameters can lead to remarkable contributions.

I will present an analysis of two-loop mass corrections of the order α_t^2 in the complex MSSM in a full Feynman-diagrammatic approach.

T 15.6 Mo 18:00 WIL-A124

Natural NMSSM Higgs Bosons — Stephen F. King[1], Margarete Mühlleitner[2], Roman Nevzorov[3], and •Kathrin Walz[2] — [1]School of Physics and Astronomy, University of Southampton — [2]Institute for Theoretical Physics, Karlsruhe Institute of Technology — [3]Institute for Theoretical and Experimental Physics, Moscow

The Higgs sector of the Next-to Minimal Supersymmetric Extension of the Standard Model (NMSSM) features five neutral Higgs bosons. Compared to the MSSM it is extended by one additional complex singlet field. The discovery of a Higgs-like boson at the LHC last summer opens up the exciting possibility to consider the idea that this might actually be one of the NMSSM Higgs bosons.

We study the phenomenology of the NMSSM Higgs sector requiring the presence of a CP-even Higgs boson with a mass close to 126 GeV. To this end we perform a parameter scan and investigate the observable Higgs cross sections into the final states $\gamma\gamma$, WW, ZZ, bb and $\tau\tau$. Our focus is on an enhanced rate into $\gamma\gamma$. We discuss where such an enhancement can originate from and study the correlations between the different channels. Our scenarios feature light stop masses, which leads to low fine-tuning, and comply nicely with the LHC results.

T 15.7 Mo 18:15 WIL-A124

Multi-Scale-Breaking of Pati-Salam-GUTs — •Florian Hartmann, Wolfgang Kilian, and Karsten Schnitter — Universität Siegen, Deutschland

As left-right-symmetric extensions of the SM, Pati-Salam GUTs contain right-handed neutrinos. By a multi-step breaking of the symmetry, their mass scale can be chosen near its best-fit value of $\sim 10^{14}$ GeV. We show in various cases that a full unification of all gauge couplings near the Planck scale is possible. In addition, we construct the Higgs parts of the Pati-Salam superpotential. We investigate the possibility of a strict Z_2 symmetry between the left and right-handed part. This may lead to interesting new features such as massless states which are associated to the Goldstone modes.

T 15.8 Mo 18:30 WIL-A124

SO(10) Origin of Fermion Masses and Mixings, Effects of Renormalization Group Evolution and Predictions for as yet unmeasured Observables — •Alexander Dueck, Werner Rodejohann, and Yasutaka Takanishi — Max-Planck-Institut für Kernphysik, Postfach 103980, D-69029 Heidelberg, Germany

Grand Unified Theories (GUTs) provide a compelling framework to establish and analyze possible relations between quarks and leptons. We analyze the possibility to explain the origin of fermion masses and mixings within several renormalizable $SO(10)$ GUTs. We improve previous analyses by including effects of renormalization group evolution (RGE) and non-degenerate seesaw scales into our fits. In addition, in the neutrino sector we consider both the normal and the inverted hierarchy. Furthermore, we constrain the models by fitting the baryon asymmetry of the universe assuming it is produced through thermal leptogenesis. Supersymmetric and non-supersymmetric models with different Higgs

representations are investigated for their ability to reproduce the data. After constraining the model parameters with experimental data we give the model predictions and allowed ranges for undetermined observables such as the leptonic CP violating phase and point out the importance to include full RGE into the analysis.