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GKZ hypergeometric systems of the three-loop vacuum Feynman integrals

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We present the Gel'fand-Kapranov-Zelevinsky (GKZ) hypergeometric systems of the Feynman integrals of the three-loop vacuum diagrams with arbitrary masses, basing on Mellin-Barnes representations and Miller's transformation. The codimension of derived GKZ hypergeometric systems equals the number of independent dimensionless ratios among the virtual masses squared. Through GKZ hypergeometric systems, the analytical hypergeometric series solutions can be obtained in neighborhoods of origin including infinity. The linear independent hypergeometric series solutions whose convergent regions have non-empty intersection can constitute a fundamental solution system in a proper subset of the whole parameter space. The analytical expression of the vacuum integral can be formulated as a linear combination of the corresponding fundamental solution system in certain convergent region.

Primary author: Dr HAI-BIN, Zhang (Hebei University)

Co-author: Prof. TAI-FU, Feng (Hebei University)

Presenter: Dr HAI-BIN, Zhang (Hebei University)

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