Quantum computation and information is a rapidly developing interdisciplinary field. It is not easy to understand its fundamental concepts and central results without facing numerous technical details. This book provides the reader with a useful guide. In particular, the initial chapters offer a simple and self-contained introduction; no previous knowledge of quantum mechanics or classical computation is required.

Various important aspects of quantum computation and information are covered in depth, starting from the foundations (the basic concepts of computational complexity, energy, entropy, and information, quantum superposition and entanglement, elementary quantum gates, the main quantum algorithms, quantum teleportation, and quantum cryptography) up to advanced topics (like entanglement measures, quantum discord, quantum noise, quantum channels, quantum error correction, quantum simulators, and tensor networks).

It can be used as a broad range textbook for a course in quantum information and computation, both for upper-level undergraduate students and for graduate students. It contains a large number of solved exercises, which are an essential complement to the text, as they will help the student to become familiar with the subject. The book may also be useful as general education for readers who want to know the fundamental principles of quantum information and computation.

"Thorough introductions to classical computation and irreversibility, and a primer of quantum theory, lead into the heart of this impressive and substantial book. All the topics – quantum algorithms, quantum error correction, adiabatic quantum computing and decoherence are just a few – are explained carefully and in detail. Particularly attractive are the connections between the conceptual structures and mathematical formalisms, and the different experimental protocols for bringing them to practice. A more wide-ranging, comprehensive, and definitive text is hard to imagine."

— Sir Michael Berry, *University of Bristol, UK*

"This second edition of the textbook is a timely and very comprehensive update in a rapidly developing field, both in theory as well as in the experimental implementation of quantum information processing. The book provides a solid introduction into the field, a deeper insight in the formal description of quantum information as well as a well laid-out overview on several platforms for quantum simulation and quantum computation. All in all, a well-written and commendable textbook, which will prove very valuable both for the novices and the scholars in the fields of quantum computation and information."

— Rainer Blatt, *Universität Innsbruck and IQOQI Innsbruck, Austria*

"The book by Benenti, Casati, Rossini and Strini is an excellent introduction to the fascinating field of quantum information, of great benefit for scientists entering the field and a very useful reference for people already working in it. The second edition of the book is considerably extended with new chapters, as the one on many-body systems, and necessary updates, most notably on the physical implementations."

— Rosario Fazio, *The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy*

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Benenti
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Principles of Quantum Computation and Information
A Comprehensive Textbook

Giuliano Benenti Giulio Casati
Davide Rossini Giuliano Strini

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