

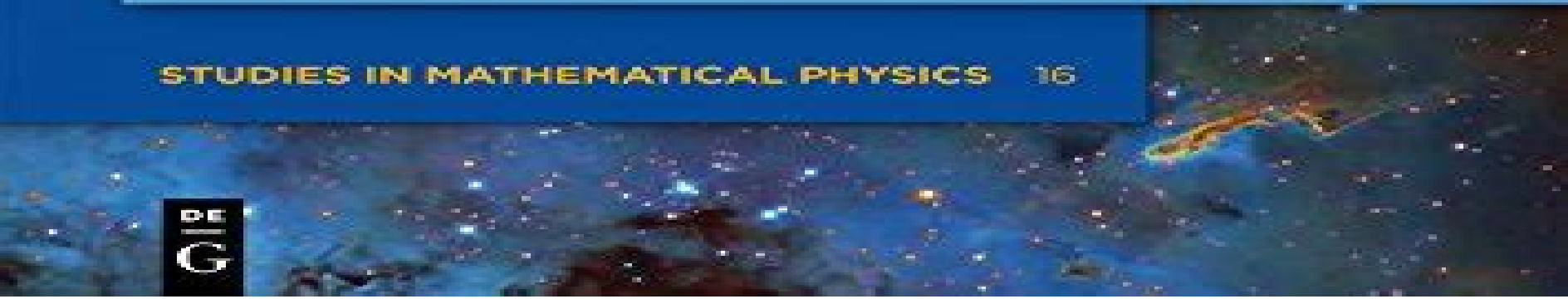
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Alexander S. Holevo

QUANTUM SYSTEMS, CHANNELS, INFORMATION

A MATHEMATICAL INTRODUCTION

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Quantum Systems Channels Information De Gruyter Studies In Mathematical Physics

Joseph Renes



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Quantum Systems, Channels, Information Alexander S. Holevo, 2012-11-27 The subject of this book is theory of quantum system presented from information science perspective The central role is played by the concept of quantum channel and its entropic and information characteristics Quantum information theory gives a key to understanding elusive phenomena of quantum world and provides a background for development of experimental techniques that enable measuring and manipulation of individual quantum systems This is important for the new efficient applications such as quantum computing communication and cryptography Research in the field of quantum informatics including quantum information theory is in progress in leading scientific centers throughout the world This book gives an accessible albeit mathematically rigorous and self contained introduction to quantum information theory starting from primary structures and leading to fundamental results and to exiting open problems

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Quantum Systems, Channels, Information Alexander S. Holevo, 2012-12-06 The main emphasis of this work is the mathematical theory of quantum channels and their entropic and information characteristics Quantum information theory is one of the key research areas since it leads the way to vastly increased computing speeds by using quantum systems to store and process information Quantum cryptography allows for secure communication of classified information Research in the field of quantum informatics including quantum information theory is in progress in leading scientific centers throughout the world The past years were marked with impressive progress made by several researchers in solution of some difficult problems in particular the additivity of the entropy characteristics of quantum channels This suggests a need for a book that not only introduces the basic concepts of quantum information theory but also presents in detail some of the latest achievements

Quantum Information Theory Mark M. Wilde, 2017-02-06 Developing many of the major exciting pre and post millennium developments from the ground up this book is an ideal entry point for graduate students into quantum information theory Significant attention is given to quantum mechanics for quantum information theory and careful studies of the important protocols of teleportation superdense coding and entanglement distribution are presented In this new edition readers can expect to find over 100 pages of new material

including detailed discussions of Bell's theorem, the CHSH game, Tsirelson's theorem, the axiomatic approach to quantum channels, the definition of the diamond norm and its interpretation, and a proof of the Choi-Kraus theorem. Discussion of the importance of the quantum dynamic capacity formula has been completely revised, and many new exercises and references have been added. This new edition will be welcomed by the upcoming generation of quantum information theorists and the already established community of classical information theorists.

Approximate Quantum Markov Chains David

Sutter, 2018-04-20 This book is an introduction to quantum Markov chains and explains how this concept is connected to the question of how well a lost quantum mechanical system can be recovered from a correlated subsystem. To achieve this goal, we strengthen the data processing inequality such that it reveals a statement about the reconstruction of lost information. The main difficulty in order to understand the behavior of quantum Markov chains arises from the fact that quantum mechanical operators do not commute in general. As a result, we start by explaining two techniques of how to deal with non-commuting matrices: the spectral pinching method and complex interpolation theory. Once the reader is familiar with these techniques, a novel inequality is presented that extends the celebrated Golden-Thompson inequality to arbitrarily many matrices. This inequality is the key ingredient in understanding approximate quantum Markov chains, and it answers a question from matrix analysis that was open since 1973, i.e., if Lieb's triple matrix inequality can be extended to more than three matrices. Finally, we carefully discuss the properties of approximate quantum Markov chains and their implications. The book is aimed to graduate students who want to learn about approximate quantum Markov chains as well as more experienced scientists who want to enter this field. Mathematical maturity is necessary, but no prior knowledge of quantum mechanics is required.

Mathematical Problems in Quantum Physics Federico Bonetto, David Borthwick, Evans

Harrell, Michael Loss, 2018-10-24 This volume contains the proceedings of the QMATH13 Mathematical Results in Quantum Physics conference held from October 8-11, 2016, at the Georgia Institute of Technology, Atlanta, Georgia. In recent years, a number of new frontiers have opened in mathematical physics, such as many-body localization and Schrödinger operators on graphs. There has been progress in developing mathematical techniques as well, notably in renormalization group methods and the use of Lieb-Robinson bounds in various quantum models. The aim of this volume is to provide an overview of some of these developments. Topics include random Schrödinger operators, many-body fermionic systems, atomic systems, effective equations, and applications to quantum field theory. A number of articles are devoted to the very active area of Schrödinger operators on graphs and general spectral theory of Schrödinger operators. Some of the articles are expository and can be read by an advanced graduate student.

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

Infinite Dimensional Analysis, Quantum Probability and Applications Luigi Accardi, Farrukh Mukhamedov, Ahmed Al Rawashdeh, 2022-10-04 This proceedings volume gathers selected peer reviewed papers presented at the 41st International Conference on Infinite Dimensional Analysis Quantum Probability and Related Topics QP41 that was virtually held at the United Arab Emirates University UAEU in Al Ain Abu Dhabi from March 28th to April 1st 2021 The works cover recent developments in quantum probability and infinite dimensional analysis with a special focus on applications to mathematical physics and quantum information theory Covered topics include white noise theory quantum field theory quantum Markov processes free probability interacting Fock spaces and more By emphasizing the interconnection and interdependence of such research topics and their real life applications this reputed conference has set itself as a distinguished forum to communicate and discuss new findings in truly relevant aspects of theoretical and applied mathematics notably in the field of mathematical physics as well as an event of choice for the promotion of mathematical applications that address the most relevant problems found in industry That makes this volume a suitable reading not only for researchers and graduate students with an interest in the field but for practitioners as well [Infinite Dimensional Analysis, Quantum Probability And Related Topics, Qp38 - Proceedings Of The International Conference](#) Noboru Watanabe, Luigi Accardi, Si Si, 2023-10-25 This volume aims to return to the starting point of the fields of infinite dimensional analysis and quantum probability fields that are growing rapidly at present and to seriously attempt mutual interaction between the two with a view to enumerating and solving the many fundamental problems they entail For such a purpose we look for interdisciplinary bridges in mathematics including classical probability and to different branches of physics in particular research for new paradigms for information science on the basis of quantum theory **Quantum Information Theory** Joseph Renes, 2022-08-01 If the carriers of information are governed by quantum mechanics new principles for information processing apply This graduate textbook introduces the underlying mathematical theory for quantum communication computation and cryptography A focus lies on the concept of quantum channels understanding figures of merit e g fidelities and entropies in the quantum world and understanding the interrelationship of various quantum information processing protocols

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