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Feynman integrals at large loop order and the $\log - \Gamma$ distribution

I will present joint work on the behavior of Feynman integrals and perturbative expansions at large loop orders. Using the tropical sampling algorithm for evaluating Feynman integrals, along with a dedicated graph-sampling algorithm to generate representative sets of Feynman diagrams, we computed approximately 10^7 integrals with up to 17 loops in four-dimensional ϕ^4 theory. Through maximum likelihood fits, we find that the values of these integrals at large loop order are distributed according to a log-gamma distribution. This empirical observation opens up a new avenue towards the large-order behavior in perturbative quantum field theory. Guided by instanton considerations, we extrapolate the primitive contribution to the ϕ^4 beta function to all loop orders.

Significance

References

https://arxiv.org/abs/2503.07803

Experiment context, if any

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