Contribution ID: **779** Type: **Parallel talk**

All master integrals for three-jet production at NNLO

Friday 12 July 2019 10:00 (15 minutes)

As the experimental precision at the LHC keeps improving, next-to-next-to leading order (NNLO) corrections for scattering processes have become crucial for providing theoretical predictions of comparable accuracy. The scattering amplitudes are a fundamental ingredient of these theoretical predictions, and the perturbative analytic calculations are extremely valuable. While NNLO calculations for two-to-two scattering processes are becoming the new standard, analytic results for two-to-three processes are rather scarce and are usually restricted to the planar approximation. Many of the processes appearing in the latest Les Houches "wish list" involve yet unknown two-to-three scattering amplitudes. In particular, the three-jet production, which offers unique opportunities for precision measurements, is of great interest. In order to tackle high-multiplicity scattering processes in NNLO approximation analytically, a dramatic revolution in the tools and techniques is necessary. In my talk I will present analytic results for all master integrals (including the non-planar sector) that describe the NNLO virtual corrections for the three-jet production; in other words, these are two-loop master integrals for five-particle massless scattering. The calculation relies on the cutting-edge mathematical techniques: symbol alphabets, leading singularity analysis, the method of differential equations in their canonical form. I will describe the relevant functional space for the five-particle scattering, and then I will explain how to extract arbitrarily high precision numerical values of the master integrals. Finally, I will show some applications of the master integrals for calculating gauge-theory two-loop scattering amplitudes. The talk is based on arXiv:1812.11160; PRL 122, 121602; JHEP 1903 (2019) 115.

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Session Classification: QCD and Hadronic Physics

Track Classification: QCD and Hadronic Physics