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Integrand Reduction Reloaded: Algebraic Geometry and Finite Fields[1] RAY D. SAMESHIMA, ANDREA FERROGLIA, GIOVANNI OSSOLA, New York City College of Technology, CUNY — The evaluation of scattering amplitudes in quantum field theory allows us to compare the phenomenological prediction of particle theory with the measurement at collider experiments. The study of scattering amplitudes, in terms of their symmetries and analytic properties, provides a theoretical framework to develop techniques and efficient algorithms for the evaluation of physical cross sections and differential distributions. Tree-level calculations have been known for a long time. Loop amplitudes, which are needed to reduce the theoretical uncertainty, are more challenging since they involve a large number of Feynman diagrams, expressed as integrals of rational functions. At one-loop, the problem has been solved thanks to the combined effect of integrand reduction, such as the OPP method, and unitarity. However, plenty of work is still needed at higher orders, starting with the two-loop case. Recently, integrand reduction has been revisited using algebraic geometry. In this presentation, we review the salient features of integrand reduction for dimensionally regulated Feynman integrals, and describe an interesting technique for their reduction based on multivariate polynomial division. We also show a novel approach to improve its efficiency by introducing finite fields.

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