

1. Record Nr.	UNICASCUB0361903
Titolo	Il Lazio : Caratteristiche geografiche, sociali ed economiche, stato dell'agricoltura e Riforma agraria, industria, commercio e trasporti, problemi della rinascita economica di Roma e del Lazio / [introduzione di Mario Mammucari]
Pubbl/distr/stampa	Roma, : Tip. La Linograf, 1954
Descrizione fisica	VIII, 239 p., [5] c. di tav. ; 21 cm
Lingua di pubblicazione	Italiano
Formato	Materiale a stampa
Livello bibliografico	Monografia
2. Record Nr.	UNINA9910255455803321
Autore	Moretti Valter
Titolo	Spectral Theory and Quantum Mechanics : Mathematical Foundations of Quantum Theories, Symmetries and Introduction to the Algebraic Formulation // by Valter Moretti
Pubbl/distr/stampa	Cham : , : Springer International Publishing : , : Imprint : Springer, , 2017
ISBN	3-319-70706-X
Edizione	[2nd ed. 2017.]
Descrizione fisica	1 online resource (XXII, 950 p.)
Collana	La Matematica per il 3+2, , 2038-5757 ; ; 110
Disciplina	530.12
Soggetti	Mathematics Mathematical physics Mathematical analysis Applications of Mathematics Mathematical Methods in Physics Analysis
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia

## Nota di contenuto

1 Introduction and Mathematical Backgrounds -- 2 Normed and Banach Spaces, Examples and Applications -- 3 Hilbert Spaces and Bounded Operators -- 4 Families of Compact Operators on Hilbert Spaces and Fundamental Properties -- 5 Densely-Defined Unbounded Operators on Hilbert Spaces -- 6 Phenomenology of Quantum Systems and Wave Mechanics: an Overview -- 7 The First 4 Axioms of QM: Propositions, Quantum States and Observables -- 8 Spectral Theory I: Generalities, Abstract C\*-algebras and Operators in  $B(H)$  -- 9 Spectral theory II: Unbounded Operators on Hilbert Spaces -- 10 Spectral Theory III: Applications -- 11 Mathematical Formulation of Non-Relativistic Quantum Mechanics -- 12 Introduction to Quantum Symmetries -- 13 Selected Advanced Topics in Quantum Mechanics -- 14 Introduction to the Algebraic Formulation of Quantum Theories -- 15 Appendix A: Order Relations and Groups -- 16 Appendix B: Elements of Differential Geometry.

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## Sommario/riassunto

This book discusses the mathematical foundations of quantum theories. It offers an introductory text on linear functional analysis with a focus on Hilbert spaces, highlighting the spectral theory features that are relevant in physics. After exploring physical phenomenology, it then turns its attention to the formal and logical aspects of the theory. Further, this Second Edition collects in one volume a number of useful rigorous results on the mathematical structure of quantum mechanics focusing in particular on von Neumann algebras, Superselection rules, the various notions of Quantum Symmetry and Symmetry Groups, and including a number of fundamental results on the algebraic formulation of quantum theories. Intended for Master's and PhD students, both in physics and mathematics, the material is designed to be self-contained: it includes a summary of point-set topology and abstract measure theory, together with an appendix on differential geometry. The book also benefits established researchers by organizing and presenting the profusion of advanced material disseminated in the literature. Most chapters are accompanied by exercises, many of which are solved explicitly.

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