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Feynman Integrals in Parameter Space: Hidden Regions and Contour Deformation

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Understanding the singularity structure of Feynman integrals in parameter space is useful both for formulating numerical procedures for their evaluation (e.g. sector decomposition) and for understanding their asymptotic behaviour, as captured by the method of regions. A promising direction of exploration in this regard is the geometric description of Feynman integrals in parameter space.

In this talk, using Landau singularity analysis, we study the appearance of "hidden" regions not associated with endpoint singularities in parameter space, and so not straightforwardly captured by the geometric approach. We demonstrate that in the strict on-shell limit such Landau singularities can prevent the direct numerical evaluation of integrals in parameter space and describe how they can be re-parameterised and dissected to circumvent this problem. Using similar techniques, we demonstrate how knowledge of the variety of the second Symanzik polynomial can be used to obtain strictly positive integrands even in the Minkowski Regime, circumventing the need for contour deformation and significantly improving the numerical performance.

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