

Quantum Theory of Open Systems

Thesis at ETH Zuerich

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The Theory Of Open Quantum Systems

Bassano Vacchini



The Theory Of Open Quantum Systems:

The Theory of Open Quantum Systems Heinz-Peter Breuer, Francesco Petruccione, 2002 This book treats the central physical concepts and mathematical techniques used to investigate the dynamics of open quantum systems To provide a self contained presentation the text begins with a survey of classical probability theory and with an introduction into the foundations of quantum mechanics with particular emphasis on its statistical interpretation The fundamentals of density matrix theory quantum Markov processes and dynamical semigroups are developed The most important master equations used in quantum optics and in the theory of quantum Brownian motion are applied to the study of many examples Special attention is paid to the theory of environment induced decoherence its role in the dynamical description of the measurement process and to the experimental observation of decohering Schrodinger cat states The book includes the modern formulation of open quantum systems in terms of stochastic processes in Hilbert space Stochastic wave function methods and Monte Carlo algorithms are designed and applied to important examples from quantum optics and atomic physics such as Levy statistics in the laser cooling of atoms and the damped Jaynes Cummings model The basic features of the non Markovian quantum behaviour of open systems are examined on the basis of projection operator techniques In addition the book expounds the relativistic theory of quantum measurements and discusses several examples from a unified perspective e g non local measurements and quantum teleportation Influence functional and super operator techniques are employed to study the density matrix theory in quantum electrodynamics and applications to the destruction of quantum coherence are presented The text addresses graduate students and lecturers in physics and applied mathematics as well as researchers with interests in fundamental questions in quantum mechanics and its applications Many analytical methods and computer simulation techniques are developed and illustrated with the help of numerous specific examples Only a basic understanding of quantum mechanics and of elementary concepts of probability theory is assumed Quantum Theory of Open Systems Edward Brian Davies, 1976 *The Theory of Open Quantum Systems* Heinz-Peter Breuer, 2002 This text provides an introduction to the dynamics of open quantum systems To provide a self contained presentation the book begins with a survey of the classical theory of probability and stochastic processes and an introduction into the foundations of quantum mechanics Open Quantum Systems Ángel Rivas, Susana F. Huelga, 2011-10-01 In this volume the fundamental theory of open quantum systems is revised in the light of modern developments in the field A unified approach to the quantum evolution of open systems is presented by merging concepts and methods traditionally employed by different communities such as quantum optics condensed matter chemical physics and mathematical physics The mathematical structure and the general properties of the dynamical maps underlying open system dynamics are explained in detail The microscopic derivation of dynamical equations including both Markovian and non Markovian evolutions is also discussed Because of the step by step explanations this work is a useful reference to novices in this field However experienced researches can also benefit from the presentation of recent

results

Open Quantum Systems Subhashish Banerjee, 2018-11-01 This book discusses the elementary ideas and tools needed for open quantum systems in a comprehensive manner. The emphasis is given to both the traditional master equation as well as the functional path integral approaches. It discusses the basic paradigm of open systems: the harmonic oscillator and the two level system in detail. The traditional topics of dissipation and tunneling as well as the modern field of quantum information find a prominent place in the book. Assuming a basic background of quantum and statistical mechanics, this book will help readers familiarize with the basic tools of open quantum systems. Open quantum systems is the study of quantum dynamics of the system of interest taking into account the effects of the ambient environment. It is ubiquitous in the sense that any system could be envisaged to be surrounded by its environment which could naturally exert its influence on it. Open quantum systems allows for a systematic understanding of irreversible processes such as decoherence and dissipation of the essence in order to have a correct understanding of realistic quantum dynamics and also for possible implementations. This would be essential for a possible development of quantum technologies.

Theory of Open Quantum Systems Heinz-Peter Breuer, Francesco Petruccione, 2006

Open Quantum Systems Bassano Vacchini, 2024-12-30 The proposed book is a bridge between the foundations of quantum mechanics and the theory of open quantum systems. The treatment of open quantum systems is a rapidly growing subject of interest to an ever increasing number of scientists. The main focus is on overcoming the idealization of perfect isolation of a quantum system so as to allow for a more realistic treatment and to provide the relevant background for the development of quantum technologies. The book is addressed to students and researchers in the field of open quantum systems and more generally quantum mechanics, a wide community of physicists, mathematicians and chemists. It is devised both to enter the field and to prepare a series of lectures or a one semester course on the topic.

Open Quantum Systems I Stéphane Attal, Alain Joye, Claude-Alain Pillet, 2006-08-18 Understanding dissipative dynamics of open quantum systems remains a challenge in mathematical physics. This problem is relevant in various areas of fundamental and applied physics. Significant progress in the understanding of such systems has been made recently. These books present the mathematical theories involved in the modeling of such phenomena. They describe physically relevant models, develop their mathematical analysis and derive their physical implications.

Open Quantum Systems III Stéphane Attal, Alain Joye, Claude-Alain Pillet, 2006-08-18 This volume is the third and last of a series devoted to the lecture notes of the Grenoble Summer School on Open Quantum Systems which took place at the Institut Fourier from June 16 to July 4, 2003. The contributions presented in this volume correspond to expanded versions of the lecture notes provided by the authors to the students of the Summer School. The corresponding lectures were scheduled in the last part of the School devoted to recent developments in the study of Open Quantum Systems. Whereas the first two volumes were dedicated to a detailed exposition of the mathematical techniques and physical concepts relevant in the study of Open Systems with no a priori pre-requisites, the contributions presented in this volume request from the reader some

familiarity with these aspects Indeed the material presented here aims at leading the reader already acquainted with the basics in quantum statistical mechanics spectral theory of linear operators C dynamical systems and quantum stochastic differential equations to the front of the current research done on various aspects of Open Quantum Systems Nevertheless pedagogical efforts have been made by the various authors of these notes so that this volume should be essentially self contained for a reader with minimal previous posure to the themes listed above In any case the reader in need of complements can always turn to these rst two volumes The topics covered in these lectures notes start with an introduction to n equilibrium quantum statistical mechanics *Open Quantum Systems II* Stéphane Attal, 2006-06-07 Understanding dissipative dynamics of open quantum systems remains a challenge in mathematical physics This problem is relevant in various areas of fundamental and applied physics Significant progress in the understanding of such systems has been made recently These books present the mathematical theories involved in the modeling of such phenomena They describe physically relevant models develop their mathematical analysis and derive their physical implications

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Table of Contents The Theory Of Open Quantum Systems

1. Understanding the eBook The Theory Of Open Quantum Systems
 - The Rise of Digital Reading The Theory Of Open Quantum Systems
 - Advantages of eBooks Over Traditional Books
2. Identifying The Theory Of Open Quantum Systems
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an The Theory Of Open Quantum Systems
 - User-Friendly Interface
4. Exploring eBook Recommendations from The Theory Of Open Quantum Systems
 - Personalized Recommendations
 - The Theory Of Open Quantum Systems User Reviews and Ratings
 - The Theory Of Open Quantum Systems and Bestseller Lists

5. Accessing The Theory Of Open Quantum Systems Free and Paid eBooks
 - The Theory Of Open Quantum Systems Public Domain eBooks
 - The Theory Of Open Quantum Systems eBook Subscription Services
 - The Theory Of Open Quantum Systems Budget-Friendly Options
6. Navigating The Theory Of Open Quantum Systems eBook Formats
 - ePub, PDF, MOBI, and More
 - The Theory Of Open Quantum Systems Compatibility with Devices
 - The Theory Of Open Quantum Systems Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of The Theory Of Open Quantum Systems
 - Highlighting and Note-Taking The Theory Of Open Quantum Systems
 - Interactive Elements The Theory Of Open Quantum Systems
8. Staying Engaged with The Theory Of Open Quantum Systems
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers The Theory Of Open Quantum Systems
9. Balancing eBooks and Physical Books The Theory Of Open Quantum Systems
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection The Theory Of Open Quantum Systems
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine The Theory Of Open Quantum Systems
 - Setting Reading Goals The Theory Of Open Quantum Systems
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of The Theory Of Open Quantum Systems
 - Fact-Checking eBook Content of The Theory Of Open Quantum Systems
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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