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Analytic and Algebraic Structures in Feynman Integrals

Abstract

At the heart of both cross-section calculations at the Large Hadron Collider and gravitational wave physics lie the evaluation of Feynman integrals. These integrals are meromorphic functions (or distributions) of the parameters on which they depend and understanding their analytic structure has been an ongoing quest for over 60 years. In this talk, I will demonstrate how some of these integrals fit within the framework of generalized hypergeometry by Gelfand, Kapranov, and Zelevinsky (GKZ). In this framework the singularities are simply calculated by the principal A-determinant and I will show that some Feynman integrals can be used to generate Cohen–Macaulay rings which greatly simplify their analysis. However, not every integral fits within the GKZ framework and I will show how the singularities of every Feynman integral can be calculated using Whitney stratifications.