

as they are among the excessive verbiage and over-generalizations, are visible in the discussions. One example of a sweeping generalization is found in the last chapter, in which the authors write that educational reform has been a failure, with a few exceptions that "refer to single classrooms or single schools but never to a whole school system" (page 185). Their analysis is simply untrue. For example, the website sponsored by the department of teacher education at Ohio's Miami University (<http://www.units.muohio.edu/eap/departments/ted/centers.html>) states that "Ohio's systemic initiative, *Discovery*, has promoted systemic change in science and mathematics teaching and learning by providing high-quality, sustained professional development to teachers and administrators throughout Ohio since 1991."

Glazek and Sarason also write, "On the basis of our experience, we have concluded that the basic problem that has gone unexamined is the concept and process of learning" (page 190). It is a pity that their experience does not extend to reading books such as *How People Learn: Brain, Mind, Experience, and School* (National Academy Press, 1999), edited by John D. Bransford, Ann L. Brown, and Rodney R. Cocking.

The shortcomings mentioned above refer mostly to the portions on education; by contrast, the portions that treat the physics are wonderful. Beginning in chapter 6, readers are taken on a fascinating journey from Nicolaus Copernicus to Albert Einstein in a quest to understand time and other concepts associated with the theory of relativity. We learn who did what and why, how each discovery was built on an earlier one, and what critical questions drove the scientists of the day. Simple explanations of relevant physics concepts and vivid, everyday analogies are woven into the text along the way. The story is engaging, and the writing is easy to understand and fluid, except when interspersed with comments on education.

However fascinating the authors found their experience of working together, *Productive Learning* as a book does not work. It reads like two books glued together. If they could be unglued, I would highly recommend the one about relativity and suggest leaving the other on the shelf.

Diane Grayson
University of Pretoria
Pretoria, South Africa

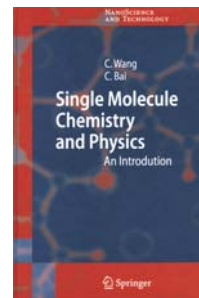
Single Molecule Chemistry and Physics

An Introduction

C. Wang and C. Bai
Springer, New York, 2006. \$119.00
(303 pp.). ISBN 978-3-540-25369-3

Chen Wang and Chunli Bai's *Single Molecule Chemistry and Physics: An Introduction* is an ambitious attempt to review the wide variety of experimental techniques applied to studies of single mol-

ecules. In the introduction the authors state that they will refer readers to the original papers for details of the experimental methods. Their intent is to focus on what has been learned from those studies and on where future developments may lead. The extent to which Wang and Bai succeed is mixed. Their expertise in scanning probe microscopy is evident in the breadth,



CAMBRIDGE

Coming this Fall....ORDER TODAY!

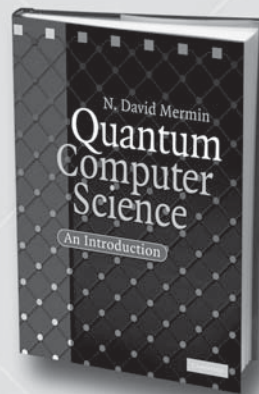
"... will be a standard for instruction and reference for years to come..."

—David DiVincenzo, IBM T. J. Watson Research Center

from *N. David Mermin*

Quantum Computer Science An Introduction

- New, from one of the most highly-respected experts on quantum foundations
- Concise introduction to quantum computation that assumes no prior familiarity with quantum physics
- Illustrates the basics of the quantum computational approach through major applications — including Shor's factoring algorithm, Grover's search algorithm, and quantum error correction
- Evolved from six years of teaching the subject matter to undergraduate and graduate students in Computer Science, Mathematics, Engineering, and Physics



\$45.00: Hb: 978-0-521-87658-2: 236 pp.

Also of Interest...

Numerical Recipes

The Art of Scientific Computing
Third Edition

William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery

Book/Hb/\$80.00/ 978-0-521-88068-8/ 1,256 pp.

Source Code CD-Rom/\$80.00/978-0-521-70685-8

Note: CD-ROM contains source code only and does not include text of the book *Numerical Recipes, Third Edition*.

- Go to www.nr.com for more general information about licenses, and to www.cambridge.org/us/numericalrecipes to learn more about the book and Source Code CD-ROM.

BUY THE BOOK AND SOURCE CODE CD-ROM TOGETHER AND SAVE!

Hb with CD-ROM/\$140.00/978-0-521-88407-5

www.cambridge.org/us



CAMBRIDGE
UNIVERSITY PRESS

depth, completeness, and correctness of their coverage. In general, they do a good job on SPM, but not nearly as well on the optical techniques.

Although the book contains many distracting grammatical problems, they rarely interfere with the meaning of the text. Many of the sentences are simply clumsy, and inappropriate word choice and the lack of subject-verb agreement are rampant. In some cases the word choice is not just inappropriate but wrong. On page 1, for instance, Wang and Bai refer to “molecules laying on surfaces.” Granted, English is not their first language, so better editing on the part of the publisher would have been appreciated.

Chapters 2 through 6 are reasonably well organized and clear, and they provide a good summary of what has been done and what can be done with a number of techniques on a variety of molecular systems. Chapters 2 through 4 focus on scanning tunneling microscopy, the oldest and best-developed single-molecule technique. Chapter 2 summarizes the principles of electron tunneling and focuses on STM in particular. The chapter is a difficult read for nonexperts, as it contains many equations without much explanation, and not all quantities are defined. For example, for the tunneling current, equations 2.4 and 2.5 contain the quantity Δ s, which is never defined. Chapters 3 and 4 address applications of STM, chapter 5 gives an introduction to scanning force microscopy, and chapter 6 covers measurements of the forces between molecules or within polymers by atomic force microscopy and related techniques and by the optical tweezers technique.

Chapter 7 reviews studies of single-molecule electrical conductivity. The chapter is brief; it summarizes some results on conductance through monolayers and single molecules and also describes a few single-molecule devices, but it gives little perspective on the fascinating experimental and theoretical issues surrounding this rapidly evolving field.

The final chapters, 8 through 10, on optical and Raman spectroscopies are much weaker than the others. They read like an ambitious literature review by a diligent yet inexperienced student. Discussion of any given experiment is limited to a few sentences. The authors offer very little critical analysis or discussion of the importance of any of the studies, nor do they commit much effort to placing them in a broader context. The order of the material within a chapter is neither chronological nor se-

lected in any other obvious way. Chapter 10, on surface-enhanced Raman spectroscopy, is particularly disappointing. After a brief introduction to Raman scattering and surface enhancement, the chapter launches into a list of briefly described results with little explanation or analysis and with references that do not seem to be in any particular order.

Measurements of single molecules involve probing physical and chemical properties at a level of detail often obscured by ensemble averaging in traditional bulk measurements. Single-molecule measurements provide the clearest experimental comparison with theory, which typically describes the behavior of an individual molecule interacting with its environment. Most of the other available books on single-molecule measurements are edited collections of articles. Such a format allows each topic to be addressed by an expert, but it inevitably introduces some repetition, gaps in coverage, and heterogeneity in style, level, notation, and point of view. Edited volumes can be good reference sources, but they are rarely useful as textbooks. The few existing monographs on the subject, such as *Handbook of Single Molecule Fluorescence Spectroscopy* (Oxford U. Press, 2006) by Alastair Smith, Christopher Gell, and David Brockwell and *Selective Spectroscopy of Single Molecules* (Springer, 2006) by Igor Osad'ko, are much narrower in scope than the edited volumes.

Bai and Wang aimed high when they attempted to cover a broad range of single-molecule measurements in one monograph. Unfortunately, the result is not fully successful. Much of the coverage in *Single Molecule Chemistry and Physics* is too terse to provide a useful learning resource for graduate students or postdocs. And in this rapidly evolving field, the book is already somewhat out of date as a reference.

Anne Myers Kelley
University of California
Merced

Quantum Optics An Introduction

Mark Fox
Oxford U. Press, New York, 2006.
\$44.50 paper (400 pp.).
ISBN 978-0-19-856673-1

Quantum optics, literally the study of quantized light, has morphed into a name for the investigations of the interactions between light and matter, with an emphasis on qualitative microscopic

models, time dependence, and coherence, rather than on the atomic-structure calculations of transition-matrix elements. Much of the current activity in quantum information science, laser cooling and trapping, and quantum-degenerate atomic gases has grown out of quantum optics. Mark Fox's *Quantum Optics: An Introduction* covers, or at least brings up, much of the core material in traditional quantum optics, quantum information, and cold gases. This could have been 1000 pages of stiff mathematics, but what is on hand is an undergraduate textbook with fewer than 400 pages.

Fox, a reader in the department of physics and astronomy at the University of Sheffield in the UK, has done a remarkable job at picking the key topics from a broad field—one that the more-expansive quantum optics nowadays claim as their own. I do not know of a comparable quantum optics textbook aimed at undergraduates. Part 1 presents background on classical optics, quantum mechanics, and radiative transitions in atoms. Parts 2, 3, and 4 cover, respectively, photons, atom-photon interactions, and quantum information processing. A couple hundred exercises, mostly straightforward, and brief answers are included.

Fox's strategy is to accommodate undergraduates by emphasizing intuition, experiments, and devices at the expense of mathematics. Sometimes his approach works very well. A hardcore theorist may cringe at seeing anti-bunched light represented as a regular stream of little balls, but those sorts of pictures have guided, and will guide, designs of successful experiments and devices. At times, though, avoiding mathematics may have become a goal of its own: The contorted presentation of the two-level system in terms of rate equations and Einstein's *A* and *B* coefficients is a case in point. By not using something equivalent to optical Bloch equations, the author may have bypassed some mathematics, but a student's understanding of one of the central themes in quantum optics is seriously compromised.

The style and depth of the presentation vary depending on the topic and, presumably, on the interests and expertise of the author. By the nature of the book, though, shortcuts are inevitable and lead to predictable quandaries. In spite of helpful margin notes, on many occasions it would be impos-

