

# UV and IR rational terms in two-loop amplitudes

*Friday 29 April 2022 17:00 (30 minutes)*

Rational terms are a key ingredient for the automation of loop calculations through numerical methods. Nowadays widely-used automated NLO tools on the market usually construct their numerators of loop integrands in 4 dimensions, while the missing (D-4) part is reconstructed through the rational terms separately. Recently, several progresses [1-3] have been made to formulate and compute the rational terms at two loop order, which opens the door to the numerical automation of NNLO virtual corrections on various non-trivial LHC processes.

In this talk, I will first review our established formalism [1-3] for the two-loop UV rational terms in a modified R-operation approach. In particular, I will discuss the reconstruction of D-dimensional two-loop renormalised amplitudes with 4-dimensional loop numerators and a finite number of local UV rational counterterms in any renormalisable theories, and show the results of QCD rational terms in the full Standard Model.

I will further discuss our most recent progress [4] on the two-loop IR rational terms in massive QED amplitudes. On this aspect, I will present the strategy and key ingredients to resolve the IR rational terms by discovering interesting cancellation mechanisms.

[1] with S. Pozzorini and M. Zoller, “Rational terms of UV origin at two loops”, JHEP 05 (2020) 077.

[2] with J.-N. Lang et al., “Two-loop rational terms in Yang-Mill theories”, JHEP 10 (2020) 016.

[3] with J.-N. Lang et al., “Two-loop rational terms for spontaneously broken theories”, JHEP 01 (2022) 105.

[4] with S. Pozzorini, “Two-loop IR rational terms in massive QED”, to appear.

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