SCET 2023

Monday, 27 March 2023 - Thursday, 30 March 2023

Lawrence Berkeley National Lab

Book of Abstracts

Contents

Session 7 / **4**

Non-Global Logarithms at NLL accuracy

Author: Nicolas Schalch[1]

[1] *University of Bern*

We implement the two-loop anomalous dimension governing the resummation of non-global logarithms into a large-N_c parton shower framework which solves the renormalization group equations used to evolve from the collision energy to the scale associated with soft emissions. Combined with the one-loop corrections to the hard and soft functions we obtain resummed predictions at next-to-leading logarithmic accuracy for gap-between jet cross sections at both lepton and hadron colliders.

Session 1 / **5**

QED radiative corrections for accelerator neutrinos

Author: Oleksandr Tomalak[1]

[1] *Los Alamos National Laboratory*

Charged-current quasielastic neutrino scattering is the signal process in neutrino oscillation experiments and requires precise theoretical prediction for the analysis of modern and future experimental data. We formulate radiative corrections in a soft-collinear effective field theory framework, evaluate soft and collinear contributions analytically in QED, provide a hadronic model for "hard" contributions, present the resulting scattering cross sections and contrast them with experimental data. We validate the precise relation between electron and muon neutrino cross sections for the experimental setup of modern and future accelerator-based neutrino oscillation experiments. The exchange of photons with nuclear medium modifies (anti)neutrino and electron scattering cross sections. We study the distortion of (anti)neutrino-nucleus and charged lepton-nucleus cross sections and estimate the QED-medium effects. We find new permille-to-percent level effects, which were never accounted for in either (anti)neutrino-nucleus or electron-nucleus scattering.

Session 9 / **6**

Refactorization in subleading B decay into photon

Author: Robert Szafron[None]

I will discuss refactorization conditions between the subleading power contributions to the inclusive B decay into photon suffering from endpoint divergences. I will also prove factorization theorem beyond leading power. This result allows for higher-order calculations of the resolved contributions and consistent summation of large logarithms. This is an example of first endpoint factorisation in a heavy flavor application of SCET, which includes nonperturbative functions as additional subtlety typically not present in collider applications.

Session 6 / **7**

Heavy Meson LCDA: SCET to bHQET Matching

Author: Gael Finauri[1]

[1] *TUM*

Light-cone distribution amplitudes (LCDAs) frequently arise in factorization theorems involving light and heavy mesons.
The QCD LCDA for heavy mesons includes short-distance physics at energy scales of the heavy quark mass.
In this talk I will explain how to achieve the separation of this perturbative scale from the purely hadronic effects by expressing the QCD LCDA as a convolution of a perturbative "jet" function with the universal, quark-mass independent HQET LCDA.
The calculation of the jet function is performed in the reference frame where the heavy meson is highly boosted, resulting in an SCET to boosted HQET (bHQET) matching.
This factorization allows to efficiently resum large logarithms between $\Lambda_{\rm QCD}$ and m_Q as well as between m_Q and the scale of the hard process in the production of boosted heavy mesons at colliders.
As an application I will present updated theoretical predictions for the brancing ratio of $W \to B\gamma$.

Session 11 / **8**

Resummation of Sudakov Shoulder Logarithms in Heavy Jet Mass

Author: Xiaoyuan Zhang[1]

[1] *Harvard University*

Sudakov shoulder arises from incomplete cancellations between virtual corrections and real emissions in the perturbation theory of some event shape observables, like thrust, heavy jet mass and C parameter. We present the next-to-next-to-leading logarithmic (NNLL) resummation of Sudakov shoulders in the heavy jet mass. The appearance of spurious Sudakov Landau poles is ameliorated by resumming its second derivative and setting scale in the conjugate Fourier space. The joint resummation of threshold logarithms and shoulder logarithms provides an essential ingredient in the extraction of strong coupling constant from heavy jet mass data.

Session 4 / **9**

Gauge invariance of radiative jet functions

Author: June-Haak Ee[1]

[1] *Fudan university*

In subleading powers of SCET, the Lagrangian contains couplings between soft quarks and hard-collinear quarks. Matrix elements of the hard-collinear part of these couplings are radiative jet functions. Although the radiative jet functions are constructed to contain hard-collinear modes, we find that, in order to render the radiative jet functions gauge invariant, it is necessary, in general, to include in the radiative jet functions certain contributions that contain a soft-quark propagator. In gauges other than the Feynman gauge, the soft-quark propagator is canceled by "gauge terms" in the gluon propagator, leaving a purely hard-collinear contribution.

Session 2 / **10**

Glauber Quarks and Backscattering Resummation in QED

Author: Arindam Bhattacharya[1]

[1] *Harvard University*

Glauber modes associated with fermion exchange lead to large logarithmic enhancements in backward scattering processes in QED and QCD. We discuss the full one-loop matching of backward scattering limit of QCD to SCET augmented with Glauber quark operators, and demonstrate that no one-loop Wilson coefficients are needed, thereby providing an analogous result to earlier work on Glauber gluons. While power-suppressed relative to Glauber gluons, we demonstrate that Glauber quarks have an abelian nature and are responsible for large and novel enhancements in total cross sections in QED.

Session 9 / **11**

Structure-Dependent QED Effects in Exclusive B Decays at Subleading Power

Authors: Claudia Cornella[1]; Matthias Neubert[1]

[1] *JGU Mainz*

Corresponding Author: cornell.claudia@gmail.com

We derive a factorization theorem for the structure-dependent QED effects in the weak exclusive process $B^- \to \mu^- \bar{\nu}_\mu$, i.e., effects probing the internal structure of the B meson. The derivation requires a careful treatment of endpoint-divergent convolutions common to subleading-power factorization formulas. We find that the decay amplitude is sensitive to two- and three-particle light-cone distribution amplitudes of the B meson as well as to a new hadronic quantity $F(\mu, \Lambda, v_B \cdot v_\ell)$, which generalizes the notion of the B-meson decay constant in the presence of QED effects. This is one of the first derivations of a subleading-power factorization theorem in which the soft functions are non-perturbative hadronic matrix elements.

Session 6 / **12**

Weak annihilation in non-leptonic B decays

Author: Philipp Böer[1]

[1] *JGU Mainz*

Exclusive non-leptonic B-meson decays provide a precision laboratory for tests of flavour-changing weak transitions.
While the factorization of the decay amplitude is well understood in the heavy-quark limit since more than two decades, very little is known so far about power-corrections.
One particular class of such suppressed effects are the so-called weak-annihilation topologies. With the recent advances in the theoretical
understanding of sub-leading power SCET, we investigate the factorization of these effects in the annihilation-dominated charmless decay $B_d \to K^+ K^-$.

Session 12 / **13**

Polarized J/ψ TMD fragmentation functions

Author: Reed Hodges[1]

[1] *Duke University*

We derive the leading-order polarized transverse momentum dependent fragmentation functions (TMDFFs) for light quark and gluon partons fragmenting to a J/ψ, and match the TMDFFs onto NRQCD. While unpolarized TMDFFs for quarkonium have been computed, a systematic treatment of the FFs for polarized quarkonium and parton has yet to appear in the literature. This will be crucial for making predictions for J/ψ production cross sections at low transverse momentum, and allow for new tests of the NRQCD factorization formalism.

Session 7 / **14**

Dilatations, Complex Boosts and the Phase of the S-Matrix

Author: Michael Saavedra[1]

[1] *Carnegie Mellon University*

It is well known that Glauber modes are responsible for generating the imaginary part of the S-matrix, even away from the forward limit. In this talk I will show this fact allows one to calculate both rapidity and canonical anomalous dimensions using unitarity methods. I will give explicit examples in the context of: the Sudakov form factor, the Regge trajectory, and the transverse momentum distribution function.

Session 5 / **15**

Collinear dynamics beyond DGLAP

Author: Max Jaarsma[None]

The DGLAP evolution equations are arguably the most important evolution equations for collider physics applications. However, DGLAP doesn't capture correlations in fragmentation, which e.g. enter in dihadron fragmentation or the study of energy flow within jets. In this talk I present a general non-linear collinear evolution equation, that accounts for these correlations. These evolution equations are needed for track functions, which can be applied to calculations of track-based observables. The advantage of track-based observables is that they can be measured to high precision due to the superior angular resulotion of tracking systems. We have calculated the next-to-leading order evolution kernels and shown that they reproduce DGLAP for single hadron fragmentation. Furthermore, the (so far unknown) next-to-leading order evolution of N-hadron fragmentation functions can be directly obtained from our results.

Session 5 / **16**

Jet veto resummation for $pp \to H$+jet with NNLL′+NNLO uncertainties

Author: Pedro Cal[1]

[1] *DESY*

Many Higgs analyses divide the data into exclusive jet bins since the background decomposition changes considerably depending on the number of jets in the final state. In this talk we present our work on exclusive Higgs+jet production via gluon fusion, with a veto on additional jets. We perform the resummation of jet-veto logarithms to NNLL′ accuracy, using a different factorization theorem than previous theory predictions for this process. We match the resummed cross section to the NNLO fixed order result, and treat unknown quantities as theory nuisance parameters.

Session 10 / **17**

NNLO jet and beam functions: Automation, distributions and jet clustering

Corresponding Author: brune@physik.uni-siegen.de

We present an extension of our automated framework for the calculation of jet and beam function to next-to-next-to-leading order in perturbation theory. In particular, we will present first results for quark and gluon jet functions that involve non-trivial phase-space constraints from jet algorithms like the winner-take-all axis recombination scheme. Moreover, we will report on a novel approach for the calculation of beam functions directly in momentum (distribution) space.

Session 8 / **18**

Quantum Entanglement and Parton Distribution functions in 1+1D

Author: Varun Vaidya[None]

Calculating Parton Distribution functions(PDFs) analytically has been a long standing problem in Nuclear physics. In this talk, I ll propose a new approach towards solving this problem by borrowing ideas from Quantum information science. In particular, I ll put forward a possible emergent minimum free energy principle based on the quantum entanglement properties of partons making up bound states of strongly interacting theories like QCD. As a preliminary step, I ll discuss the success of this technique in describing the ground state spectrum and PDF of mesons and baryons in 1+1 D gauge theories.

Session 2 / **19**

Small-x Factorization from Effective Field Theory

Author: Aditya Pathak[1]

[1] *DESY*

We derive a factorization theorem that allows for resummation of small-x logarithms by exploiting Glauber operators in the soft collinear effective field theory. Our analysis is carried out for the hadronic tensor $W^{\mu\nu}$ in deep inelastic scattering, and leads to the definition of a new gauge invariant soft function $S^{\mu\nu}$ that describes quark and gluon emission in the central region. This soft function provides a framework for extending resummed calculations for coefficient functions to higher logarithmic orders. Our factorization also defines impact factors by universal collinear functions that are process independent, for instance being identical in small-x DIS and Drell-Yan.

Session 5 / **20**

Pure quark and gluon observables

Author: Xiaojun Yao[1]

Co-author: Iain Stewart [2]

[1] *University of Washington*

[2] *MIT*

One application of jet substructure techniques is to disentangle quark- and gluon-initiated jets. Previous studies mainly relied on the difference in the quark and gluon quadratic Casimirs that appear in Sudakov factors. In this talk, I construct a set of pure quark and gluon observables with the collinear drop grooming techniques, utilizing factorization formulas constructed using Soft-Collinear Effective Theory (SCET) which crucially include both perturbative and non-perturbative effects. For example, a gluon observable is constructed so as to give a vanishing distribution for any sample that has only quark jets, and a non-vanishing result for any process which can produce gluon jets. I will also show Monte Carlo simulation results for these observables and discuss how to remove the soft contamination from the underlying events.

Session 6 / **21**

Factorization at subleading power for DY and DIS

Author: Michael Luke[1]

[1] *University of Toronto*

I discuss factorization in SCET at next-to-leading power (NLP) for quark-induced Drell-Yan scattering at low $q_\perp^2$ and Deep Inelastic Scattering in the $x \to 1$ limit. Using a SCET approach with no explicit soft or collinear modes, I discuss the fact that spurious endpoint and rapidity divergences which naively spoil factorization in SCET cancel when double-counting of degrees of freedom is consistently accounted for at NLP.

Session 1 / **22**

Factorization of diffraction from SCET

Author: Stella Schindler[1]

[1] *MIT*

Diffractive processes account for up to 30% of the inelastic cross-section at the LHC and are expected to account for over 20% of the cross-section at the planned Electron-Ion Collider. In this talk, I will derive a factorization for diffraction, using Glauber SCET. I will also compare and contrast our factorized results to formulas historically used to carry out global analyses in the diffractive literature.

Session 8 / **23**

SCET gravity with fermionic matter

Author: Patrick Hager[1]

[1] *MITP, Johannes Gutenberg Universiy Mainz*

Soft-collinear gravity describes the interactions of collinear and soft gravitons with matter and themselves to all orders in the soft-collinear power expansion. It is constructed based on the underlying diffeomorphism invariance and can describe scalar and integer-spin tensorial representations.

In this talk, I present the extension of this framework to include internal gauge symmetries consistently, at the example of the local Lorentz symmetry required to implement half-integer spin representations in curved space-times.

The treatment of the additional gauge symmetry is closely related to the standard SCET construction, but the employed Wilson lines must be modified to respect the emergent gauge symmetry of SCET gravity. With these additional Wilson lines, the effective Lagrangian can be constructed to all orders in the power-counting parameter.

The resulting Lagrangian shares the same emergent gauge symmetry as SCET gravity, and can be expressed in terms of a covariant derivative and multipole-expanded interactions featuring the Riemann tensor. The covariant derivative generalises in a natural fashion to the fermionic fields, as the total angular momentum (featuring both the orbital and spin part) arises as a gauge charge.

This concludes the Lagrangian construction of SCET gravity, which can now describe fields of arbitrary spin and internal gauge symmetry in a gravitational setting.

Session 7 / **24**

Glauber Phases in Non-Global Observables

Author: Michel Stillger[1]

[1] *JGU Mainz*

The higher-order behavior of logarithmically enhanced contributions in non-global observables at hadron colliders is very intricate, in particular as double-logarithmic corrections arise first at four-loop order. For realistic values of the low energy scale and the partonic center-of-mass energy the contribution of these so called super-leading logarithms (SLLs) is comparable to the one of Glauber phases arising from soft parton exchange in initial- or final-state. Whereas the simultaneous resummation to all orders of SLLs and Glauber phases for quark-initiated $2 \to M$ scattering processes has been achieved, the situation is way more complicated for gluon-initiated processes. We develop a special formalism using matrices in the adjoint representation of $SU(N_c)$ to perform the resummation and present some preliminary results.

Session 10 / **25**

Bottom mass corrections to boosted-top cross section

Author: Alejandro Bris[1]

[1] *IFT-UAM*

In this talk we present the computation of the secondary massive quark corrections to the bHQET thrust distribution at NNLO. The missing pieces of the corresponding factorization theorem at this order are the jet and hard functions.

For the calculation of the massive bubble diagrams we employ the Mellin Barnes representation for the dispersive integral, that enables expressing the result as analytic, fast-converging power series of a small parameter rather than integrals that can only be solved numerically.

The secondary mass makes necessary employing different EFT setups in various parts of the spectrum. We obtain the flavour matching coefficients necessary to make the top-down running continuous when integrating out the secondary quark mass. They satisfy the consistency condition from the bottom-up running.

Session 13 / **26**

LaMET3.0: Precision parton calculations on lattice

Author: Xiangdong Ji[1]

[1] *University of Maryland*

To reliably calculate parton physics on lattice, precision perturbative matching at 1-2 GeV scale is important. To achieve this, one needs to properly resum large longitudinal logs and take into account leading (mass) renormalon contribution. Moreover, threshold resummation in momentum space through SCET formalism is important. Once done, iso-vector valence PDF can be calculated at present to 5 to 10% precision in the intermediate-x region.

Session 11 / **27**

Nucleon Energy-Energy Correlator in Lepton-Ion Collisions

Author: Haotian Cao[1]

[1] *Beijing Normal University*

In this talk, I will introduce the concept of the nucleon energy energy correlator (neec). I will argue how this quantity can be measured in the dis process and present the NLL results.

Session 13 / **28**

Transverse Momentum Distributions of Heavy Hadrons and Polarized Heavy Quarks

Author: Zhiquan Sun[1]

[1] *MIT*

We initiate the study of transverse momentum-dependent fragmentation functions (TMD FFs) for heavy quarks fragmenting into heavy hadrons, and calculate all TMD parton distribution functions (PDFs) for the production of polarized heavy quarks from gluons within nucleons. We analyze the rich hierarchies of scales involved in heavy-quark TMD FFs by matching massive SCET onto novel nonperturbative matrix elements in boosted HQET (bHQET). We in particular identify the bHQET matrix elements characterizing the so-called Collins function, which encodes the fragmentation of transversely polarized (heavy) quarks. Another new ingredient of our analysis is the perturbative unpolarized TMD FF for heavy quarks, which we expect to also appear in other observables like flavor-tagged energy-energy correlators in the back-to-back limit. To connect our EFT analysis with

phenomenology at the future EIC, we calculate all leading-order matching coefficients of polarized heavy-quark TMD PDFs onto collinear gluon PDFs. We find a nonzero transition rate from longitudinally polarized gluons to transversely polarized heavy quarks, which offers a promising probe of the heavy-quark Collins function in semi-inclusive DIS at the future EIC.

Session 3 / **29**

The q_T spectrum for Higgs production via quark annihilation at N^{3}LL'+ aN^{3}LO

Author: Rebecca von Kuk[1]

[1] *DESY*

Due to the limited detector resolution and the challenges involving the tagging of individual quark flavors, it is difficult to measure the Yukawa coupling of bottom, charm and strange quarks from the final state.
A precise prediction of the q_T spectrum for Higgs production via quark annihilation allows to access the Yukawa coupling for bottom and lighter quarks from the initial state as the q_T spectra of the quark flavors show a different shape.
Especially in the peak region this allows for a possible discrimination of bottom, charm, and strange initiated production once a full treatment of mass effects is included.
I will present an N^{3}LL'+ approximate N^{3}LO prediction for Higgs production via quark annihilation where I will in particular focus on the differences to the related Drell-Yan process.

Session 3 / **30**

Azimuthal decorrelation and the Winner-Takes-All axis

Authors: Rudi Rahn[1]; Wouter Waalewijn[None]

[1] *University of Manchester*

The azimuthal decorrelation between a vector boson and a jet is an essential hard probe in high energy proton-proton and heavy-ion collisions. It suffers from large logarithms in the back-to-back limit, which can be resummed using SCET. In this talk I will demonstrate that by adopting the Winner-Takes-All recombination scheme the observable's theoretical treatment simplifies tremendously, which allows us to derive resummed predictions at NNLL accuracy. I will discuss and motivate the simplicity of the WTA azimuthal decorrelation by contrasting it with the closely related radial decorrelation, and discuss various theoretically interesting features and extensions, such as the appearance of large non-singular corrections of electroweak origin, or the extension to dijet decorrelation.

Session 3 / **31**

One-jettiness resummation for color singlet plus jet production at hadron colliders

Author: Simone Alioli[1]

[1] *UNIMIB & INFN*

We present results for the resummation of one-jettiness (Tau1) for the production of a color singlet system associated with a hard jet at hadron colliders, up to NNLL' accuracy. As a case study we focus on Z+1jet production at the LHC. We study different definitions of Tau1, depending on the frame in which one-jettiness is defined, assessing the size of the higher-order logarithmic corrections in three benchmark cases. The resulting predictions are matched to the appropriate fixed order contributions. We then proceed to study the size of the power-suppressed nonsingular corrections in the different frames, highlighting the advantages and drawbacks of using each definition of one-jettiness for a nonlocal subtraction scheme. These results pave the way to the implementation of V+jet processes into NNLO+PS Monte Carlo generators such as GENEVA.

Session 12 / **32**

Renormalization for NLP TMD Quark-Gluon-Quark Correlators

Author: Anjie Gao[1]

[1] *MIT*

For the canonical TMD processes including Drell-Yan and semi-inclusive DIS, several azimuthal angle-dependent structure functions show up at the next-to-leading power (NLP). Previously at SCET, I discussed the bare factorization theorem for these NLP structure functions, where a set of TMD quark-gluon-quark correlators and their hard matching coefficient are the main new ingredients. This year I will discuss the renormalization for the qgq correlators which is nontrivial, including both endpoint divergences as well as a novel rapidity divergence that is not canceled by standard multiplicative counterterms. In this talk, I will discuss definitions for the renormalized quark-gluon-quark correlators, which cancel these divergences, and only depend on one hadronic state.

Session 12 / **33**

Probing charming and beautiful dynamics with energy correlators

Author: Kyle Lee[None]

In this talk, I will discuss how one can use energy correlators to study the intrinsic heavy quark mass scale present in QCD. Specifically, I will discuss how heavy quark dynamics interplay with the standard TMD observable in the back-to-back configuration and how it is imprinted on the collinear jet limit. Furthermore, I will discuss how energy correlators provide important consistency between the dynamics in the back-to-back, collinear, and finite angle regions.

Session 10 / **34**

Threshold factorization of the Drell-Yan quark-gluon channel and two-loop soft functions at NLP

Author: Sebastian Jaskiewicz[1]

[1] *IPPP, Durham University*

Extension of factorization formulas beyond leading power within Soft Collinear Effective Theory (SCET) in recent years has not proved straightforward due to appearance of endpoint divergences

and complicated functions with extra dependence on convolution variables. In this talk, I will discuss the basis for a resummation of the quark-gluon channel of the Drell-Yan process at threshold at next-to-leading power (NLP) using SCET. I will discuss the factorization formula and describe NLP collinear functions and generalized soft functions that emerge beyond leading power. I will focus on the technical aspects of the calculation of the generalized soft functions that appear in NLP factorization formulas up to the two-loop order.

Session 4 / **35**

TMD Factorization and Resummation at NLO+NLP

Author: John Terry[1]

[1] *LANL*

In this talk, I'll present our results on transverse momentum dependent factorization and resummation at sub-leading power. I'll discuss the explicit formalism for calculating the hard, soft and collinear contributions to the sub-leading cross sections at one loop. I'll demonstrate that at this perturbative order, the leading and sub-leading power distributions mix, which gives rise to anomalous dimension matrices. Additionally, I'll discuss how the NLP TMDs match onto the collinear distributions.

Session 4 / **36**

Sudakov logarithms from double lightcone OPE

Author: Huaxing Zhu[1]

[1] *Zhejiang University*

Energy-Eenrgy Correlator exhibits Sudakov logarithms in the back-to-back limit. At leading power, these logarithms can be resummed to all orders using TMD factorization method. However, going beyond the leading power remains challenging in this approach. In this talk I will introduce a novel approach to resum Sudakov logarithms in EEC, both at leading and subleading power. I will show that the Sudakov logarithms in EEC are intimately related to the double lightcone limit of four-point Wightman correlators in position space, where the four points are connected consecutively by null separation. We develop a systematic method to resum the logarithms at leading and subleading power by exploiting the conformal symmetry of massless QCD in the classical limit. This talk is based on arXiv:2301.03616 and ongoing work.

Session 14 / **37**

SCET and Fermi Liquid Theory

Author: Ira Rothstein[1]

[1] *Carnegie Mellon University*

In this pedagogical talk I will try to show how these two rather distinct physical systems are more similar than one would have expected, once looked upon through the lens of effective field theory. While the observables are wildly different, the kinematics which define the "ground state"(superselection sectors) can be considered to be in the same class.

Session 11 / **38**

Resummation for photon isolation

Author: Thomas Becher[None]

To separate the energetic photons produced in hard scattering processes from those from other sources, measurements impose isolation requirements which restrict the hadronic radiation inside a cone around the photon. In our talk we explain that for small cone radius R, photon isolation effects can be captured by a fragmentation function describing the decay of a parton into a photon accompanied by hadronic radiation. We solve the associated renormalization group equations to resum logarithms of R. For small isolation energy, the cone fragmentation function factorizes further, into collinear functions describing energetic quarks and gluons near the cone boundary and functions encoding their soft radiation emitted into the cone. Based on this factorization we also resum the non-global logarithms of the ratio of the photon energy and the isolation energy, so that we control all logarithmically enhanced terms in the cross section. Finally, we provide a simple formula to convert NNLO cross section results from smooth-cone isolation to fixed-cone isolation.

Session 8 / **39**

Non-perurbative computation of a U(1) soft function using quantum simulation

Author: Marat Freytsis[1]

[1] *University of Oregon*

This talk will discuss how to compute a U(1) soft function using quantum algorithms.

Session 1 / **40**

Welcome

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Session 9 / **41**

Structure-Dependent QED Effects in Exclusive B Decays at Subleading Power: Factorization and Operator Basis

Corresponding Author: cornell.claudia@gmail.com

We derive a factorization theorem for the structure-dependent QED effects in the weak exclusive process $B^- \to \mu^- \bar{\nu}_\mu$, i.e., effects probing the internal structure of the B meson. The derivation requires a careful treatment of endpoint-divergent convolutions common to subleading-power factorization formulas. We find that the decay amplitude is sensitive to two- and three-particle light-cone distribution amplitudes of the B meson as well as to a new hadronic quantity $F(\mu, \Lambda, v_B \cdot v_\ell)$, which generalizes the notion of the B-meson decay constant in the presence of QED effects. This is one of the first derivations of a subleading-power factorization theorem in which the soft functions are non-perturbative hadronic matrix elements.

Session 8 / **42**

The q_T spectrum for Higgs production via quark annihilation at N^{3}LL'+ aN^{3}LO

Author: Rebecca von Kuk[1]

[1] *DESY*

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