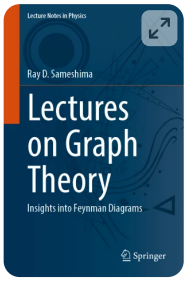


# Lectures on Graph Theory

## Insights into Feynman Diagrams

| Book | Feb 2025

## Overview

**Authors:** Ray D. Sameshima

Provides a clear and accessible introduction to mastering Feynman integral computations

Offers a detailed exploration of essential techniques for practical calculations in particle physics

Features numerous examples and algorithms to help readers learn quickly and effectively

**Part of the book series:** Lecture Notes in Physics (LNP, volume 1035)

## About this book

This book introduces foundational topics such as group theory, fields, linear algebra, matrix theory, and graph theory, providing readers with the essential background needed to understand Feynman diagrams and their integral representations.

The book highlights Feynman's parametrization as a central tool for studying Feynman integrals, starting with the traditional momentum representation. Schwinger and Lee-Pomeransky parametrizations are covered in a supplementary chapter. Readers will develop a clear understanding of the mathematical properties and practical applications of these techniques, with a particular emphasis on Feynman's approach. Advanced topics such as integration-by-parts identities and intersection number theory are explored in the final chapter, offering readers a gateway to key mathematical structures.

The prerequisites are minimal—only a basic familiarity with algebra and calculus is recommended. The content begins with introductory concepts and gradually progresses to more advanced material, ensuring a balanced learning curve. Practical examples throughout the book reinforce the main ideas, allowing readers to apply what they've learned and deepen their understanding as they move through the material.

## Keywords

multi-dimensional integrals Feynman diagrams multi-loop calculations

scattering amplitudes particle colliders perturbation theory

## Authors and Affiliations

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**Ray D. Sameshima** earned his Ph.D. in Physics from the Graduate School and University Center of CUNY in 2019, following an M.A. from the City University of New York (CUNY) and a B.S. from Kyoto University. His research focuses on the mathematical structures of Feynman integrals, exploring their algebraic, geometrical, and topological properties. Dr. Sameshima is currently an Adjunct Professor at the New York City College of Technology (CUNY) and the New York Institute of Technology (NYIT).

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