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 remaining 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. Phy. 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. $48.00 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

which comes from genetics and evolution: It is just geometry."

Reading these two books stimulates reflection and raises questions: What is symmetry? Is a square more symmetric that a pentagon? (We learn that the mathematical answer is no.) Why are natural constructions so symmetric, but nevertheless often depart from exact symmetry? All these questions are good reasons to read with pleasure these two books.

But the repetition of the same points in different parts of the two books is sometimes boring. For example, the affirmation that researchers have determined that the proportions of the human body "can be" related to the golden mean, even if supported by the Leonardo da Vinci drawing, appears several times. Once would have been sufficient, and the statement should have been analyzed in philosophical terms. To be provocative, I am sure that there is to be found among all pigs one that can be inserted in a golden triangle. It is not always clear whether an author is explaining a theory or agreeing with and supporting the theory. This is the case with Jay Kappraff's article on mystic theories on the golden mean. Therefore, these two books, while stimulating, should be read with a critical mind.

Pickover gives a very nice quotation from the English mathematician Godfrey Harold Hardy that emphasizes the spirit of these books: "A mathematician, like a painter or a poet, is a master of pattern."

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Introducing Einstein's Relativity

R. A. d'Inverno
Oxford U. P., 1992. 383 pp.
$39.95 pb ISBN 0-19-859686-3

The author of a textbook is faced with many decisions. Among the most important are how much of the subject to cover and what level and depth of discussion to use. Unconscious constraints generated by the source of the material and by personal attitudes affect these decisions. The important constraints of *Introducing Einstein's Relativity* are its origin in printed notes prepared by Ray d'Inverno for his students in a course on special and general relativity (and applications of the latter) and his view that the material must be acquired by the student rather than taught by the teacher.