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Advances in Quantum Mechanics

Contemporary Trends and Open Problems

 Springer

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Preface

This volume is a collection of recent contributions and up-to-date surveys on many contemporary trends in the mathematics of quantum mechanics, and more generally on mathematical problems arising in quantum many-body dynamics, quantum graph theory, cold atoms and unitary gases. Special emphasis is devoted to development of the specific mathematical tools needed, including linear and non-linear Schrödinger equations, topological invariants, non-commutative geometry, resonances and operator extension theory.

Most of the contributors are leading international experts or recognised young researchers in mathematical physics, PDE theory and operator theory. The material that they present is the fruit of recent studies that have already become a reference in the community. The underlying motivation from condensed matter physics, solid state physics and ultra-cold atom physics, and the topicality of the research topics, give the volume a distinctive perspective at the edge of mathematics and physics.

A large part of the material was presented and discussed thoroughly on the occasion of the INdAM international meeting entitled “Contemporary Trends in the Mathematics of Quantum Mechanics”, which took place in Rome from 4 to 8 July 2016 and which we had the honour of organising thanks to a very generous funding and most helpful logistic support from INdAM. The remainder of the material was produced as a follow-up to that meeting or as closely related work.

First and foremost, our thanks go to the scientific board of INdAM and the responsible administrative staff at the INdAM headquarters in Rome for providing such a stimulating atmosphere and all the necessary practical help. We would also like to warmly acknowledge all contributors and anonymous reviewers for their careful work and the quality of their reports. Finally, we extend our gratitude to the extremely supportive team of the INdAM Springer Series for their services throughout the editing and publishing process.

Trieste, Italy
Trieste, Italy
April 2017

Gianfausto Dell’Antonio
Alessandro Michelangeli

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Prof. Gianfausto Dell'Antonio's research focuses on axiomatic quantum field theory, local field theory, mathematics of quantum mechanics, critical point theory, stochastic processes, singular interactions, and many-body problems. He graduated in theoretical physics in Milan, was research associate in Copenhagen (Niels Bohr institute), Zurich (ETH), and Evanston (Northwestern), then professor of theoretical physics in Naples and professor of rational mechanics and mathematical physics at La Sapienza Rome. He held visiting professorships at the IHES Paris, Courant Institute NY, The University of Marseille Luminy, Bielefeld University (as a recipient of a von Humboldt prize), CERN, SISSA Trieste, and the Interdisciplinary Laboratory of the Accademia dei Lincei. He held also visiting positions at the IAS Princeton, Ecole Polytechnique Paris, Paris Dauphine, Harvard University, and the Max Planck Institute in Munich.

Dr. Alessandro Michelangeli's research is in the field at the interface between mathematical physics, functional analysis and non-linear dispersive PDE, and operator theory, with a special focus on the mathematical methods for quantum mechanical and condensed matter systems. He graduated in theoretical physics in Pisa and in mathematical physics at SISSA Trieste, held faculty positions at the LMU Munich and SISSA Trieste, and visiting positions at the University of Cambridge, SISSA Trieste, and Bilkent.