T 91: Standard model 3 (strong/QCD)

Time: Thursday 16:00–18:00 Location: Geb. 30.23: 2/0

T 91.1 Thu 16:00 Geb. 30.23: 2/0

Recent updates in the Sherpa event generator — •Mareen Hoppe[1], Stefan Höche[2], Marek Schönherr[3], and Frank Siegert[1] — [1]Institute of Nuclear and Particle Physics, TUD Dresden University of Technology, Germany — [2]Fermi National Accelerator Laboratory, Batavia, USA — [3]Institute for Particle Physics Phenomenology, Durham University, UK

Sherpa is a general-purpose Monte-Carlo event-generator for particle collisions in high-energy collider experiments. It is able to provide complete hadronic final states for various processes with hard scattering process calculation up to NLO QCD and approximate NLO EW. During this talk, some recent updates in the Sherpa matrix element generation are presented including progress in the simulation of polarized cross sections of intermediate particle states at higher orders.

T 91.2 Thu 16:15 Geb. 30.23: 2/0

Workflow and performance optimization for fast NNLO pQCD Calculations — •Johannes Gässler — Karlsruhe Institute of Technology, Germany

fastNLO is a library that allows for fast NNLO pQCD calculations by interpolating parton distribution functions. This makes it possible to reuse the results of an expensive Monte Carlo integration for arbitrary a posteriori choices of the PDFs, the strong coupling constant, and the energy scales. A new procedure for determining momentum fraction nodes for the interpolation has been implemented. New nodes are added dynamically as needed. This obsoletes one of the steps in the previous workflow in which the interpolation nodes were first determined in a so-called "warmup" run.

T 91.3 Thu 16:30 Geb. 30.23: 2/0

Fast simulations with NNLO QCD accuracy - new developments in the APPLfast project — •Lucas Kunz — Karlsruhe Institute of Technology, Karlsruhe, Germany

The calculation of theoretical predictions for hadron colliders at higher orders in perturbation theory involves computing time expensive iterative procedures. The same is true for the extraction of parton distribution functions (PDFs) from measured data. Hence, to produce results in reasonable time, a very efficient and flexible setup is needed. The APPLfast project fulfills these requirements by linking the parton-level Monte Carlo program NNLOJET with both the APPLgrid and fastNLO grid libraries, thereby allowing for an a posteriori choice of a set of PDFs or value of the strong coupling constant. This talk will give an overview of the project, focusing on an explanation of the general logic and on possible applications rather than technical details. It will further present some results for NNLO dijet production at the LHC, both at leading and full color, as well as corresponding new determinations of the strong coupling.

T 91.4 Thu 16:45 Geb. 30.23: 2/0

Deep Inelastic Scattering events for photon and heavy boson TMDs in the Parton Branching Method — •Keila Moral Figueroa — Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, D-22607 Hamburg

Deep Inelastic Scattering (DIS) events at HERA are the most precise DIS measurement to date, which constitutes an important tool to study transverse momentum dependent (TMD) parton distribution functions. In this study, we introduce standard DIS Monte Carlo events recreating HERA conditions, and apply their cross section as a constraint for both photon and heavy boson TMDs in the Parton Branching Method.

T 91.5 Thu 17:00 Geb. 30.23: 2/0

Two-loop matching of the chromo-magnetic dipole operator with the gradient flow — •Janosch Borgulat[1], Robert Harlander[1], Matthew D. Rizik[2], and Andrea Shindler[1,3,4] — [1]TTK, RWTH Aachen University, 52056 Aachen, Germany — [2]Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA — [3]NSD, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA — [4]Department of Physics, University of California, Berkeley, CA 94720, USA

The baryon asymmetry of the universe requires sources of CP-violation beyond those predicted by the standard model. On the other hand, experimental constraints on the neutron electric dipole moment leave a large window for CP-violating contributions beyond the standard model. Such contributions can be described by CP-violating effective interactions at hadronic energies in QCD. Because of confinement, these contributions cannot be computed perturbatively. However, they are accessible to lattice simulations. These, on the other hand, suffer from power divergences in the inverse lattice spacing.

A useful tool to circumvent these inconveniences is the gradient flow which acts on the fields similar to the heat equation, smoothing them along an auxiliary fifth dimension, the flow time. This removes all ultraviolet divergences and leads to well-behaved flowed operators on the lattice. The mixing matrix translating between regular and flowed operators is accessible to perturbative calculations. In our work, we compute the renormalized mixing matrix for the chromomagnetic dipole operator through next-to-next-to-leading order.

T 91.6 Thu 17:15 Geb. 30.23: 2/0

Diagrammatic resummation of QCD double logarithms in $B_c \to \eta_c$ form factors — Guido Bell[1], Philipp Böer[2], Thorsten Feldmann[1], •Dennis Horstmann[1], and Vladyslav Shtabovenko[1] — [1]Theoretische Teilchenphysik, Center for Particle Physics Siegen, Universität Siegen — [2]PRISMA+ Cluser of Excellence & Mainz Institute for Theoretical Physics, JGU Mainz

Soft-Collinear Effective Theory is an important tool used for setting up factorisation theorems and achieving resummations for collider and flavour observables. While most conceptual problems appearing in calculations at leading power have been understood, at subleading power endpoint divergent convolution integrals appear in the factorisation theorems preventing the use of renormalization group equations for resummations. While this problem has recently been solved for several collider observables, it persists in exclusive B-decays. We therefore resort to diagrammatic resummation techniques to derive the double-logarithmic series of the "soft-overlap" contribution to $B_c \to \eta_c$ transition form factors at large hadronic recoil, assuming the scale hierarchy $m_b \gg m_c \gg \Lambda_{\rm QCD}$. In this case, the relevant hadronic matrix elements can be computed perturbatively. We find that the leading double logarithms arise from a peculiar interplay of soft-quark "endpoint logarithms" from ladder diagrams with energy-ordered spectator-quark propagators, as well as standard Sudakov-type soft-gluon corrections. We elucidate the all-order systematics, and show that their resummation proceeds via a novel type of integral equations.

T 91.7 Thu 17:30 Geb. 30.23: 2/0

Three-loop heavy-to-light form factors in QCD — Robin Brüser[2], Tobias Huber[1], •Jakob Müller[1], and Maximilian Stahlhofen[2] — [1]Theoretische Teilchenphysik, Center for Particle Physics Siegen, Universität Siegen — [2]University of Freiburg

Precision calculations require the evaluation of higher orders in the perturbative expansion of quantum field theory. In this talk, we discuss the computation of form factors for decays of heavy into light quarks at third order in QCD for various currents. We describe the generation and simplification of the corresponding Feynman diagrams and the integration-by-parts reduction to a finite basis of master integrals. Further, we report on the status of the calculation of the master integrals and give an outlook on the phenomenological applications of the results.

T 91.8 Thu 17:45 Geb. 30.23: 2/0

Short-flow-time expansion of quark bilinears through next-to-next-to-leading order QCD — Janosch Borgulat[1], Robert Harlander[1], •Jonas Kohnen[1], and Fabian Lange[2,3,4,5] — [1]TTK, RWTH Aachen University, 52056 Aachen, Germany — [2]Physik-Institut, Universität Zürich, Winterthurerstrasse 190, 8057 Zürich, Switzerland — [3]Paul Scherrer Institut, 5232 Villigen PSI, Switzerland — [4]Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology (KIT), Wolfgang-Gaede-Straße 1, 76128 Karlsruhe, Germany — [5]Institut für Astroteilchenphysik, Karlsruhe Institute of Technology (KIT), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

The gradient-flow formalism has proven to be a valuable tool for calculations in lattice gauge theory. It extends the fields of QCD by the flow time t. Matrix elements of flowed composite operators do not mix un-

der renormalization and can be calculated efficiently on the lattice. In order to match the flowed operators to regular QCD, one can perform an operator-product expansion at short flow times. The coefficients of this short-flow-time expansion can be calculated perturbatively. The topic of this talk is the calculation of the coefficients of the short-flow-time expansion for the scalar, pseudoscalar, vector, axialvector and tensor currents at next-to-next-to leading order.