

# Tropical Integration for Gauge Theory Feynman Integrals

I will present recent progress in extending the tropical integration framework originally proposed by Borinsky to Feynman integrals with numerators. This generalisation is essential for applications in gauge theories and significantly broadens the scope of tropical Monte Carlo methods to physically relevant observables in Quantum Chromodynamics (QCD) and N=4 super Yang–Mills theory (SYM).

I will introduce the extended tropical integration framework and a corresponding numerical implementation, which will be made publicly available. As a key benchmark, I will demonstrate the numerical evaluation of high-loop integrals arising in correlation functions of N=4 SYM, including the integrated correlator verified up to eight loops—far beyond the reach of existing analytic techniques.

In addition, the method has been tested on a variety of phenomenologically relevant QCD integrals involving multiple external legs, internal masses, and non-trivial numerators. In all cases, we find excellent agreement with established numerical tools such as pySecDec, while achieving substantially improved performance.

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