Deterministic Entanglement Of Trapped Ion Spin Qubits

Manipulation of Entanglement and Its Realisation Using Trapped Ions
Entanglement and Decoherence in a Trapped-ion Quantum Register
Computational Complexity
Journal of Research of the National Institute of Standards and Technology
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Handbook of Nanophysics
Trapped Charged Particles: A Graduate Textbook With Problems And Solutions
Quantum Computation And Quantum Information Theory, Collected Papers And Notes
Principles Of Quantum Computation And Information - Volume Ii: Basic Tools And Special Topics
Macroscopic Quantum Coherence and Quantum Computing
Ultracold Bosonic and Fermionic Gases
TCP 2006
Experimental Issues in Coherent Quantum-State Manipulation of Trapped Atomic Ions
Bio-Inspired and Nanoscale Integrated Computing
Entanglement of Two Trapped-ion Spin Qubits
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Charged Particle Traps II
Research in Atomic, Ionic and Photonic Systems for Scalable Deterministic Quantum Logic
Mathematics of Quantum Computation and Quantum Technology

Ion Traps for Tomorrow's Applications
Physical Realizations of Quantum Computing
Quantum Computing
Exploring the Quantum/classical Frontier
High-Fidelity Quantum Logic in Ca+
Long Distance Entanglement Between Quantum Memories

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Manipulation of Entanglement and Its Realisation Using Trapped Ions John Wiley & Sons
Complex systems are systems that comprise many interacting parts with the ability to generate a new quality of collective behavior through self-organization, e.g. the spontaneous formation of temporal, spatial or functional structures. These systems are often characterized by extreme sensitivity to initial conditions as well as emergent behavior that are not readily predictable or even completely deterministic. The recognition that the collective behavior of the whole system cannot be simply inferred from an understanding of the behavior of the individual components has led to the development of numerous sophisticated new computational and modeling

tools with applications to a wide range of scientific, engineering, and societal phenomena. Computational Complexity: Theory, Techniques and Applications presents a detailed and integrated view of the theoretical basis, computational methods, and state-of-the-art approaches to investigating and modeling of inherently difficult problems whose solution requires extensive resources approaching the practical limits of present-day computer systems. This comprehensive and authoritative reference examines key components of computational complexity, including cellular automata, graph theory, data mining, granular computing, soft computing, wavelets, and more.

Entanglement and Decoherence in a Trapped-ion Quantum Register

Cambridge University Press

This volume can be justified by the following three facts, the need to provide, from time to time, a co-ordinated set of lectures which present the relevant progress in Metrology, the increasing intertwining between Fundamental Physics and the practice of Metrological Measurements, and, third, the flurry of new and unexpected

discoveries in this field, with a correlated series of Nobel Prizes bestowed to individuals working in Fundamental Constants research and novel experimental methods. One of the most fascinating and exciting characteristics of metrology is its intimate relationship between fundamental physics and the leading edge of technology which is needed to perform advanced and challenging experiments and measurements, as well as the determination of the values and interrelations between the Fundamental Constants. In some cases, such as the caesium fountains clocks or the optical frequency standards, the definition of the value of a quantity is, in the laboratory, in the region of 10-16 and experiments are under way to reach 10-18. Many of these results and the avenues leading to further advances are discussed in this volume, along a major step in metrology, expected in the near future, which could change the “old” definition of the kilogram, still based on a mechanical artefact, toward a new definition resting on a fixed value of a fundamental constant.

Computational Complexity John Wiley & Sons

At Les Houches in

January 2015, experts in the field of charged particle trapping came together for the Second Winter School on Physics with Trapped Charged Particles. This textbook collates the lectures delivered there, covering the fundamental physics of particle traps and the different types of applications of these devices.Taken as a whole, the book gives an overview of why traps for charged particles are important, how they work, their special features and limitations, and their application in areas such as precision measurements, mass spectrometry, optical clocks, plasma physics, antihydrogen creation, quantum simulation and quantum information processing. Chapters from various world experts include those on the basic properties of Penning traps and RF traps, as well as those covering important practical aspects such as vacuum systems, detection techniques, and different types of particle cooling, including laser cooling.Each individual chapter provides information and guidance on the application of the above methods. Additionally, each chapter is complemented by fully worked problems and solutions,

making Trapped Charged Particles perfect for advanced undergraduate and postgraduate students new to this topic.

Journal of Research of the National Institute of Standards and Technology

World Scientific Publishing Company

This book aims to provide a pedagogical introduction to the subjects of quantum information and quantum computation. Topics include non-locality of quantum mechanics, quantum computation, quantum cryptography, quantum error correction, fault-tolerant quantum computation as well as some experimental aspects of quantum computation and quantum cryptography. Only knowledge of basic quantum mechanics is assumed. Whenever more advanced concepts and techniques are used, they are introduced carefully. This book is meant to be a self-contained overview. While basic concepts are discussed in detail, unnecessary technical details are excluded. It is well-suited for a wide audience ranging from physics graduate students to advanced researchers.This book is based on a lecture series held at Hewlett-Packard Labs, Basic Research Institute in the

Mathematical Sciences (BRIMS), Bristol from November 1996 to April 1997, and also includes other contributions. *Fast Gates and Mixed-species Entanglement with Trapped Ions* World Scientific This second volume of the Charged Particle Traps deals with the rapidly expanding body of research exploiting the electromagnetic con?nement of ions, whose principles and techniques were the subject of volume I. These applications include revolutionary advances in diverse ?elds, ranging from such practical ?elds as mass spectrometry, to the establishment of an ult-stable standard of frequency and the emergent ?eld of quantum computing made possible by the observation of the quantum behavior of laser-cooled con?nedions. Bothexperimentalandtheoreticalactivity intheseapplications has proliferated widely, and the number of diverse articles in the literature on its many facets has reached the point where it is useful to distill and organize the published work in a uni?ed volume that de?nes the current status of the ?eld. As explained in volume I, the technique of con?ning charged particles in suitable electromagnetic ?elds was initially

conceived by W. Paul as a thr- dimensional version of his rf quadrupole mass ?lter. Its ?rst application to rf spectroscopy on atomic ions was completed in H. G. Dehmelt's laboratory where notable work was later done on the free electron using the Penning trap. The further exploitation of these devices has followed more or less - dependently along the two initial broad areas: mass spectrometry and high resolution spectroscopy. In volume I a detailed account is given of the theory of operation and experimental techniques of the various forms of Paul and Penning ion traps. *Robust Laser-free Entanglement with Trapped Ions* American Mathematical Soc.
Ion trapping was first accomplished in Europe more than 50 years ago. Since then, research and development have increased steadily, and the last decades have seen a remarkable growth in applications, mainly due to the improvement of laser-based techniques for spectroscopy, cooling and the manipulation of ions. Nowadays ion trapping plays a crucial role in a wide range of disciplines, including atomic and plasma physics, chemistry, high precision measurement,

high energy physics and the emerging field of quantum technologies. This book presents lectures and reports from the Enrico Fermi School ‘Ion Traps for Tomorrow's Applications’, held in Varenna, Italy, in July 2013. Reflecting the aim of the school to exploit diversity and stimulate cross fertilization, the selected topics and highlights in this book partly review the wide range of subjects discussed during the course, while providing an overview of this topical domain. As well as providing a useful reference guide, the book will be a source of inspiration for all those planning to work on ion trapping in the future.

Fast Gates and Mixed-Species Entanglement with Trapped Ions

CRC Press

This volume is an outgrowth of the Second International Workshop on Macroscopic Quantum Coherence and Computing held in Napoli, Italy, in June 2000. This workshop gathered a number of experts from the major Universities and Research Institutions of several countries. The choice of the location, which recognizes the role and the traditions of Naples in this field, guaranteed the participants a stimulating

atmosphere. The aim of the workshop has been to report on the recent theoretical and experimental results on the macroscopic quantum coherence of macroscopic systems. Particular attention was devoted to Josephson devices. The correlation with other atomic and molecular systems, exhibiting a macroscopic quantum behaviour, was also discussed. The seminars provided both historical overview and recent theoretical ground on the topic, as well as information on new experimental results relative to the quantum computing area. The first workshop on this topic, held in Napoli in 1998, has been ennobled by important reports on observations of Macroscopic Quantum Coherence in mesoscopic systems. The current workshop proposed, among many stimulating results, the first observations of Macroscopic Quantum Coherence between macroscopically distinct fluxoid states in rf SQUIDs, 20 years after the Leggett's proposal to experimentally test the quantum behavior of macroscopic systems. Reports on observations of quantum behaviour in molecular and magnetic systems, small Josephson devices,

quantum dots have also been particularly stimulating in view of the realization of several possible q-bits.

Classical and Quantum Information

World Scientific

Quantum computation and information is a new, rapidly developing interdisciplinary field. Its fundamental concepts and central results may not be easily understood without facing numerous technical details.Building on the basic concepts introduced in Vol I, this second volume deals with various important aspects, both theoretical and experimental, of quantum computation and information in depth. The areas include quantum data compression, accessible information, entanglement concentration, limits to quantum computation due to decoherence, quantum error-correction, and the first experimental implementations of quantum information protocols. This volume also includes a selection of special topics: chaos and quantum to classical transition, quantum trajectories, quantum computation and quantum chaos, and the Zeno effect.

Quantum Information Processing with Trapped 43Ca+ Ions

Elsevier

Quantum mechanics impacts on many areas of

physics from pure theory to applications. However it is difficult to interpret, and philosophical contradictions and counter-intuitive results are apparent at a fundamental level. This book presents current understanding of the theory, providing a historical introduction and discussing many of its interpretations. Fully revised from the first edition, this book contains state-of-the-art research including loophole-free experimental Bell test, and theorems on the reality of the wave function including the PBR theorem, and a new section on quantum simulation. More interpretations are now included, and these are described and compared, including discussion of their successes and difficulties. Other sections have been expanded, including quantum error correction codes and the reference section. It is ideal for researchers in physics and maths, and philosophers of science interested in quantum physics and its foundations. Quantum Computation and Quantum Information Theory Nova Publishers Quantum information theory has revolutionised our view on the true nature of information and has led to such intriguing topics as teleportation and quantum computation.

The field - by its very nature strongly interdisciplinary, with deep roots in the foundations both of quantum mechanics and of information theory and computer science - has become a major subject for scientists working in fields as diverse as quantum optics, superconductivity or information theory, all the way to computer engineers.

Metrology and Fundamental Constants Springer Nature

In the 1990s, nanoparticles and quantum dots began to be used in optical, electronic, and biological applications. Now they are being studied for use in solid-state quantum computation, tumor imaging, and photovoltaics. Handbook of Nanophysics: Nanoparticles and Quantum Dots focuses on the fundamental physics of these nanoscale materials and struct

Introduction To Quantum Computation And Information Springer

The rapidly developing topic of ultracold atoms has many actual and potential applications for condensed-matter science, and the contributions to this book emphasize these connections. Ultracold Bose and Fermi quantum gases are introduced at a level appropriate

for first-year graduate students and non-specialists such as more mature general physicists. The reader will find answers to questions like: how are experiments conducted and how are the results interpreted? What are the advantages and limitations of ultracold atoms in studying many-body physics? How do experiments on ultracold atoms facilitate novel scientific opportunities relevant to the condensed-matted community? This volume seeks to be comprehensible rather than comprehensive; it aims at the level of a colloquium, accessible to outside readers, containing only minimal equations and limited references. In large part, it relies on many beautiful experiments from the past fifteen years and their very fruitful interplay with basic theoretical ideas. In this particular context, phenomena most relevant to condensed-matter science have been emphasized. Introduces ultracold Bose and Fermi quantum gases at a level appropriate for non-specialists Discusses landmark experiments and their fruitful interplay with basic theoretical ideas Comprehensible rather than comprehensive, containing only minimal

equations
A Guide to Experiments in Quantum Optics
Springer Science & Business Media
Research and development in the pioneering field of quantum computing involve just about every facet of science and engineering, including the significant areas of mathematics and physics. Based on the firm understanding that mathematics and physics are equal partners in the continuing study of quantum science, Mathematics of Quantum Computation an
A Single Trapped Rydberg Ion
World Scientific
A new discipline, Quantum Information Science, has emerged in the last two decades of the twentieth century at the intersection of Physics, Mathematics, and Computer Science. Quantum Information Processing is an application of Quantum Information Science which covers the transformation , storage, and transmission of quantum information; it represents a revolutionary approach to information processing. Classical and Quantum Information covers topics in quantum computing, quantum information theory, and quantum error correction, three important areas of quantum information

processing. Quantum information theory and quantum error correction build on the scope, concepts, methodology, and techniques developed in the context of their close relatives, classical information theory and classical error correcting codes. - Presents recent results in quantum computing, quantum information theory, and quantum error correcting codes - Covers both classical and quantum information theory and error correcting codes - The last chapter of the book covers physical implementation of quantum information processing devices - Covers the mathematical formalism and the concepts in Quantum Mechanics critical for understanding the properties and the transformations of quantum information **Frequency Standards** World Scientific Quantum information theory has revolutionised our view on the true nature of information and has led to such intriguing topics as teleportation and quantum computation. The field — by its very nature strongly interdisciplinary, with deep roots in the foundations both of quantum mechanics and of information theory and computer science — has become a

major subject for scientists working in fields as diverse as quantum optics, superconductivity or information theory, all the way to computer engineers.The aim of this book is to provide guidance and introduce the broad literature in all the various aspects of quantum information theory. The topics covered range from the fundamental aspects of the theory, like quantum algorithms and quantum complexity, to the technological aspects of the design of quantum-information-processing devices. Each section of the book consists of a selection of key papers (with particular attention to their tutorial value), chosen and introduced by leading scientists in the specific area. An entirely new introduction to quantum complexity has been specially written for the book.

Do We Really Understand Quantum Mechanics?

SPIE-International Society for Optical Engineering

Examines the potential of various physical realizations of a quantum computer in view of the DiVincenzo criteria. In an influential article, DiVincenzo, the keynote speaker of the symposium, proposed 5 criteria that any physical system must

satisfy to be a viable quantum computer. Physical Realizations Of Quantum Computing: Are The Divincenzo Criteria Fulfilled In 2004? (With Cd-rom) Springer Nature The contributors of this volume are working at the forefront of various realizations of quantum computers. They survey the recent developments in each realization, in the context of the DiVincenzo criteria, including nuclear magnetic resonance, Josephson junctions, quantum dots, and trapped ions. There are also some theoretical contributions which have relevance in the physical realizations of a quantum computer. This book fills the gap between elementary introductions to the subject and highly specialized research papers to allow beginning graduate students to understand the cutting-edge of research in the shortest possible time. **Quantum Computation** Springer Science & Business Media This book presents written versions of the eight lectures given during the AMS Short Course held at the Joint Mathematics Meetings in Washington, D.C. The objective of this course was to share with the scientific

community the many exciting mathematical challenges arising from the new field of quantum computation and quantum information science. The course was geared toward demonstrating the great breadth and depth of this mathematicall y rich research field. Interrelationsh ips withexisting mathematical research areas were emphasized as much as possible. Moreover, the course was designed so that participants with little background in quantum mechanics would, upon completion, be prepared to begin reading the research literature on quantum computation and quantum informationsci ence. Based on audience feedback and questions, the written versions of the lectures have been greatly expanded, and supplementar y material has been added. The book features an overview of relevant parts of quantum mechanics with an introduction to quantum computation, including many potential quantum mechanical computing devices; introduction to quantum algorithms and quantum complexity theory; in-depth discussion on quantum error correcting codes and quantum cryptography; and finally,explora tion into

diverse connections between quantum computation and various areas of mathematics and physics.

Manipulation of Entanglement and Its Realisation in Trapped Ions Springer

Of all measurement units, frequency is the one that may be determined with the highest degree of accuracy. It equally allows precise measurements of other physical and technical quantities, whenever they can be measured in terms of frequency. This volume covers the central methods and techniques relevant for frequency standards developed in physics, electronics, quantum electronics, and statistics. After a review of the basic principles, the book looks at the realisation of commonly used components. It then continues with the description and characterisation of important frequency standards from atomic clocks, to frequency stabilised lasers. The whole is rounded of with a discussion of topical applications in engineering, telecommunications, and metrology.

Handbook of Nanophysics Academic Press

Work has been completed on the three projects supported by

this grant. This Final Project Report summarizes the achievements of the project and the project milestones, which highlight deterministic entanglement between two trapped ions and the demonstration of the highest efficiency conditional single photon source to date.

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