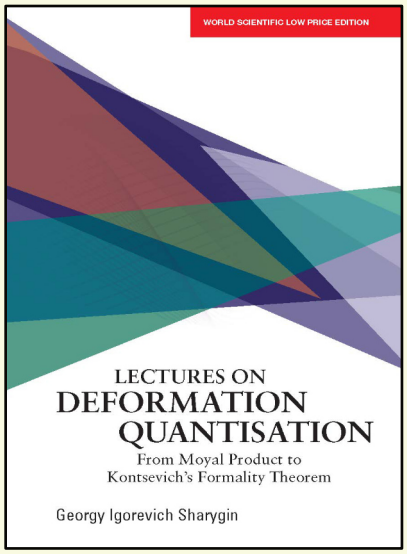
Lectures on Deformation Quantisation

From Moyal Product to Kontsevich's Formality Theorem



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ABOUT THE BOOK

Principles of classical Hamiltonian mechanics say that the evolution of a dynamical system is determined by the Poisson bracket of observable functions with the given Hamiltonian function of the system. In Quantum Mechanics, these principles are modified so that the algebra of observable functions should be replaced by a noncommutative algebra of operators and the Poisson bracket by their commutator so that the canonical commutation relations hold. Thus, working with quantum systems, we must determine the "quantisation" of our observables, i.e. to choose a noncommutative algebra whose elements would play the role of the observables. With some modifications, this question is the main content of the Deformation Quantisation problem formulated in 1978 by Flato and others.

This book is based on the course that the author taught in the Fall semester of 2019 at Peking University. The main purpose of that course and of this book is to acquaint the reader with the vast scope of ideas related to the Deformation Quantisation of Poisson manifolds. The book begins with Quantum Mechanics and Moyal product formula and covers the three main constructions that solve the Deformation Quantisation problem: Lecomte and de Wilde deformation of symplectic manifolds, Fedosov's Quantisation theory and Kontsevich's formality theorem. In the appendices, the Tamarkin's proof of formality theorem is outlined.

The book is written in a reader-friendly manner and is as self-contained as possible. It includes several sets of problems and exercises that will help the reader to master the material.

READERSHIP

Postgraduate and advanced undergraduate students of Mathematics and Physics, researchers and scholars in the fields of Quantum Physics and Mathematics, aiming at learning the basics of deformation quantisation theory, or to teach a course on this subject. Researchers in the fields of Applied Physics and Mathematics.

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Georgy Igorevich Sharygin obtained his PhD degree in Pure Mathematics from Lomonosov Moscow State University in 2000. Since 2001, he has been teaching various topics in Mathematics (elementary and advanced) in different schools and colleges in Moscow. His field of interest includes Euclidean Geometry, Differential Geometry, Algebraic Topology, Integrable Systems Theory, Noncommutative Geometry and Deformation Theory.

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