T 17: Elektroschwache Physik (Theorie)

Zeit: Montag 14:00–16:15 Raum: K.11.20 (K5)

T 17.1 Mo 14:00 K.11.20 (K5)

QCD radiation patterns in WH and WZ production and anomalous coupling measurements — Francisco Campanario[1], •Robin Roth[2], and Dieter Zeppenfeld[2] — [1]Theory Division, IFIC, University of Valencia-CSIC, E-46980 Paterna, Valencia, Spain — [2]Institute for Theoretical Physics, KIT, 76128 Karlsruhe, Germany

We present a study of QCD radiation for WH and WZ production at the LHC. Regions with high sensitivity to anomalous couplings are identified by considering the contribution of jet activity to the transverse energy. For this, WHj and WZj production cross sections are calculated at NLO QCD using the Monte Carlo program `VBFNLO`. Based on the observations, we propose a dynamical jet veto to enhance the sensitivity to anomalous couplings, especially in WZ production. The dynamical jet veto avoids large logarithms, which are typical for a fixed jet veto, hence, it provides more reliable predictions.

T 17.2 Mo 14:15 K.11.20 (K5)

Unitarisation of Anomalous Couplings in Vector Boson Scattering — Dieter Zeppenfeld, Michael Rauch, and •Maximilian Löschner — Institut für Theoretische Physik, KIT

The Standard Model predicts the existence of quartic gauge boson couplings. The experimental test of their size has only begun recently. A model-independent approach to describe new physics effects in these couplings is the introduction of dimension-8 operators in an effective field theory framework.

In this talk we will show that the unitarisation of the resulting anomalous couplings is a necessary condition when comparing theoretical predictions to experimental data. To this effect we have implemented the so called K-matrix unitarisation scheme in the parton-level Monte Carlo event generator VBFNLO and we will present results obtained in this scheme. Moreover a comparison between this and other approaches for unitarisation like form factors will be discussed.

T 17.3 Mo 14:30 K.11.20 (K5)

Phase space master integrals for N^{3}LO Higgs boson production — Chihaya Anzai[1], •Maik Höschele[1], and Takahiro Ueda[2] — [1]KIT, 76128 Karlsruhe, Germany — [2]Nikhef, 1098 XG Amsterdam, Netherlands

Master integrals needed for Higgs boson production in gluon fusion are computed using the method of differential equations. We apply the recently proposed method to transform the system of differential equations to a canonical form which simplifies its integration. We discuss in detail our strategy to obtain the transformation matrices and explain our method used for the evaluation of the initial conditions. Finally, non-trivial results are shown.

T 17.4 Mo 14:45 K.11.20 (K5)

Matching coefficient for Higgs boson pair production in gluon fusion at NNLO — •Jonathan Grigo, Matthias Steinhauser, and Kirill Melnikov — Karlsruhe Institute of Technology, Karlsruhe, Germany

The cross section for Higgs boson pair production is of great interest since it gives access to the Higgs boson self interaction and the Higgs potential of the SM. It receives large radiative corrections, such that NLO corrections are essential and NNLO corrections are not negligible. For a consistent description of this process at NNLO in the heavy top quark effective theory, the matching coefficient describing the gluon-gluon-Higgs-Higgs (ggHH) interaction is needed to three-loop accuracy. We compute the ggHH matching coefficient and find that it differs from the gluon-gluon-Higgs (ggH) matching coefficient at NNLO, whereas both matching coefficients coincide up to NLO. We discuss the validity of the heavy top approximation and the effect of the ggHH matching coefficient on Higgs boson pair production at the LHC.

T 17.5 Mo 15:00 K.11.20 (K5)

Soft gluon resummation for gluon-induced Higgs Strahlung — Robert Harlander[1], Anna Kulesza[2], •Vincent Theeuwes[2], and Tom Zirke[1] — [1]Fachbereich C, Bergische Universität Wuppertal — [2]Institute for Theoretical Physics, WWU Münster

We study the effect of soft gluon emission on the total cross section predictions for the $gg \to HZ$ associated Higgs production process at the LHC. To this end, we perform resummation of threshold corrections at the NLL accuracy in the absolute threshold production limit and in the threshold limit for production of a ZH system with a given invariant mass. Analytical results and numerical predictions for various possible LHC collision energies are presented. The perturbative stability of the results is verified by including universal NNLL effects. We find that resummation significantly reduces the scale uncertainty of the $gg \to HZ$ contribution, which is the dominant source of perturbative uncertainty to ZH production. We use our results to evaluate updated numbers for the total inclusive cross section of associated $pp \to ZH$ production at the LHC. The reduced scale uncertainty of the $gg \to HZ$ component translates into a decrease of the overall scale error by about a factor of two.

T 17.6 Mo 15:15 K.11.20 (K5)

Bounding the Higgs width at LHC - Two-loop virtual corrections to Z boson pair production — •Sebastian Kirchner — Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen University

Obtaining accurate theoretical predictions for the Higgs boson width became recently important for LHC studies. Using a simple cut-and-count method, first introduced by Caola and Melnikov, it is possible to bound the Higgs boson width by measuring the on-shell and off-shell cross section for Higgs boson production and the underlying background processes. We compute the two-loop virtual corrections to Z boson production via the heavy top loop as the last missing piece for a complete analysis at NNLO. We employ both large-mass expansions and differential equations. First results will be presented.

T 17.7 Mo 15:30 K.11.20 (K5)

Finite top-mass effects in gluon-induced Higgs production with a jet-veto at NNLO — •Tobias Neumann[1] and Marius Wiesemann[2] — [1]Universität Wuppertal — [2]Universität Zürich

Effects from a finite top quark mass on the H+n-jet cross section through gluon fusion are studied for $n = 0/n \geq 1$ at NNLO/NLO QCD. For this purpose, sub-leading terms in $1/m_t$ are calculated. We show that the asymptotic expansion of the jet-vetoed cross section at NNLO is very well behaved and that the heavy-top approximation is valid at the five permille level up to jet-veto cuts of 300 GeV. For the inclusive Higgs+jet rate, we introduce a matching procedure that allows for a reliable prediction of the top-mass effects using the expansion in $1/m_t$. The quality of the effective field theory to evaluate differential K-factors for the distribution of the hardest jet is found to be better than 1-2% as long as the transverse momentum of the jet is integrated out or remains below about 150 GeV.

T 17.8 Mo 15:45 K.11.20 (K5)

Next-to-leading order electroweak corrections to pp $\to$ W^+W^- $\to$ 4 leptons **at the LHC** — Marina Billoni[1], Stefan Dittmaier[2], Barbara Jäger[1], and •Lukas Salfelder[1] — [1]Eberhard Karls Universität Tübingen — [2]Albert-Ludwigs-Universität Freiburg

Weak boson pair production processes are very sensitive to the gauge structure of the electroweak (EW) Standard Model. Although the effect of EW corrections on total cross sections is typically much smaller than of QCD corrections, in certain regions of phase space EW corrections lead to a significant reduction of the cross section. Providing both types of corrections for weak boson pair production processes in a fully differential form is therefore essential for further experimental precision tests of the SM.

In this talk we present a calculation of the next-to-leading order EW corrections to the process pp $\to$ W^+W^- $\to$ $\nu_\mu \mu^+ e^- \bar{\nu}_e$ at the LHC. Off- shell effects of the W bosons as well as non-resonant contributions are included. For a realistic event-selection setup we present numerical results and discuss the effect of the EW corrections by means of several differential distributions, such as transverse momenta or invariant masses of the final state leptons.

T 17.9 Mo 16:00 K.11.20 (K5)

High-energy Vector Boson Scattering after the Higgs Discovery — Wolfgang Kilian[1], Thorsten Ohl[2], Jürgen Reuter[3], and •Marco Sekulla[1] — [1]University of Siegen, Siegen, Germany — [2]Würzburg University, Würzburg, Germany — [3]DESY, Hamburg,

Germany

Weak vector boson scattering (VBS)at high energies will be one of the key measurements in the upcoming LHC runs. It is very sensitive to any new physics associated with electroweak symmetry breaking. But a conventional EFT analysis will fail at high energies, especially in the presence of the light 125 GeV Higgs boson.

In this talk I present how to extend the EFT to a simplified model by adding additional resonances to VBS and therefore increase the energy validity of the theoretical description.
Furthermore I introduce the T-matrix unitarization scheme as an extension of the K-matrix unitarization prescription. It provides an asymptotically consistent reference model, which has been matched to the low-energy effective theory of arbitrary non-perturbative and perturbative models.