

Locally finite two-loop amplitudes for multi Higgs production in gluon fusion

Tuesday, 10 September 2024 14:55 (25 minutes)

A universal numerical method for computing loop amplitudes would enable precise theoretical predictions for a broad range of phenomenological relevant processes. A major obstacle in developing such methods is the treatment of infrared and ultraviolet singularities, which must be eliminated at the integrand level before numerical integration becomes feasible.

In this talk, I will introduce a framework under development aimed at constructing locally finite two-loop amplitudes for arbitrary process. The framework is based on the universality of infrared singularities, realizing infrared factorization manifestly at the local level. As a specific example, I will explain the construction of locally finite two-loop amplitudes for gluon-fusion processes with an arbitrary number of Higgs final states. We find that infrared singularities reside in simple amplitudes of well-known $2 \rightarrow 1$ processes. Anticipating the generalization of our method, I will also discuss our progress on more complex QCD processes, which require novel techniques to achieve local Ward identity cancellations of collinear singularities.

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Session Classification: Methods for amplitudes and integrals

Track Classification: Methods for amplitudes and integrals