books available, *Science Explorer: Astronomy* (Prentice-Hall, 2000). Together, they are uniquely qualified to write a book on the Sun, and they have produced a truly fascinating tour, complete with an outstanding set of images.

Nearest Star takes us on a multidimensional journey—in space, from the center of the sun to the atmosphere of the Earth, and in time, from the Big Bang to our current arguments about global warming. If you ever wondered what the "saros" is, or how the solar wind is generated, this is the book for you. The breadth of information the authors provide is exceptional. I don't think I will be the only reader to stop and reread sections, taking in all that these expert authors have to offer.

This book can appeal to a wide audience. Students of space science will find it provides a wonderful overview, and the wider public would enjoy it as well; *Nearest Star* is, for the most part, written at a *Scientific American* level. The chapter on current and future space missions might be less appealing to general readers, but space buffs will appreciate the birds-eye view that the authors provide. Overall, the grand scope of the book will engage folks who enjoy keeping abreast of current science.

One especially appealing feature of this book is the historical context provided by the authors. The Sun is the dominant feature in our sky and has absorbed the attentions of observers for millennia. In the scientific age, the Sun continued to be the source of such fundamental questions as How does it shine? Golub and Pasachoff treat the subject by essentially providing a biography of the Sun, weaving together current knowledge and history into a seamless tapestry.

The last chapters of the book deal with the Sun's influence on Earth. As elsewhere, Golub and Pasachoff are thorough, leading the reader through a wide-ranging discussion of climate, ice ages, and global warming. They also point out that we are, after all, living with a variable star. Solar variability is a wild card in the global climate question, despite the clear anthropogenic forcing of the industrial age. A more direct effect of solar variability is "space weather." For readers unfamiliar with the term, *Nearest Star* will provide a nice introduction. And it is gratifying to see a discussion of the aurora that gets the basics right—too many books, even today, still invoke an obsolete picture of direct entry of solar wind particles into the polar regions to explain the northern lights.

In sum, *Nearest Star* provides an excellent overview of our current understanding of the Sun and its effects on Earth. But, of course, science does not stand still. Already one of the questions left open by this book has been answered: The recent results from the Sudbury Neutrino Observatory have confirmed that neutrinos do change flavors, and that we do seem to understand the processes that power the Sun's core. That new and fundamental understandings continue to emerge from the study of our nearest star is a testament to the importance of solar physics.

Ramon E. Lopez
University of Texas at El Paso

Quantum Computation and Quantum Information

Michael A. Nielsen
and Isaac L. Chuang
Cambridge U. Press, New York, 2000. $130.00, $47.95 paper (700 pp.). ISBN 0-521-63235-8, ISBN 0-521-63503-9 paper

Michael Nielsen and Isaac L. "Ike" Chuang have produced a highly readable, thorough, and timely survey of the field of theoretical quantum information science. Their *Quantum Computation and Quantum Information* is probably destined to become a standard text for researchers in this still emerging, rapidly developing field. Quantum information science is the application of the fundamental quantum physics phenomena to the storage, communication, and processing of information; it represents a complete paradigm shift for information processing technology. Phenomena such as superposition and entanglement, in theory, allow the solution of important mathematical problems thought to be intractable with standard electronic computers.

Research in quantum information science, which has seen remarkable growth in the last five years or so, is highly interdisciplinary, encompassing mathematics, computer science, physics, electrical engineering, materials science, and physical chemistry. Nielsen, an associate professor at the University of Queensland node of the Australian Special Research Center for Quantum Computing Technology, in Sydney, Australia, and Chuang, an associate professor at the MIT Media Laboratory, are two of the brightest

young scientists in a field replete with bright young scientists. They have made numerous important theoretical and experimental contributions to this field, most notably the first experimental implementation of a quantum algorithm, by Chuang and coworkers, in 1997.

The book is divided into three sections, dealing respectively with fundamental concepts, quantum computation, and quantum information. The authors rightly choose to examine key issues in depth rather than attempt a mile-wide, inch-deep, catholic approach. They concentrate on the development of an understanding of quantum information theory, of what a quantum computer can do and why it will be powerful, rather than on how such a device can be constructed. Descriptions of experiments are confined to a single chapter that serves to whet the appetite and direct the reader to other sources.

While all of the topics covered in the book are of considerable importance and interest, others of possibly equal or greater import—such as decoherence-free subspaces, continuous variable quantum information processing, or the characterization of quantum state entanglement—are covered only in passing or not at all. When describing an emerging field such as this, it is difficult to know what will be the most popular topic a few months hence, let alone judge which are of lasting importance to the field as a whole. Thus, I cannot really level criticism at the authors for such omissions; indeed, the background material needed to assimilate such new developments is all very well covered.

In a work of this size, minor errors are inevitable. The authors are maintaining a web site with errata at www.squint.org/qci.

There are quite a few books published on quantum information science, none with either the scope or depth of the Nielsen–Chuang work, but which nevertheless might serve as suitable complements to it. The compendium works *The Physics of Quantum Information*, edited by Dirk Bouwmeester, Artur Ekert, and Anton Zeilinger (Springer, 2000), and *Scalable Quantum Computers: Paving the Way to Realization*, edited by Sam Braunstein and Hoi-Kwong Lo (Wiley, 2001), offer much more information on experiments and technology development. Other books on this field, aimed at working physicists (as opposed to the plethora of semipopular works), are: *Explorations in Quantum Computing* by Colin Williams and Scott Clearwater (Telos, 1998, with a new edition to appear), *Introduction to Quantum Computers* by Gennady Berman, Gary Doolen, Ronnie Mainieri, and Vladimir Tsifrinovitch (World Scientific, 1998), and *Introduction to Quantum Computation and Information*, edited by Hoi-Kwong Lo, Sandu Popescu, and Tim Spiller (World Scientific, 1998), all of which are shorter, more introductory works.

The book is very well written and a pleasure to read. The authors assume initially only minimal knowledge of quantum theory and/or computer science, and bring the reader up to the current state of the art as it pertains to this field. Problem sets to aid the student and instructor are included. The text is enlivened with occasional insertions of wit and apt quotations. In this spirit, I will conclude with a quotation from Niccolò Machiavelli's *The Prince*: "There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things."

DANIEL F. V. JAMES
Los Alamos National Laboratory
New Mexico

Managing Science: Management for R&D Laboratories

Claude Gelès, Gilles Lindecker, Mel Month, and Christian Roche
Wiley, New York, 2000. $79.95 (359 pp.). ISBN 0-471-18508-6

Collectively, Claude Gelès, Gilles Lindecker, Mel Month, and Christian Roche have many decades of involvement in managing accelerator laboratories, primarily at CERN (European Laboratory for Particle Physics) and at Brookhaven National Laboratory. They note in an informative preface to *Managing Science: Management for R&D Laboratories* that "scientists tend not to respect management as a scholarly field on a par with the hard sciences—or with sociology or economics for that matter." These authors, however, obviously do respect management as a scholarly field; they have developed and taught university courses on the management of scientific laboratories. Now they offer their insights in a book that covers nearly every topic of value in the management of nonprofit research facilities and organizations.

The emphasis here is on facilities and organizations. This is not a book about the art of managing individual