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Five-loop massive tadpoles

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Feynman integrals (FIs) play a central role in quantum field theory (QFT). They comprise the coefficients of weak-coupling expansions within theoretical particle physics, allowing for high-precision comparisons of theory with collider experiments with the ultimate goal of discovering new elementary particles.

Given this strong phenomenological motivation, FIs form interesting objects to study, since they can be argued to encompass the numbers that occur in nature. From the mathematical side, FIs have been (and continue to be) a rich source of inspiration in fields such as e.g. special functions, graph theory, or number theory, and many different methods have been developed to get a grip on numerical as well as analytical evaluations.

In this talk, I will briefly review recent progress achieved in precise evaluations of so-called massive tadpoles, which form an important sub-class of FIs that is universal in the sense that it allows for a complete characterization of renormalization constants within QFT. Furthermore, I will formulate a number of well-defined open problems in these evaluations. Applications of results to the renormalization of a specific four-dimensional QFT will also be sketched.

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