T 10: QCD (Theorie) I

Convenor: Peter Uwer

Zeit: Montag 16:45–19:00 Raum: HG XVI

T 10.1 Mo 16:45 HG XVI

NLO QCD corrections to VV+jet at hadron colliders — Stefan Dittmaier[1,2], •Stefan Kallweit[2,3], and Peter Uwer[4] — [1]Albert-Ludwigs-Universität Freiburg — [2]Max-Planck-Institut für Physik (Werner-Heisenberg-Institut) — [3]Paul Scherrer Institut, Würenlingen und Villigen, Schweiz — [4]Institut für Physik, Humboldt-Universität zu Berlin

We report on the calculation of the next-to-leading order QCD corrections to the production of massive gauge-boson pairs in association with a hard jet at the Tevatron and the LHC. Leptonic decays of the gauge bosons are included by applying an improved version of the narrow-width approximation that treats them as on-shell particles, but keeps the information on their spins. The QCD corrections stabilize the leading-order prediction for the cross sections with respect to scale variations. However, the scale dependence of the next-to-leading order results for the LHC is only reduced considerably if a veto against the emission of a second hard jet is applied. In general, the corrections do not simply rescale the differential leading-order cross sections. In particular, their shapes are distorted if an additional energy scale is involved.

T 10.2 Mo 17:00 HG XVI

NLO QCD corrections to $pp \to W^{\pm}Z\gamma$ with leptonic decays — •Michael Rauch, Francisco Campanario, Heidi Rzehak, and Dieter Zeppenfeld — Institut für Theoretische Physik, Karlsruher Institut für Technologie (KIT)

We present the computation of the next-to-leading order QCD corrections to $W^{\pm}Z\gamma$ production at hadron colliders. The photon in the final state we take as real, but include full leptonic decays for the W and Z bosons. With its signature including three leptons and missing transverse energy, it is a background for new-physics searches, in particular supersymmetry. The presence of the quartic gauge-boson couplings $WW\gamma\gamma$ and $WWZ\gamma$ in the Feynman diagrams additionally allows for testing the gauge sector of the Standard Model. Numerical results are obtained via a fully flexible parton-level Monte Carlo, which is based on the VBFNLO program package.

T 10.3 Mo 17:15 HG XVI

Hexagon Evaluation — •Francisco Campanario and Dieter Zeppenfeld — Institut für Theoretische Physik, Karlsruhe Institute of Technology - Campus South, Wolfgang-Gaede-Str. 1, 30.23 76131 Karlsruhe

Some of the virtual contributions necessary for the calculation of the NLO QCD corrections for pp -> VVjj + X are presented. A second example concerns the hexagon heavy quark loops for the full quark mass dependence of H-> jjj in gluon fusion at LO QCD. The calculation is performed using Feynman diagrams collected in topologically different subsets. Stability issues associated with the evaluation of the hexagons up to rank 5 are studied. The CPU time of the fortran subroutines for the hexagons is of order two milliseconds.

T 10.4 Mo 17:30 HG XVI

Massive Streuamplituden mittels Unitaritätsschnitten — •Ralf Sattler — HU Berlin / DESY Zeuthen

In der anstehenden Ära des LHC bilden Rechnungen auf *NLO* Ebene einen unverzichtbaren Baustein für die Überprüfung phenomenologischer Modelle des Standardmodells und darüber hinaus. Der Vortrag gibt einen Überblick über „On-Shell“ Methoden, die eine effektive Möglichkeit zur Berechnung von Streuamplituden und Streuquerschnitten bieten. Diese Techniken haben eine rasante Entwicklung in den letzten 5 Jahren erfahren und gelten heute als der vielversprechendeste Weg zur Standardisierung von *NLO*-Rechnungen.

Schwerpunkt des Vortrages ist der Einsatz analytischer Methoden zur Konstruktion von Einschleifenkorrekturen zu massiven Mehrteilchen Prozessen wie zum Beispiel der top Quark Produktion.

T 10.5 Mo 17:45 HG XVI

Computation of one-loop gluon amplitudes — •Benedikt Biedermann — Humboldt University of Berlin, Germany

A numerical approach for the computation of QCD one-loop gluon amplitudes in pure gauge theory is presented. Using generalized unitarity, we compute the coefficients of the occuring scalar one-loop integrals. As basic ingredient, the Berends-Giele recursion is used to construct on-shell tree amplitudes. The performance of the program is explored and the algorithms of the implemented methods are explained.

T 10.6 Mo 18:00 HG XVI

Two-Loop Corrections to Top-Quark Pair Production — •Cedric Studerus — Institut für Theoretische Physik, Universität Zürich

The study of the top-quark properties is one of the crucial points of the LHC physics program. The expected experimental precision on the measurement of the top-quark pair production cross section requires the calculation of the next-to-next-to-leading order (NNLO) corrections to this process in QCD. The calculation of the two-loop corrections to the top-quark pair production is an unavoidable step in the evaluation of the NNLO corrections, and poses interesting technical challenges. In this talk I will discuss the salient features of the calculation of the two-loop Feynman diagrams, and I will present analytic results for several sets of graphs in the quark annihilation production channel.

T 10.7 Mo 18:15 HG XVI

Contributions to the NNLO differential cross section in ttbar production — •Valentin Ahrens, Andrea Ferroglia, Mathias Neubert, Ben Pecjack, and Lilin Yang — Institut für Physik (WA THEP), Johannes-Gutenberg-Universität, 55099 Mainz

The calculation of the $O(\alpha s^4)$ contributions to the ttbar invariant mass distribution at hadron colliders is addressed in this talk. The results determine at NNLO in αs the coefficients of all singular plus distributions and μ-dependent logarithms in the differential partonic cross section, in the limit where the invariant mass of the ttbar pair approaches the partonic center-of-mass energy. We give a numerical analysis of the effect of the NNLO corrections.

T 10.8 Mo 18:30 HG XVI

Korrekturen höherer Ordnung zu nichtdiagonalen Quarkstromkorrelatoren — •Andreas Maier und Peter Marquard — Institut für Theoretische Teilchenphysik, Karlsruher Institut für Technologie

Korrelatoren nichtdiagonaler Quarkströme stehen über das optische Theorem in direktem Zusammenhang zu hadronischen Zerfällen von W-Bosonen oder geladenen Higgsbosonen. Voraussichtlich ermöglichen sie zudem in Verbindung mit Gittersimulationen eine präzise Bestimmung der Charmmasse.

In diesem Vortrag werden Methoden zur Berechnung der QCD-Korrekturen höherer Ordnung und erste Ergebnisse präsentiert.

T 10.9 Mo 18:45 HG XVI

Towards complete asymptotic Heavy Flavor Wilson Coefficients of the Structure Function $F_2(x,Q^2)$ at $O(\alpha_s^3)$: $C_iT_F^2$- and $C_iN_fT_F^2$ Contributions — Johannes Bluemlein[1], Sebastian Klein[2], and •Fabian Wissbrock[1] — [1]DESY — [2]RWTH Aachen

We compute the 3-loop fermion-loop corrections to the asymptotic heavy flavor Wilson coefficients of the structure function $F_2(x,Q^2)$ and of Transversity in the asymptotic region $Q^2 \gg m^2 \propto C_iN_fT_F^2$ and first contributions $\propto C_iT_F^2$, with $i = F, A$. The computation is based on a factorization theorem of the massive Wilson coefficients into massive operator matrix elements and the massless Wilson coefficients. Our method is based on direct integration, avoiding the integration-by-parts technique, which is advantageous due to the compactness of the intermediate and final results. We also obtain the corresponding contributions to the 3-loop anomalous dimensions and confirm results in the literature