engineers and scientists in other fields who want to get a feel for the excitement in quantum computing but don't require thorough understanding of it. The accompanying CD-ROM includes free-standing animations of quantum experiments, such as two-slit interference and tunneling, as well as notebook files that can be used in conjunction with the Mathematica computer algebra program (to be purchased separately) to run simulations of Shor's algorithm, teleportation and quantum error correction, and to do other quantum calculations.

After an initial chapter that places quantum computation in its social and technological context, there is a handy introduction to the basics of computation theory, including Turing machines, the notion of proof, computability and complexity classes. As is much of the rest of the book, this chapter is written at a semitechnical but nonrigorous level that will be easily digestible to a technically trained person seeking a rough impression, but it will be frustrating to a student looking for a thorough understanding of these notions.

The next chapter provides a similarly nonrigorous overview of quantum mechanics, followed by chapters on quantum computers, classical cryptography, randomness versus pseudorandomness, quantum cryptography, quantum teleportation and quantum error correction. The last chapter covers possible physical implementations, culminating in the bulk nuclear magnetic resonance technique that has generated many recent experimental results.

In a field as profound and counterintuitive as quantum mechanics, digestibility is sometimes the enemy of understanding, and I fear the authors have sacrificed the latter to the former by not treating the central hard notions in a more forthright and rigorous manner at the beginning of their book, before moving on to the applications. For example, entanglement is mentioned, but not defined, in the introductory quantum mechanics chapter. It is again mentioned briefly in the chapter on quantum cryptography, but it is not discussed at length until the teleportation chapter, too late for the reader to appreciate its role in quantum computation, quantum randomness and noise processes.

Despite numerous small and medium-sized inaccuracies, which will doubtless be corrected in subsequent editions (for example, the device used to produce entangled pairs of photons was incorrectly called a beam splitter rather than a down-converting crystal), the book gives a balanced and broadly accurate survey of the field, leaving out no important area. Mathematica users will find the simulations amusing and may even be able to use some of the software modules in serious research. Even those who do not use Mathematica will be able to watch the animations, which illustrate features of quantum dynamics, such as back reflection from the two-slit screen, not usually emphasized in simple textbook discussions.

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Introduction to Ionomers

Adi Eisenberg and Joon-Seop Kim
Wiley, New York, 1998. 327 pp.
$99.95 hc ISBN 0-471-24678-6

Ionomers are best defined, as Adi Eisenberg and Joon-Seop Kim do in their *Introduction to Ionomers*, as "polymers in which the bulk properties are governed by ionic interactions in discrete regions of the material (ionic aggregates)." These materials are of substantial technical interest in areas as different as electrochemistry and packaging, and they present a host of intriguing technical and fundamental problems. They are a category of block copolymer, and, like other block copolymers, they can have widely different transport, structural and morphological properties, depending on the components, the arrangement of the components and the treatment history.

The study of ionomers is a very active area of research—there are roughly 650 technical publications per year in this area, of which a third are patents. The huge patent interest arises mostly from applications in electrochemistry and in the transport of charged and uncharged small particles. Eisenberg, arguably the best-known figure in his field, developed many of the concepts and has edited a number of multiauthored volumes on ionomers; Kim has published and collaborated extensively with Eisenberg.

The book is systematic, clear, readable and wide-ranging. Although many disclaimers are offered about limitation in the scope, the book discusses everything from the definition of an ionomer through structural variability, morphology, phase transitions, specific ionomer classes, treatment and applications. It is a well-organized and focused guidebook.

Most of the work on the topic has been done by the engineering community, and those with a background in fundamental science will be both fascinated and challenged by the complexity of these materials and the difficulty involved in understanding them with simple models. The book does a very good job of reducing the enormous complexity of morphological and response properties to simple verbal pictures and structural diagrams; this is one of its great strengths. The field is clearly one in which analysis at a fundamental level is quite difficult, but the rewards of that analysis may be spectacular.

This book is a pleasure in many ways—the symbols are clearly defined, the figures are appropriate, the questions attacked are the major ones in the field. These are complex materials whose response properties and structures cannot be described in simple terms. The book clarifies the source of the complexity and describes well the approaches to understanding these complicated species.

Almost the only negative comment I can make has to do with the index. Most scientists who get interested in ionomers were probably first interested in Nafion and related fluorosulfonate polymers, but the word "Nafion" does not appear in the index, despite its presence at several places in the book. Such a minor criticism can be leveled at almost any advanced text, and it detracts only in a tiny way from a very excellent treatment.

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The Invisible Sky: ROSAT and the Age of X-Ray Astronomy

Bernd Aschenbach, Hermann-Michael Hahn and Joachim Trümper
Translated by Helmut Jenkner
Copernicus (Springer-Verlag), New York, 1998. 175 pp.
$40.00 hc ISBN 0-387-94928-3

There is nothing comparable to the feeling of direct contact with the universe that comes with looking up at the stars on a clear, moonless night or gazing at a distant galaxy through the eyepiece of an optical telescope. So it is with some skepticism that one might approach *The Invisible Sky*, a large picture-book that consists of sky views rendered in false color. These images were computer-generated from soft x-ray data obtained with a spaceborne, grazing-incidence x-ray telescope at wavelengths somewhat longward of ~5 Å ($h\nu = 0.1$–2.4 keV). The program was carried out with the ROSAT (ROentgen SATellite) mission (of which Joachim Trümper was principal investigator), which was launched on 1 June 1990. The elaborate collection of mar-