T 31: Elektroschwache Wechselwirkung und BSM (Theorie)

Zeit: Montag 16:45–18:35 Raum: VMP8 SR 105

Gruppenbericht T 31.1 Mo 16:45 VMP8 SR 105

NLO QCD Corrections to Higgs Pair Production including Dimension-6 Operators — Ramona Gröber[1], Margarete Mühlleitner[2], Michael Spira[3], and •Juraj Streicher[2] — [1]INFN - Sezione di Roma Tre, Roma, Italy — [2]Karlsruher Institut für Technologie - Institut für Theoretische Physik, Karlsruhe, Germany — [3]Paul Scherrer Institut, Villigen, Switzerland

The role of the Higgs boson has developed from the long-sought particle into a tool for exploring beyond Standard Model (BSM) physics. While the Higgs boson signal strengths are close to the values predicted in the Standard Model (SM), the trilinear Higgs-selfcoupling can still deviate significantly from the SM expectations in some BSM scenarios. The Effective Field Theory (EFT) framework provides a way to describe these deviations in a rather model independent way, by including higher-dimensional operators which modify the Higgs boson couplings and induce novel couplings not present in the SM.

The trilinear Higgs-selfcoupling is accessible in Higgs pair production, for which the gluon fusion is the dominant production channel. The next-to-leading (NLO) QCD corrections to this process are important for a proper prediction of the cross section and are known in the limit of heavy top quark masses. In our work, we provide the NLO QCD corrections in the large top quark mass limit to Higgs pair production including dimension-6 operators. The various higher-dimensional contributions are affected differently by the QCD corrections, leading to deviations in the relative NLO QCD corrections of several per-cent, while modifying the cross section by up to an order of magnitude.

T 31.2 Mo 17:05 VMP8 SR 105

Implementation dimension-6 operators into WHIZARD — •So Young Shim and Juergen Reuter — Notkestrasse 85, DESY, Hamburg, Germany

To test physics beyond the Standard Model (SM) at the LHC in a model-independent way, we studied an Effective Field Theory (EFT) consisting of the SM with additional dimension-6 operators. Using a special basis for the operators, the GIMR basis, we implemented the complete set of dim-6 operators into the Monte Carlo Event Generator WHIZARD. Focusing on electroweak boson observables, we show preliminary results for LHC Run II at 13 TeV.

T 31.3 Mo 17:20 VMP8 SR 105

Vector Boson Scattering at CLIC — Wolfgang Kilian[1], Juergen Reuter[2], Marco Sekulla[3], and •Christian Fleper[1] — [1]Department Physik, Universitaet Siegen, 57068 Siegen, Deutschland — [2]DESY Theory Group, 22603 Hamburg, Deutschland — [3]Institut für Theoretische Physik, Karlsruher Institut für Technologie, 76131 Karlsruhe, Deutschland

Linear colliders operating in a range of multiple TeV are able to investigate the details of vector boson scattering and electroweak symmetry breaking.
We calculate cross sections with the Monte Carlo generator WHIZARD for vector boson scattering processes at the future linear e^+e^- collider CLIC. By finding suitable cuts, the vector boson scattering signal processes are isolated from the background. Finally, we are able to determine exclusion sensitivities on the non-Standard Model parameters of the relevant dimension eight operators.

T 31.4 Mo 17:35 VMP8 SR 105

Anomalous couplings in WZ production beyond NLO QCD — Francisco Campanario[1], •Robin Roth[1], Sebastian Sapeta[2], and Dieter Zeppenfeld[1] — [1]Institute for Theoretical Physics, KIT, Karlsruhe, Germany — [2]CERN PH-TH, Geneva, Switzerland

We study WZ production with anomalous couplings (AC) at $\bar{n}$NLO QCD using the LoopSim method in combination with the Monte Carlo program VBFNLO. Higher order corrections to WZ production are dominated by additional hard jet radiation. Those contributions are insensitive to AC and should thus be suppressed in analyses. We do this using a dynamical jet veto based on the transverse energy of the QCD and EW final state particles. This removes jet dominated events without introducing problematic logs like a fixed p_T jet veto.

T 31.5 Mo 17:50 VMP8 SR 105

Resonances at the LHC beyond the Higgs: The Scalar/Tensor Case — Wolfgang Kilian[1], Thorsten Ohl[2], Jürgen Reuter[3], and •Marco Sekulla[4] — [1]Department of Physics, University of Siegen, Germany — [2]Faculty of Physics and Astronomy, Würzburg University, Germany — [3]DESY Theory Group, Hamburg, Germany — [4]Institute for Theoretical Physics, Karlsruhe Institute of Technology, Germany

Weak vector boson scattering (VBS) at high energies will be one of the key measurements in current and upcoming LHC runs. It is most sensitive to any new physics associated with electroweak symmetry breaking. However, a conventional EFT analysis will fail at high energies.

In this talk I present an extension of the bottom-up EFT, which includes the 125 GeV Higgs boson. Within a simplified model the effects of generic tensor and scalar resonances are considered. The spurious degrees of freedom of tensor resonances that would lead to bad high-energy behavior are treated using a gen- eralization of the Stueckelberg formalism. To ensure that the scattering amplitudes are well behaved on the whole phase space, the T-matrix unitarization procedure is used.

The implementation of this model into the Monte Carlo generator WHIZARD can be used for further studies at the LHC as I will show with exemplary plots.

T 31.6 Mo 18:05 VMP8 SR 105

Automation of electroweak NLO corrections in general models — •Jean-Nicolas Lang — Universität Würzburg

I discuss the automation of generation of scattering amplitudes in general quantum field theories at next-to-leading order in perturbation theory. The work is based on Recola, a highly efficient one-loop amplitude generator for the Standard Model, which I have extended so that it can deal with general quantum field theories. Internally, Recola computes off-shell currents and for new models new rules for off-shell currents emerge which are derived from the Feynman rules. My work relies on the UFO format which can be obtained by a suited model builder, e.g. FeynRules. I have developed tools to derive the necessary counterterm structures and to perform the renormalization within Recola in an automated way. I will describe the procedure using the example of the two-Higgs-doublet model.

T 31.7 Mo 18:20 VMP8 SR 105

Nonlinear neutrino-photon interactions inside strong laser pulses — •Sebastian Meuren, Christoph H. Keitel, and Antonino Di Piazza — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg

As different neutrino mass eigenstates exist, only the lightest neutrino is absolutely stable. However, due to the small phase space and the GIM suppression mechanism the radiative neutrino lifetime is much larger than the age of the universe [1]. Interestingly, the photon-emission probability by a neutrino is drastically increased in the presence of an external background field [2]. Therefore, it is natural to ask the question whether this so-called "electromagnetic catalysis" could be studied in an laboratory experiment using existing and upcoming laser facilities [3]. To shed light on this question, we derive the vector-axialvector coupling tensor in the presence of an arbitrary plane-wave background field [4], which is needed for the calculation of the radiative neutrino decay. Furthermore, we study the Adler-Bell-Jackiw anomaly associated with this object in detail.

[1] P.B. Pal and L. Wolfenstein, Phys. Rev. D **25**, 766 (1982)
[2] A.A. Gvozdev et al., Phys. Lett. B **313**, 161 (1993)
[3] Di Piazza et al., Rev. Mod. Phys. **84**, 1177 (2012)
[4] S. Meuren, C. H. Keitel and A. Di Piazza, JHEP **6**, 127 (2015)