

BOOKS

tered, blackmailed, threatened, convinced and forced the US Navy into becoming a nuclear powered Navy. It is a tale of the power of positive rudeness and singleminded stubbornness, always with a vision of what the Navy should be and in the cause of impeccable, high-quality engineering and engineering practice. Everything else was made secondary to the vision and to the quality of design, execution, training and operation.

Rickover's brilliance was not only in practical engineering, but in bureaucracy. By arranging to be the officer in the Navy nuclear program office, and the civilian in the AEC office of naval nuclear power, Admiral Rickover could send memos to himself and answer them, threaten each office with the bureaucratic disapproval of the other and testify before Congress as military officer or civilian, Navy or AEC, as convenient.

While the work was not without its possible costs, in dollars and in the dedication of the Navy's best people to one program, its accomplishments were clearly unique. Rickover created a nuclear Navy at an important time and demonstrated how successful a singleminded dedication to quality, accomplishment and careful engineering can be.

Rickover's approach created a nuclear Navy with a long history of freedom from nuclear accidents. There were serious problems with other parts of the engineering plan—generally parts Rickover had not been able to control. The engineering he did control has been remarkably trouble free: While much of the original engineering was radical in concept, it was conservative in execution. This fact contains an important lesson. Having worked with him, and in some cases in opposition to him, I can testify to the quality of his thought and the irritatingly successful properties of his methods. The book reflects the flavor, the methods and the results well. It is not only a lesson in a way of doing things, it is a fascinating tale as well.

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Cranks, Quarks and the Cosmos

Jeremy Bernstein
BasicBooks (HarperCollins),
New York, 1993. 220 pp.
\$23.00 hc ISBN 0-465-08897-X

Ever wonder what happened to Tom Lehrer? He's teaching math and mu-

sicals in Santa Cruz. That's one of the interesting tidbits you can find in Jeremy Bernstein's *Cranks, Quarks, and the Cosmos*, a selection of his profiles of scientists previously published in *The New Yorker*.

Two of the essays concern Einstein. In "Einstein when Young," Bernstein reviews the 1987 publication of the first volume of Einstein's personal correspondence and other papers. These include letters between Einstein and his first wife, Mileva Maric. They offer a fascinating new perspective on the humanitarian who never mentioned Mileva or his children in his autobiography, who emphasized instead his lifelong attempt to free himself from the "merely personal."

Mileva was a physicist, very unusual for women at that time, and the letters between Albert and Mileva contain a mixture of physics and the personal. Some revisionists have suggested that Mileva was the one who actually developed relativity. Einstein's letters to Mileva frequently refer to "our theory," but he gives her no acknowledgment in any of his publications. Bernstein draws no conclusion other than that the letters leave Einstein as much an enigma as he was before.

The physics in the letters is less interesting than the personal material, and Bernstein includes a hilarious quotation in which Einstein tells about his Jewish mother's reaction to the prospect of his marrying an older gentile. "You are ruining your future and blocking your path through life," Albert's mother wails. "That woman cannot gain entrance to a decent family.... When you'll be 30, she'll be an old hag."

In several of the other essays, Bernstein criticizes biographers for giving too many details about the lively heterosexuality of Schrödinger, Feynman, Watson and Crick, and the tragic homosexuality of Alan Turing. However, this criticism comes across as a bit hypocritical, because Bernstein includes a few racy details himself. You won't find much dry science here.

However, *Cranks* is not simply a survey of the diversions of famous scientists. Several essays offer new insights on historically important characters. I found the essay on Ernst Mach particularly interesting because I have been curious about his role in scientific history. Einstein credited Mach as one of his inspirations, and Mach's Principle is usually mentioned *pro forma* in cosmology books, but it is not really used anywhere in Einstein's relativity. Mach



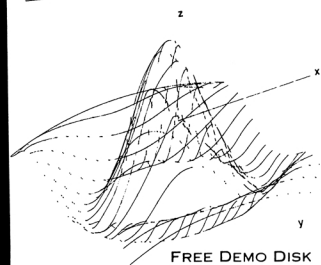
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FORMING MATRICES
x = fillvec(grid', 20)
y = fillvec(grid, 20)
ELEMENT-BY-ELEMENT OPERATIONS
r = sqrt(x^2 + 2*y^2) + 1e-4
3-D PLOTTING
mesh(sin(r)/r, [30, 0, 130])
  
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was an interesting character, though. He doubted both atoms and relativity, and the essay relates his interactions with Boltzmann and Einstein.

You won't learn much about cranks, quarks or the cosmos in this book, but you will find some entertaining tales about a few of the more famous, and one or two of the less famous, stars in the scientific drama.

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Critical Phenomena at Surfaces and Interfaces: Evanescent X-Ray and Neutron Scattering

Helmut Dosch

*Springer-Verlag, New York,
1992. 145pp. \$79.00 hc
ISBN 0-387-54534-4*

Most physicists learn about evanescent waves from textbook descriptions of the total internal reflection of visible light. For x rays and neutrons, it is the other way around—total external reflection is the rule. This consequence of the low index of refraction for x rays and neutrons has turned grazing angle studies into a big business at synchrotron light sources and reactors around the world. The shallow penetration depths of these evanescent waves make them ideal for studies of surface structure and critical phenomena.

Helmut Dosch has tackled this subject in a monograph that combines the physics of scattering from surfaces with the surface science that comes out of it. The author has specialized in the observation of solid-liquid and ordering phase transitions at crystal surfaces by means of diffraction at grazing angles. Much of the book is devoted to work carried out in his group, as described in his characteristically flamboyant style.

Roughly half of the book is devoted to the scattering of x rays and neutrons from surfaces, covering the basic theory, the distorted wave Born approximation for reflection and diffraction and applications to scattering from surfaces whose symmetry is broken in different ways (such as by roughening or disorder). There is some description of x-ray and neutron beamlines used to observe the scattering. Dosch spends the re-

maining half of the book on obtaining critical exponents from grazing-angle x-ray and neutron diffraction experiments. He describes several studies that demonstrate how bulk transitions are inevitably modified by the presence of a surface, with its effect on long-range correlations.

While this book is billed as a tutorial text, it should be regarded more as a review article. Material is drawn from many sources, using the individual notation of each. Although the basic elements of x-ray and neutron scattering are presented, the material is largely summarized. Readers who are not already familiar with surface diffraction would be advised to supplement their reading with the kinematical treatments of surface x-ray diffraction in recent review articles by Robert Feidenhans'l (*Surf. Sci. Rpts.* 10 (1989) 105) and by Ian Robinson and Douglas Tweet (*Rep. Prog. Phys.* 55 (1992) 599). Similarly, in the second half of the book, the author assumes he is speaking to a reader who has already acquired some familiarity with modern concepts of critical phenomena such as renormalization groups and universality classes.

Considered as a review of a burgeoning field of research, the book is a veritable treasure trove of references. Dosch has covered the areas broadly, and even experienced readers are likely to find references of which they were not aware. Some errors have also crept in. The author incorrectly defines the height-difference correlation function as a height-height correlation function in his presentation of the distorted-wave Born approximation applied to rough surfaces. I noted other errors in the description of experiments and results.

Unfortunately, the book is marred by poor-quality English text. Typographical errors, misspellings, incorrect usage of words and non-English grammatical constructions abound. This detracts from the author's message and reflects poorly on the editorial supervision of the publisher.

Dosch's book fills a niche in a field that has progressed considerably, even since the book was written. It is a useful starting point for those who wish to study surface ordering on crystals with scattering experiments.

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Fivefold Symmetry

Edited by István Hargittai
*World Scientific, River Edge,
N. J., 1992. 561 pp. \$68.00
hc ISBN 981-02-0600-3*

Spiral Symmetry

**Edited by István Hargittai
and Clifford A. Pickover**
*World Scientific, River Edge,
N. J., 1992. 449 pp. \$68.00
hc ISBN 981-02-0615-1*

Understanding the universe requires simplification through models and images—this is the usual approach in science. In art, literature and religion the representation of the world is in some sense similar. Nevertheless, "things" are not images, and images are not things. We first simplify the observation of nature, and in a second step we take into account its complexity. This is probably what motivated these two books, one edited by István Hargittai and the other by Hargittai and Clifford A. Pickover.

Hargittai is a professor of chemistry at the Technical University of Budapest; the symmetry of molecules is his main professional interest. Pickover is a research staff member at IBM T.J. Watson Research Center in Yorktown Heights, New York. His primary interest is scientific visualization.

Symmetry is the best way to simplify, but it is also a source of monotony. A square pattern of tiles on the bathroom floor is too uniform to be fascinating. Then there is *Fivefold Symmetry*, the title of the second book, which has a particular property: It cannot be repeated periodically. This is the source of artistic works; for instance, in Islamic art, it appears in the "Maragha" pentagonal tiling described by Emil Markovicky in *Fivefold Symmetry*. It is also the source of geometrical studies on tilings. Roger Penrose's pentagonal tiling, which anticipated the discovery of quasicrystals, is the most recent interesting aspect of fivefold symmetry research.

Spiral Symmetry, the title of the second book, is also largely present in nature. Pickover presents some fractal spirals obtained on graphic computers, showing aesthetically appealing and scientifically interesting patterns. But why does plant growth (phyllotaxis) follow spiral symmetries? This question appears recurrently in both books. In *Spiral Symmetry* Roger Jean reviews the most recent work in that field. A quotation summarizes his main point: "There is nothing in phyllotaxis