T 1: QCD and electroweak interactions (theory)

Time: Monday 16:00–18:30 Location: Ta

T 1.1 Mon 16:00 Ta

Soft Gluon Resummation for the Associated Single Top and Higgs Production at the LHC — •Laura Moreno Valero[1], Anna Kulesza[1], and Vincent Theeuwes[2] — [1]Institut für Theoretische Physik, Westfälische Wilhelms Universität Münster, Deutschland — [2]Institut für Theoretische Physik, Georg-August-Universität Göttingen, Deutschland

Processes involving the Higgs boson and the top quark are of high interest in searches for BSM physics because they allow to directly measure the top Yukawa coupling. Although it has a relatively small cross section, the single top and Higgs production process $pp \to Htj$ is particularly sensitive to new physics, calling for precise theoretical predictions. For many processes at the LHC, a reduction of theoretical uncertainties can be achieved by means of resummation techniques, accounting for large logarithmic corrections, which originate from soft gluon emissions. In this talk, we discuss extending the precision with which theoretical predictions for the s-channel tHj production are known from NLO (next-to-leading order) to NLO+NLL (next-to-leading logarithmic matched to NLO) accuracy.

T 1.2 Mon 16:15 Ta

Soft gluon resummation for single leptoquark production at the LHC — •Fausto Frisenna, Anna Kulesza, and Daniel Schwartlaender — WWU, Institut für Theoretische Physik, Muenster, Germany

Leptoquarks provide one of the most promising explanations to the hints of lepton flavor non-universality in B decays. At the LHC, a single leptoquark can be directly produced together with a lepton in the final state. For TeV-scale leptoquarks, theoretical predictions can be improved by resumming large logarithmic corrections originating from soft gluon emissions. In this talk we discuss how to perform threshold resummation in Mellin space for single leptoquark production.

T 1.3 Mon 16:30 Ta

Automating the calculation of jet functions in SCET — Guido Bell, •Kevin Brune, Goutam Das, and Marcel Wald — Center for Particle Physics Siegen, Theoretische Physik 1, Universität Siegen

In pertubative QCD large logarithms can arise in the computation of collider observables. These logarithms can be resummed via factorization theorems within Soft-Collinear Effective Theory(SCET). The factorization theorems contain jet functions, which describe collinear interactions. In this talk I present a systematic framework for the computation of jet functions for generic observables. For this purpose we introduce a phase space parametrization which allows the factorization of universal singularities of jet functions. We have implemented this framework for different observables, by using the public code "pySecDec" to compute the next-to-leading order and part of the next-to-next-to-leading order jet function.

T 1.4 Mon 16:45 Ta

On the automated calculation of beam functions in Soft-Collinear Effective Theory — Guido Bell, Kevin Brune, Goutam Das, and •Marcel Wald — Center for Particle Physics Siegen, Theoretische Physik 1, Universität Siegen

Over the last decades, factorization theorems became an important method to tackle problems in perturbative QCD, especially within the framework of effective field theories. In Soft-Collinear Effective Theory, these factorization theorems include beam functions accounting for the initial-state collinear interactions. While these functions have been calculated case by case for different observables until now, we are investigating an automated approach for a general class of observables. For this, we study a general phase-space parameterization which factorizes the singularities of the beam function in an universal way. This approach has been implemented in the public code "pySecDec" in order to calculate the next-to-leading order and part of the next-to-next-to leading order beam function.

T 1.5 Mon 17:00 Ta

Investigation of Intrinsic kT and DY processes — •Mikel Mendizabal and Hannes Jung — DESY (Deutsches Elektronen-Synchrotron DESY), Hamburg, Germany

With Parton Branching (PB) we are able to describe the parton evolution in terms of transverse momentum dependent parton density functions (TMDs). We present an application of PB-TMDs to Drell-Yan (DY) production, where the PB-TMDs are matched to MC@NLO matrix element. We compare our predictions to a wide DY mass range (NuSea $\sqrt{s} = 38.8$ GeV, LHC $\sqrt{s} = 8, 13$ TeV), showing a good agreement with measurements. In addition, we study the role of non-perturbative effects in the PB approach at NLO, specifically, the role of the intrinsic, non-perturbative k_T distribution.

T 1.6 Mon 17:15 Ta

Charm quark mass effects to Upsilon decays — Matthias Steinhauser[1], Jan Piclum[2], Kay Schönwald[1], Matteo Fael[1], and •Manuel Egner[1] — [1]Karlsruher Institut für Technologie — [2]Universität Siegen

The decay of the $\Upsilon(1S)$ meson is described within non-relativistic QCD where an important building block is given by the matching coefficient of the vector current. We compute two-loop corrections to this quantity for bottom quarks including the dependence of the charm quark mass. Details to the calculation are provided. In the second part of the talk we will discuss the decay of the $\Upsilon(1S)$ meson into leptons including perturbative corrections up to order α_s^3. Full charm quark mass dependence is taken into account up to order α_s^2.

T 1.7 Mon 17:30 Ta

Heavy-quark hadro-production at next-to-leading-order in QCD and beyond. — •Yewon Yang and Sven-Olaf Moch — Universität Hamburg, Hamburg, Germany

Heavy-quark hadro-production is accessible to quantum chromodynamics (QCD) perturbation theory for heavy quark mass scales which are larger than the QCD scale. The talk reports on phenomenological results for heavy-quark pair production beyond next-to-leading-order (NLO) for the hard scattering in combination with modern parton distribution functions (PDFs).

Transverse momentum and rapidity distributions beyond NLO are obtained using single-particle inclusive kinematics where the threshold logarithms are resummed to derive approximate fixed-order perturbative corrections at next-to-next-to-leading-order (NNLO). For the total inclusive cross section, complete predictions at NNLO are used, which include also the contributions from the high energy limit. These complete predictions at NNLO for total cross section are compared with four different modern PDF sets in proton-proton collisions at 7, 8 and 13 TeV hadronic center-of-mass energy for the Large Hadron Collider.

T 1.8 Mon 17:45 Ta

Mixed NNLO QCD×electroweak corrections of $\mathcal{O}(N_f\alpha_s\alpha)$ to single-W/Z production at the LHC — •Jan Schwarz[1], Stefan Dittmaier[1], and Timo Schmidt[2] — [1]Albert-Ludwigs-Universität Freiburg — [2]Universität Würzburg

Owing to its clean experimental signature and its high cross section the Drell–Yan-like W/Z production is among the most important processes at the LHC. Drell–Yan-like processes can be used for a variety of applications, e.g., for detector calibration or measuring the W-boson mass and beyond that are also an important SM background for searches of new physics. On the theoretical side the $\mathcal{O}(\alpha_s\alpha)$ corrections seem to be the largest missing fixed order part, and in recent years it has been possible to get a handle on these corrections in the vicinity of the pole corresponding to the on-shell production of Drell–Yan-like W/Z bosons using, e.g., so-called pole approximations (PA). However, since new physics like the production of Z′ or W′ might show up for example in the tails of invariant mass spectra, the theoretical uncertainty on the SM background has to be controlled in these off-shell regions of phase space where the PA is not applicable. Therefore, a full off-shell calculation of the $\mathcal{O}(\alpha_s\alpha)$ corrections is desirable. In this talk we present results on the radiative corrections of order $\mathcal{O}(N_f\alpha_s\alpha)$ for the off-shell production of W or Z bosons at the LHC, where N_f is the number of fermion flavours. These corrections form a gauge-invariant part of the next-to-next-to-leading-order corrections of mixed QCD×EW type and include all diagrams at $\mathcal{O}(\alpha_s\alpha)$ with closed fermion loops.

T 1.9 Mon 18:00 Ta

Electroweak Corrections for W^+W^- Scattering — •Robert Franken — JMU Würzburg

Vector boson scattering (VBS) processes are a very good testing ground for the validity of the Standard Model (SM) and electroweak symmetry breaking in general. Over the last few years, Atlas and CMS have been able to measure the cross sections of VBS. To search for deviations, it is important to have precise predictions for VBS processes within the SM. Whilst only the QCD NLO predictions were available for some time, recently electroweak corrections have become available for the like-sign WW, WZ and ZZ scattering, and turned out to be at the the level of 15% for fiducial cross sections. In this talk we report on our efforts to calculate the NLO EW corrections to opposite sign WW scattering and the complete NLO corrections to the process $pp \to e^+\mu^-\nu_e\bar{\nu}_\mu jj$.

T 1.10 Mon 18:15 Ta

`ARGES` – **Advanced Renormalisation Group Equation Simplifier** — •Tom Steudtner[1,2] and Daniel Litim[2] — [1]Fakultät für Physik, TU Dortmund, Otto-Hahn-Str. 4, D-44221 Dortmund, Germany — [2]Department of Physics and Astronomy, University of Sussex, Brighton, BN19QH, United Kingdom

I will present `ARGES`, a Mathematica toolkit for obtaining perturbative renormalisation group equations in arbitrary four-dimensional QFTs. The framework exhibits several distinctive features from similar software: the computation is symbolic rather than numeric, input of unconventional scalar and Yukawa sectors is allowed, the evaluation and disentanglement of couplings is interactive and there are capabilities to inject algebraic simplification rules. I will give a conceptual and practical introduction, highlight differences to existing packages, and provide an outlook on applications.