T 11: Elektroschwache Physik (Theorie) 2

Convenor: Stefano Pozzorini

Zeit: Montag 16:45–18:45 Raum: WIL-A120

T 11.1 Mo 16:45 WIL-A120

Deep Inelastic Lepton Scattering With Polarized Nucleons — •Till Martini[1] and Hubert Spiesberger[2] — [1]Humboldt-Universität zu Berlin, PEP — [2]Johannes-Gutenberg-Universität Mainz, THEP

Knowledge about the spin-dependent gluon densities in the proton may be gained by studying the scaling violation of the structure function g_1. In order to get information on the spin-dependent structure functions (and hence parton distribution functions) it is essential to polarize both leptons and hadrons. Experiments for precision measurements at possible future electron proton or electron ion colliders (EIC, eRHIC, LHeC) with polarized targets require Monte Carlo event generators that allow to simulate complicated experimental conditions and include higher-order radiative corrections. The existing version of DJANGOH has been updated by the option of nucleon polarization to provide a tool to be used at future EICs. I will show how this was realized for both cases of neutral and charged current electroweak interactions including full $O(\alpha)$ corrections. Generated pseudo data according to two design stages of the planned EIC eRHIC at BNL is presented and the expected effect of radiative corrections is illustrated. Simulations of charged current interaction with polarized protons are for example inquired from eRHIC to predict the achievable precision and the accessible phase space (in x, Q^2).

T 11.2 Mo 17:00 WIL-A120

Heavy lepton contribution to the anomalous magnetic moment of the muon and the electron at four loops in QED — •Alexander Kurz, Tao Liu, Peter Marquard, and Matthias Steinhauser — Institut fuer Theoretische Teilchenphysik, Karlsruhe

We present results for the QED contribution from a heavy lepton loop to the anomalous magnetic moment of the muon and the electron. Exploiting the strong hierarchy between the tau, muon and electron masses ($m_\tau \gg m_\mu \gg m_e$), we use the method of asymptotic expansion which leads to on-shell and vacuum integrals up to three and four loops, respectively. Analytic results are presented up to four loops for the muon anomalous moment involving virtual τ-lepton loops and for the electron magnetic moment involving τ- and μ-lepton loops.

T 11.3 Mo 17:15 WIL-A120

Corrections of the order $\alpha\,\alpha_s$ to W boson decays — •Dominik Kara and Matthias Steinhauser — Institut für Theoretische Teilchenphysik, Karlsruher Institut für Technologie, D-76128 Karlsruhe, Germany

We compute the mixed two-loop electroweak and QCD corrections to hadronic W boson decays within the Standard Model. The optical theorem is applied to the W boson two-point function. The multi-scale integrals are computed with the help of asymptotic expansions which factorize the three-loop diagrams into one- and two-loop vacuum and propagator-type integrals.

T 11.4 Mo 17:30 WIL-A120

Electroweak Corrections to Gauge-Boson Pair Production at the LHC — •Anastasiya Bierweiler, Tobias Kasprzik, and Johann Kühn — Karlsruhe Institute of Technology (KIT), TTP

Vector-boson pair production is of great phenomenological importance at the Large Hadron Collider. These processes not only constitute an important irreducible background to Higgs and New Physics searches; since the leptonic decay products can be reconstructed well, pair production of weak bosons provides an excellent opportunity to probe the non-abelian structure of the Standard Model at high energies and may give hints to the existence of anomalous trilinear and quartic couplings, which are predicted to have sizable effects at high energies. We present the calculation of the full next-to-leading order electroweak corrections to WZ and Z-pair production. We discuss the impact of the corrections on the total cross sections as well as on relevant differential distributions. The resulting electroweak corrections are negative and strongly increase with increasing transverse momenta and lead to significant modifications of rapidity and angular distributions.

T 11.5 Mo 17:45 WIL-A120

Vacuum stability in the SM and the three-loop β-functions for the Higgs and Yukawa sector — Konstantin Chetyrkin and •Max Zoller — KIT, Germany

The ground state of the Higgs field in the Standard Model is introduced through the mechanism of Spontaneous Symmetry Breaking in the electroweak sector. In the presence of radiative corrections this vacuum state may become unstable as the Higgs potential can develop a deeper minimum than the one at the Fermi scale. This phenomenon is closely related to the evolution of the quartic Higgs self-interaction described by the corresponding β-function and the question whether it becomes negative at high scales. In this talk the effect of the three-loop β-functions on the Higgs self-interaction and the Yukawa coupling, which we recently calculated, on the SM vacuum stability will be discussed for a Higgs mass in the vicinity of 125 GeV.

T 11.6 Mo 18:00 WIL-A120

Theoretical status of the measurement of the Higgs self-coupling — Julien Baglio[1], Abdelhak Djouadi[2,3], •Ramona Groeber[1], Margarete Muehlleitner[1], and Jeremie Quevillon[2] — [1]Institut fuer Theoretische Physik, KIT, 76128 Karlsruhe, Germany — [2]Laboratoire de Physique Theorique, U. Paris-Sud and CNRS, 91405 Orsay, France — [3]Theory Unit, Department of Physics, CERN, 1211 Geneva 23, Switzerland

Now that the Higgs boson has been observed, as a next step its properties must be determined. Besides the measurement of the Higgs couplings to gauge particles and fermions and the determination of its spin and CP properties, the Higgs self-couplings have to be extracted. In this way the Higgs potential can be reconstructed and it can be ultimately tested if the particle masses are generated through electroweak symmetry breaking. The triple Higgs coupling is accessible in Higgs pair production. In this talk the main processes including higher order QCD corrections will be presented and theoretical uncertainties will be estimated. The prospects of extracting the triple Higgs coupling will be discussed.

T 11.7 Mo 18:15 WIL-A120

Higgs Spin Determination in Vector-Boson Fusion — •Jessica Frank, Michael Rauch, and Dieter Zeppenfeld — ITP, Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany

A new Higgs-like particle with a mass of about 126 GeV has been discovered at the LHC. For a verification that this is the Standard Model Higgs boson, all of its features, including its spin, need to be tested. Observation of this resonance in the di-photon channel disfavours a spin-1 particle due to the Landau-Yang theorem. Besides the spin-0 of the Higgs boson, a spin-2 particle would also be possible. In order to distinguish these two possibilities, we study the phenomenology of light Higgs-like spin-2 resonances produced in different vector-boson-fusion processes at the LHC. Starting from an effective model for the interaction of a spin-2 particle with electroweak gauge bosons, we calculate cross sections and differential distributions within the Monte Carlo program VBFNLO at NLO QCD accuracy.

T 11.8 Mo 18:30 WIL-A120

A neutral scalar singlet as Higgs imposter — •Hanna Hoffmann, Michael Rauch, and Dieter Zeppenfeld — Karlsruher Institut für Technologie (KIT), Karslruhe, Germany

Recently, the LHC has discovered a resonance at 126 GeV, and first measurements of its properties show agreement with those of a Standard Model Higgs boson. In this talk, we investigate the possibility of an alternative hypothesis, that the resonance is an additional neutral scalar singlet S. The interactions of S with the gauge bosons are described via an effective Lagrangian consisting of dimension five operators. The free coupling constants appearing in the Lagrangian are then adjusted, such that the decay rates of the 126 GeV resonance are reproduced as good as possible. We find that a significant amount of fine tuning is necessary to achieve this. Finally, we also investigate how mediator particles could induce such couplings at the loop level.