LoopFest XXIV

Report of Contributions

Contribution ID: **1** Type: **not specified**

NLO corrections to inclusive $\bar{B} \to X_s\gamma$ decays at subleading power

Theoretical predictions in hadron physics are often limited by non-perturbative uncertainties in QCD. Nevertheless, several phenomenologically important processes require improved theoretical control. Effective field theories, such as Soft-Collinear Effective Theory (SCET) and Heavy Quark Effective Theory (HQET), provide powerful tools to overcome these limitations by exploiting factorisation.
A particularly interesting class of observables arises in flavour physics, and in particular in inclusive $\bar{B} \to X_s\gamma$ decays. Among the resolved contributions to this process, the dominant theoretical uncertainty currently originates from the interference between the WET operators O_1 and O_7, which corresponds to non-local subleading power corrections.
In this work, we derive a factorisation formula for the O_1–O_7 interference that is suitable for the inclusion of perturbative α_s corrections. The factorised expression involves four distinct functions. We present explicit results for all of them, with particular emphasis on the renormalisation-group evolution of the shape function g_{17}, a generalised light-cone distribution amplitude depending on both light-cone directions, and the two-loop penguin jet function, which was computed fully analytically.
These ingredients complete the $\mathcal{O}(\alpha_s)$ corrections to the O_1–O_7 interference. Moreover, they provide important insight into the technical structure of these higher-order corrections. These results are expected to be highly relevant for future precision studies at subleading power.

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Contribution ID: **2** Type: **not specified**

The spectrum of Feynman-integral geometries at two loops

In this talk, I will present the results of our recent paper arXiv:2512.13794 for a complete classification of the Feynman-integral geometries at two-loop order in four-dimensional Quantum Field Theory with standard quadratic propagators. Concretely, we consider a finite basis of integrals in the 't Hooft–Veltman scheme, i.e. with D-dimensional loop momenta and four-dimensional external momenta, which belong to 79 independent topologies, or sectors. Then, we analyze the leading singularities of the integrals in those sectors for generic values of the masses and momenta, using the loop-by-loop Baikov representation. Aside from the Riemann sphere, we find that elliptic curves, hyperelliptic curves of genus 2 and 3 as well as K3 surfaces occur. Moreover, we find a smooth and non-degenerate Del Pezzo surface of degree 2, a particular Fano variety known to be rationalizable, resulting in a curve of geometric genus 3. These geometries determine the space of functions relevant for Quantum Field Theories at two-loop order, including in the Standard Model.

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Contribution ID: **3** Type: **not specified**

Parity-Violating Moller Scattering at NNLO: Electroweak bosonic contribution

We present the analytic computation of the two-loop electroweak bosonic correction to the parity asymmetry in Moller scattering at low energy. The hierarchy of scales, namely $m_Z^2 \gg q^2 \gg m_e^2$, and the IR singularities are treated with the method of regions. We discuss the implications of our results to MOLLER at JLab and give an outlook for electron-proton and electron-nucleus scattering at P2.

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Contribution ID: **4** Type: **not specified**

Factorization and Resummation for PDFs at threshold

We study factorization at next-to-leading power (NLP) in deep inelastic scattering (DIS) in the endpoint region within the framework of soft-collinear effective theory (SCET). The full QCD process is matched onto two SCET currents, whose matrix elements factorize into individual component functions. By employing endpoint reshuffling theorems that relate these component functions at endpoint kinematics, we remove all endpoint divergences. We then derive the relevant renormalization-group (RG) equations and solve them at leading order in RG-improved perturbation theory, thereby resumming large logarithms to all orders. Our main finding is that, in the endpoint limit, new structures emerge for the parton distribution functions (PDFs). We argue that a non-minimal subtration scheme is well-suited to subtract both UV and endpoint divergences at the same time.

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