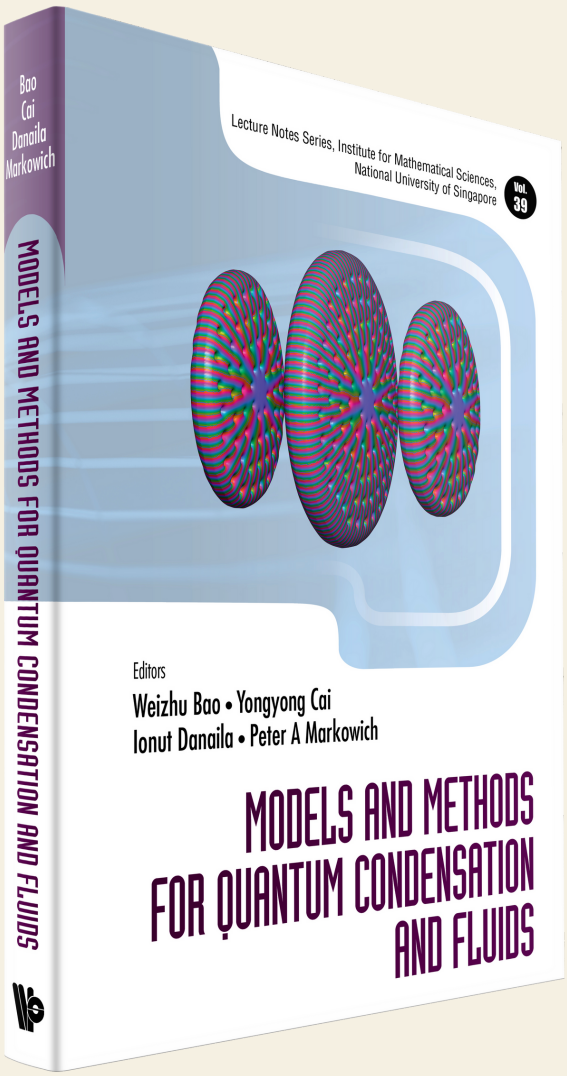
# LECTURE NOTES SERIES, INSTITUTE FOR MATHEMATICAL SCIENCES, NATIONAL UNIVERSITY OF SINGAPORE - VOLUME 39




The Institute for Mathematical Sciences at the National University of Singapore hosted a thematic program on *Quantum and Kinetic Problems: Modeling, Analysis, Numerics and Applications* from September 2019 to March 2020. As an important part of the program, tutorials and special lectures were given by leading experts in the fields for participating graduate students and junior researchers.

This invaluable volume collects six expanded lecture notes with self-contained tutorials. The coverage includes mathematical models and numerical methods for multidimensional solitons in linear and nonlinear potentials; Bose–Einstein condensation (BEC) with dipole-dipole interaction, higher order interaction and spin-orbit coupling; classical and quantum turbulence; and molecular dynamics process based on the first-principle in quantum chemistry.

This volume serves to inspire graduate students and researchers who will embark into original research work in these fields.

## Contents

- Multidimensional Self-Trapping in Linear and Nonlinear Potentials *(Boris A Malomed)*
- Dipolar Bose–Einstein Condensates — Droplets and Supersolids Arising from Beyond Meanfield Effects *(P Blair Blakie)*
- Mathematical Theory and Numerical Methods for Bose–Einstein Condensation with Higher-Order Interaction *(Yongyong Cai and Xinran Ruan)*
- Synthetic Gauge Field and Spin-Orbit Coupling in Ultracold Atomic Condensate *(Li Chen and Han Pu)*
- From Classical to Quantum Turbulence: Basic Concepts and Models *(Ionut Danaila and Luminita Danaila)*
- Numerical Methods for Solving the Time-Dependent Schrödinger Equation for a Molecular Dynamics Process *(Hailin Zhao and Zhigang Sun)*

## Readership

Graduate students and researchers in computational and applied mathematics, computational quantum physics, atomic and molecular physics, nonlinear optics, and computational quantum chemistry.

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