T 17: Quantenfeldtheorie (perturbativ)

Convenor: C. Bogner, P. Maierhöfer

Zeit: Montag 16:45–19:00 Raum: VSH 11

T 17.1 Mo 16:45 VSH 11

Diagrammatic coaction of one-loop Feynman integrals — •Samuel Abreu[1], Ruth Britto[2], Claude Duhr[3], and Einan Gardi[4] — [1]Albert-Ludwigs-Universität, Freiburg, Germany — [2]Trinity College Dublin, Dublin, Ireland — [3]CERN, Geneva, Switzerland & Université Catholique de Louvain, Louvain-La-Neuve, Belgium — [4]Edinburgh University, Edinburgh, United Kingdom

We conjecture a completely diagrammatic representation of the so-called coaction of Feynman integrals, an operator that, amongst other things, encodes information about their discontinuities and differential equations. As a consequence, we obtain a very simple differential equation satisfied by one-loop integrals with a completely general configuration of internal and external masses, valid to all orders in dimensional regularisation. Equivalently, we show how to iteratively construct the symbol of arbitrary one-loop integrals.

T 17.2 Mo 17:00 VSH 11

Aspects of the Unitarity Approach for Multi-Loop Amplitudes in QCD — •Ben Page — Albert-Ludwigs-Universitaet Freiburg, Germany

The unitarity method has become a useful tool for computing one-loop amplitudes of phenomenological interest. We explore conceptual aspects of the method as a preparation towards new applications.

T 17.3 Mo 17:15 VSH 11

Finding canonical bases of master integrals with `epsilon` — •Mario Prausa — RWTH Aachen, Aachen, Germany

The calculation of master integrals is a crucial point in any multiloop calculation. In 2013, Henn proposed a special basis for a certain class of master integrals, which are expressible in terms of iterated integrals (e.g. generalized polylogarithms). In this basis the master integrals obey a differential equation, where the right hand side is proportional to ϵ in $d = 4 - 2\epsilon$ space-time dimensions. An algorithmic approach to find such a basis was found by Lee. We present an efficient implementation of Lee's algorithm based on the `Fermat` computer algebra system as computational backend.

T 17.4 Mo 17:30 VSH 11

Transforming multi-loop Feynman integrals to a canonical basis with *CANONICA* — •Christoph Meyer — Humboldt-Universitaet zu Berlin, Berlin, Germany

In the past years the method of differential equations has proven itself to be a powerful tool for the computation of multi-loop Feynman integrals. This method relies on the choice of a basis of master integrals in which the dependence on the dimensional regulator factorizes. I will present an algorithm that automatizes the transformation to such a basis, starting from a given basis that is obtained for instance by one of the publicly available Laporta implementations. The algorithm is applicable to differential equations with multiple scales and rational dependence on the dimensional regulator. An implementation of the algorithm in mathematica will be shown and its application to multi-scale problems will be illustrated.

T 17.5 Mo 17:45 VSH 11

Nonlinear QED in null fields — •Ibrahim Akal[1] and Gudrid Moortgat-Pick[2] — [1]Theory Group, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]II. Institute for Theoretical Physics, Hamburg University, Hamburg, Germany

QED in an external coherent background field gives rise to various non-linear phenomena. In this talk we discuss the non-linear Compton process in an electromagnetic null field. We compare the total scattering probability by confronting the bosonic and fermionic energies with the natural electric (magnetic) field amplitude far below the critical Sauter-Schwinger limit. For various parameter combinations the emission probabilities are calculated. We focus on the comparison between the intense low-frequent and the weak high-frequent regime. The former case is completely behaving classically where the fermion becomes highly relativistic and hence strongly radiative. However, a sufficient number of scattered field photons has to be taken into account. Conversely, in the perturbative high-frequent regime the energy of absorbed field quanta approaches the energy of the dressed fermion. Thus, recoil drastically quenches the emission probability. Effects of this kind can be reduced by increasing the field amplitude such that comparable probabilities become achievable even for moderate intensities.

T 17.6 Mo 18:00 VSH 11

Nichtlineare Compton-Streuung: Anwendung der Operator-Methode — •Arne Müller und Gudrid Moortgat-Pick — Universität Hamburg, Hamburg, Deutschland

Im Rahmen einer Masterarbeit stellen wir die von Baier et al. entwickelte Operator-Methode vor. Wir zeigen, wie man damit die Selbstenergie berechnet und mit Hilfe des optischen Theorems daraus die nichtlineare Compton-Streuung ableiten kann. Wir vergleichen die hieraus gewonnenen Spektren mit Berechnungen, die für das Elektron explizite Volkov Zustände ansetzen. Die jeweils zugrundeliegenden Näherungen und die Anwendbarkeit der Methoden für die verschiedenen kinematischen Bereiche werden diskutiert.

T 17.7 Mo 18:15 VSH 11

Three-loop beta functions in the Standard Model and beyond — •Florian Herren[1], Luminita Mihaila[2], and Matthias Steinhauser[1] — [1]Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology (KIT) — [2]Institut für Theoretische Physik, Universität Heidelberg

We review the beta functions of the Standard Model (SM) couplings to three-loop order. In particular, we provide a first independent calculation of the Yukawa coupling beta functions and discuss our calculational setup and the treatment of γ_5.

Furthermore, we turn to extensions of the SM and present the gauge and Yukawa coupling beta functions for the general two-Higgs-doublet model.

T 17.8 Mo 18:30 VSH 11

Towards an automation of EW NLO corrections with Sherpa and Recola — •Stephan Bräuer and Steffen Schumann — II. Physikalisches Institut, Georg-August-Universität Göttingen

In order to keep up with the ever increasing experimental precision, higher-order perturbative corrections need to be considered in corresponding theoretical predictions.

This talk provides an overview over the recent developments in the automation of electroweak next-to-leading order correction with the Monte Carlo event generator Sherpa and the one-loop generator Recola. We report on the implementation and validation of an interface to access Recola loop amplitudes from the Sherpa framework for carrying out next-to-leading order QCD and EW computations. Furthermore, first results for NLO QCD+EW calculations with Sherpa+Recola are shown and the remaining challenges for fully automated calculations of NLO EW corrections are outlined.

T 17.9 Mo 18:45 VSH 11

Unitarization for Vector Boson Scattering at the LHC — •Genessis Perez, Marco Sekulla, and Dieter Zeppenfeld — Institute for Theoretical Physics, KIT, Karlsruhe, Germany

Weak vector boson scattering (VBS) at high energies will be one of the key measurements in current and upcoming LHC runs: it is very sensitive to new physics associated with electroweak symmetry breaking. However, a pure effective Lagrangian analysis is insufficient because observable deviations from the SM typically lead to unitarity violation within the energy reach of the LHC.

To obtain valid predictions, the T/K-matrix unitarization prescription is widely used. However, an implementation of this scheme is only available for a small number of effective Lagrangian operators for VBS due to the difficulty to handle VBS with arbitrarily polarized off-shell vector bosons in the full $VVjj$ production process.

In this Talk, I introduce a procedure of the T/K-matrix unitarization scheme for generic operators within VBS and describe its implementation in the Monte Carlo generator VBFNLO. The implementation can be used for further studies at the LHC as I will show with some exemplary distributions.