Quantum Machines Measurement Control Of Engineered Quantum Systems Lecture Notes Of The Les Houches Summer School Volume 96 July 2011

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Current Trends in Atomic Physics CRC Press
The book gathers the lecture notes of the Les Houches Summer School that was held in August 2011 for an audience of advanced graduate students and post-doctoral fellows in particle physics, theoretical physics, and cosmology, areas where new experimental results were on the verge of being discovered at CERN. The lectures by theoreticians covered many directions in the theory of elementary particles, from classics such as the Supersymmetric Standard Model to veryrecent ideas such as the relation between black holes, hydrodynamics, and gauge-gravity duality. The lectures by experimentalists explained in detail how intensively and how precisely the LHC colliderhas verified the theoretical predictions of the Standard Model, predictions that were at the front lines of experimental discovery during the 70's, 80's and 90's, and how the LHC is ready to make new discoveries. They described many of the ingenious and pioneering techniques developed at CERN for the detection and the data analysis of billions of billions of proton-proton collisions.
Quantum Machines: Measurement and Control of Engineered Quantum Systems World Scientific
This book gathers the lecture notes of the 100th Les Houches Summer School, which was held in July 2013. These lectures represent a comprehensive pedagogical survey of the frontier of theoretical and observational cosmology just after the release of the first cosmological results of the Planck mission. The Cosmic Microwave Background is discussed as a possible window on the still unknown laws of physics at very high energy and as a backlight for studying the late-time Universe. Other lectures highlight connections of fundamental physics with other areas of cosmology and astrophysics, the successes and fundamental puzzles of the inflationary paradigm of cosmic beginning, the themes of dark energy and dark matter, and the theoretical developments and observational probes that will shed light on these cosmic conundrums in the years to come.
Granular aluminium superinductors Oxford University Press
Over the last decade new experimental tools and theoretical concepts are providing new insights into collective nonequilibrium behavior of quantum systems. The exquisite control provided by laser trapping and cooling techniques allows us to observe the behavior of condensed bose and degenerate Fermi gases under nonequilibrium drive or after `quenches' in which a Hamiltonian parameter is suddenly or slowly changed. On the solid state front, high intensity short-time pulses and fast (femtosecond) probes allow solids to be put into highly excited states and probed before relaxation and dissipation occur. Experimental developments are matched by progress in theoretical techniques ranging from exact solutions of strongly interacting nonequilibrium models to new approaches to nonequilibrium numerics. The summer school `Strongly interacting quantum systems out of equilibrium' held at the Les Houches School of Physics as its XCIX session was designed to summarize this progress, lay out the open questions and define directions for future work. This books collects the lecture notes of the main courses given in this summer school.
Quantum Thermodynamic Processes Oxford University Press
This volume, 106 of the Les Houches Summer School series, brings together applications of integrability to supersymmetric gauge and string theory. The book focuses on the application of integrability and problems in quantum field theory. Particular emphasis is given to the exact solution of planar N=4 super-Yang-Mills theory and its relation with string theory on the one hand, and the exact determination of the low-energy physics of N=2 super-Yang-Mills theories on the other; links with other domains are also explored. The purpose of the Les Houches Summer School was to bring together young researchers and specialists from statistical physics, condensed matter physics, gauge and string theory, and mathematics, to stimulate discussion across these different research areas.
Lecture Notes of the Les Houches Summer School: Volume 108, July 2017 Oxford University Press
A thorough exposition of quantum computing and the underlying concepts of quantum physics, with explanations of the relevant mathematics and numerous examples. The combination of two of the twentieth century's most influential and revolutionary scientific theories, information theory and quantum mechanics, gave rise to a radically new view of computing and information. Quantum information processing explores the implications of using quantum mechanics instead of classical mechanics to model information and its processing. Quantum computing is not about changing the physical substrate on which computation is done from classical to quantum but about changing the notion of computation itself, at the most basic level. The fundamental unit of computation is no longer the bit but the quantum bit or qubit. This comprehensive introduction to the field offers a thorough exposition of quantum computing and the underlying concepts of quantum physics, explaining all the relevant mathematics and offering numerous examples. With its careful development of concepts and thorough explanations, the book makes quantum computing accessible to students and professionals in mathematics, computer science, and engineering. A reader with no prior knowledge of quantum physics (but with sufficient knowledge of linear algebra) will be able to gain a fluent understanding by working through the book.
Advanced Data Assimilation for Geosciences Oxford University Press, USA
In the last decade, there has been an increasing convergence of interest and methods between theoretical physics and fields as diverse as probability, machine learning, optimization and compressed sensing. In particular, many theoretical and applied works in statistical physics and computer science have relied on the use of message passing algorithms and their connection to statistical physics of spin glasses. The aim of this book, especially adapted to PhD students, post-docs, and young researchers, is to present the background necessary for entering this fast developing field.
Fundamental Aspects of Turbulent Flows in Climate Dynamics Oxford University Press, USA
Many of the distinctive and useful phenomena of soft matter come from its interaction with interfaces. Examples are the peeling of a strip of adhesive tape, the coating of a surface, the curling of a fiber via capillary forces, or the collapse of a porous sponge. These interfacial phenomena are distinct from the intrinsic behavior of a soft material like a gel or a microemulsion. Yet many forms of interfacial phenomena can be understood via common principles valid for many forms of soft matter. Our goal in organizing this school was to give students a grasp of these common principles and their many ramifications and possibilities. The Les Houches Summer School comprised over fifty 90-minute lectures over four weeks. Four four-lecture courses by Howard Stone, Michael Cates, David Nelson and L. Mahadevan served as an anchor for the program. A number of shorter courses and seminars rounded out the school. This volume collects the lecture notes of the school.
Quantum Optomechanics and Nanomechanics Springer
The physics of strong light-matter coupling has been addressed in different scientific communities over the last three decades. Since the early eighties, atoms coupled to optical and microwave cavities have led to pioneering demonstrations of cavity quantum electrodynamics, Gedanken experiments, and building blocks for quantum information processing, for which the Nobel Prize in Physics was awarded in 2012. In the framework of semiconducting devices, strong coupling has

allowed investigations into the physics of Bose gases in solid-state environments, and the latter holds promise for exploiting light-matter interaction at the single-photon level in scalable architectures. More recently, impressive developments in the so-called superconducting circuit QED have opened another fundamental playground to revisit cavity quantum electrodynamics for practical and fundamental purposes. This book aims at developing the necessary interface between these communities, by providing future researchers with a robust conceptual, theoretical and experimental basis on strong light-matter coupling, both in the classical and in the quantum regimes. In addition, the emphasis is on new forefront research topics currently developed around the physics of strong light-matter interaction in the atomic and solid-state scenarios.

Lecture Notes of the Les Houches Summer School: Volume 106, June 2016 OUP Oxford

First-ever comprehensive introduction to the major new subject of quantum computing and quantum information.

New Trends in Control Theory Cambridge University Press

The authors provide an introduction to quantum computing. Aimed at advanced undergraduate and beginning graduate students in these disciplines, this text is illustrated with diagrams and exercises.

Measurement Control of Engineered Quantum Systems Oxford University Press

The introduction of control theory in quantum mechanics has created a rich, new interdisciplinary scientific field, which is producing novel insight into important theoretical questions at the heart of quantum physics. Exploring this emerging subject, Introduction to Quantum Control and Dynamics presents the mathematical concepts and fundamental physics behind the analysis and control of quantum dynamics, emphasizing the application of Lie algebra and Lie group theory. To advantage students, instructors and practitioners, and since the field is highly interdisciplinary, this book presents an introduction with all the basic notions in the same place. The field has seen a large development in parallel with the neighboring fields of quantum information, computation and communication. The author has maintained an introductory level to encourage course use. After introducing the basics of quantum mechanics, the book derives a class of models for quantum control systems from fundamental physics. It examines the controllability and observability of quantum systems and the related problem of quantum state determination and measurement. The author also uses Lie group decompositions as tools to analyze dynamics and to design control algorithms. In addition, he describes various other control methods and discusses topics in quantum information theory that include entanglement and entanglement dynamics. Changes to the New Edition: New Chapter 4: Uncontrollable Systems and Dynamical Decomposition New section on quantum control landscapes A brief discussion of the experiments that earned the 2012 Nobel Prize in Physics Corrections and revised concepts are made to improve accuracy Armed with the basics of quantum control and dynamics, readers will invariably use this interdisciplinary knowledge in their mathematics, physics and engineering work.

Lecture Notes of the Les Houches Summer School August 2011 Oxford University Press

This book addresses and introduces new developments in the field of Quantum Information and Computing (QIC) for a primary audience of undergraduate students. Developments over the past few decades have spurred the need for QIC courseware at major research institutions. This book broadens the exposure of QIC science to the undergraduate market. The subject matter is introduced in such a way so that it is accessible to students with only a first-year calculus background. Greater accessibility allows a broader range of academic offerings. Courses, based on this book, could be offered in the Physics, Engineering, Math and Computer Science departments. This textbook incorporates Mathematica-based examples into the book. In this way students are allowed a hands-on experience in which difficult abstract concepts are actualized by simulations. The students can ‘turn knobs" in parameter space and explore how the system under study responds. The incorporation of symbolic manipulation software into course-ware allows a more holistic approach to the teaching of difficult concepts. Mathematica software is used here because it is easy to use and allows a fast learning curve for students who have limited experience with scientific programming.

Adding nonlinearity to an electromagnetic-magnonic quantum hybrid device Oxford University Press

The field of stochastic processes and Random Matrix Theory (RMT) has been a rapidly evolving subject during the last fifteen years. The continuous development and discovery of new tools, connections and ideas have led to an avalanche of new results. These breakthroughs have been made possible thanks, to a large extent, to the recent development of various new techniques in RMT. Matrix models have been playing an important role in theoretical physics for a long time and they are currently also a very active domain of research in mathematics. An emblematic example of these recent advances concerns the theory of growth phenomena in the Kardar-Parisi-Zhang (KPZ) universality class where the joint efforts of physicists and mathematicians during the last twenty years have unveiled the beautiful connections between this fundamental problem of statistical mechanics and the theory of random matrices, namely the fluctuations of the largest eigenvalue of certain ensembles of random matrices. This text not only covers this topic in detail but also presents more recent developments that have emerged from these discoveries, for instance in the context of low dimensional heat transport (on the physics side) or integrable probability (on the mathematical side).

Effective Field Theory in Particle Physics and Cosmology Cambridge University Press

The book gathers lecture notes of courses given at the 2014 summer school on integrated biology in Les Houches, France, Session CII. It addresses an emerging field ranging from molecules to cells and to organisms. Through examples it presents a new way of thinking using a combination of interdisciplinary and cutting-edge methods, bridging physics and biology beyond current biophysics. Important novel developments are expected in the coming years that may well introduce paradigm shifts in biological science. The school had the ambition to prepare participants to become major actors in these breakthroughs. The power of integrated approaches is illustrated through two cases: interactions between viruses and host cells, and flower development. The role of forces in biology, as well as their mathematical modeling, is illustrated in both processes: how they allow flower organs to emerge or how they control membrane fusion during virus budding. The book also underlines the importance of conformational changes and dynamics of proteins particularly during membrane processes. It explains how membrane proteins can be handled and studied by molecular simulations. Finally, the book also contains concepts in cell biology, in thermodynamics and several novel approaches such as in-cell NMR. Altogether, the chapters show how examining a biological system from different viewpoints based on multidisciplinary aspects often leads to enriching controversial arguments.

Quantum Mechanics Oxford University Press, USA

This book gathers the lecture notes of courses given at Session CVII of the summer school in physics, entitled "Current Trends in Atomic Physics" and held in July, 2016 in Les Houches, France. Atomic physics provides a paradigm for exploring few-body quantum systems with unparalleled control. In recent years, this ability has been applied in diverse areas including condensed matter physics, high energy physics, chemistry and ultra-fast phenomena as well as foundational aspects of quantum physics. This book addresses these topics by presenting developments and current trends via a series of tutorials and lectures presented by international leading investigators.

Strongly Interacting Quantum Systems out of Equilibrium Oxford University Press

In this book, hybrid systems based on yttrium-iron-garnet (YIG), three dimensional microwave cavity resonators, and superconducting transmon qubits, are investigated by continuous wave and pulsed microwave spectroscopy. Limitations to the magnetic linewidth in the quantum regime are identified and coherent exchange between a magnon and a superconducting qubit are demonstrated. Finally, a first step towards a strongly coupled hybrid system containing all three components is demonstrated.

Integrability: From Statistical Systems to Gauge Theory National Academies Press

This book targets computer scientists and engineers who are familiar with concepts in classical computer systems but are curious to learn the general architecture of quantum computing systems. It gives a concise presentation of this new paradigm of computing from a computer systems' point of view without assuming any background in quantum mechanics. As such, it is divided into two parts. The first part of the book provides a gentle overview on the fundamental principles of the quantum theory and their implications for computing. The second part is devoted to state-of-the-art research in designing practical quantum programs, building a scalable software systems stack, and controlling quantum hardware components. Most chapters end with a summary and an outlook for future directions. This book celebrates the remarkable progress that scientists across disciplines have made in the past decades and reveals what roles computer scientists and engineers can play to enable practical-scale quantum computing.

Quantum Computing Cambridge University Press

Comprehensive and accessible coverage from the basics to advanced topics in modern quantum condensed matter physics.

An Introduction to Quantum Computing Springer Nature

"First published by Cappella Archive in 2008."

From Atoms to Solid-state Systems Oxford University Press

In many applications of geophysics (weather forecast, study of climate evolution and variability), it is necessary to get the best possible estimate of the state of the system under study. In general, information about this system comes from observations and numerical models. However, none of these sources is perfect. Data assimilation designates the set of mathematical methods used to optimally combine observations with models, to fulfil the need of an accurateestimate of the system state. Because of the weather forecast problem in particular, the geophysical sciences have shaped a long history and a strong background on data assimilation, particularly with big and complex systems such as the atmosphere and the ocean. This book gathers notes from lecturesgiven during a three-week summer school on the fundamentals and the most recent developments of geophysical data assimilation.