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From Trees to Two Loops by Maximal Unitarity

Kasper Larsen

NIKHEF, AMSTERDAM

Abstract

In this talk we take the first steps towards a new framework for computing two-loop amplitudes, based on unitarity rather than Feynman diagrams. In this approach, the two-loop amplitude is first expanded in a basis of integrals. The expansion coefficients are then determined by applying generalized unitarity cuts. We find explicit formulas for the integral coefficients as products of tree-level amplitudes integrated over specific contours in the complex plane, thus allowing the construction of the two-loop amplitude from appropriately defined tree amplitudes. The validity of this method extends to all four-dimensional gauge theories, in particular QCD. This approach is suited for obtaining analytical expressions as well as for numerical implementations.