routinely in investigations of polycrystalline materials for the identification of crystalline phases in "unknowns," as well as for the determination of residual stresses in metals, particle sizes in powdered materials, and the textures of fibers and synthetic polymers.

X-ray crystallography had come of age but had yet to find an appropriate place within the academic hierarchy. Some schools of mineralogy continued to place emphasis on the study of "classical crystallography," that is, on the study of macroscopic crystal structure, with courses in x-ray diffraction reserved for more advanced students. Most universities, however, offered courses in crystallography in several departments, depending on local circumstances. These generally exposed students to a bare minimum of crystallography, to just enough to enable them to go on to what appeared to be the more exciting field of x-ray diffraction. To a large extent, that situation prevails to this day.

In the four volumes of *Modern Crystallography*, Boris K. Vainshtein, the director of the Institute of Crystallography of the Academy of Sciences of the USSR, attempts, with some help from a number of colleagues, to bring together the many branches of crystallography, to take account of their complex relationships with other disciplines, and to present crystallography as a coherent and unified science. Volumes 3 and 4 of the series have not yet appeared in print. They will deal with the *Formation of Crystals* and the *Physical Properties of Crystals*.

Almost all of Volume 1, *Symmetry of Crystals, Methods of Structural Crystallography*, and much of Volume 2, *Structure of Crystals*, were written by Vainshtein. Few crystallographers are better equipped to undertake so formidable a task. In many respects, Vainshtein is the "Renaissance man" of Soviet crystallography. He is a leader in diffraction theory, x-ray and electron diffraction, electron microscopy, polymer science and molecular biology. Nevertheless, his efforts and those of his colleagues have not been wholly successful.

Almost half of the first volume is devoted to a detailed and somewhat formal presentation of the theory of symmetry. The illustrations are plentiful, carefully drawn, and often very attractive, especially those dealing with color symmetry. I doubt, however, whether so much space for symmetry is justified when only seven pages are devoted to polycrystalline materials and only 25 go to the determination of crystal structures. The favored treatment accorded symmetry appears to reflect the author's personal tastes more than the needs and interests of the probable readers.

The need for concise treatment of wide ranges of subject matter imposes severe constraints on the authors. Brevity is sometimes achieved at the cost of adequacy of treatment. In some cases, however, and particularly in the sections written by Vainshtein, the treatment is clear and concise, with evidence throughout of his profound and encyclopaedic knowledge of the subjects discussed. The author is at his best in Volume 2, where, in the first two chapters, he presents elegant and comprehensive discussions of the principles of structure formation and of the "Principal Types of Crystal Structures." The latter is almost unique in the crystallographic literature in that it presents, in one chapter, detailed and illuminating discussions of subjects as diverse as intermetallic structures, structure of high polymers and structures of substances of biological origin, topics that are usually treated superficially or not at all in crystallographic texts. In all cases, the material is presented from the point of view of the structural crystallographer.

The material at the back of the book is not adequately assembled. The bibliographies are extensive, but give no indication of critical selection. They appear to be designed for display rather than for use. Smaller, carefully selected listings would be much more useful. The subject indexes to the two volumes are far too sketchy; their cross-listings are sporadic and unsystematic. The usefulness of the subject indexes would, nevertheless, be significantly increased by the addition of a "name" index.

Modern Crystallography, we are told, was designed for use by research workers involved in crystallography and related areas, and for undergraduate and graduate students of the solid state. Unfortunately, the level of treatment is often too advanced for undergraduates and insufficiently detailed for graduate students involved in crystallographic research. It is, however, well suited to serve as an authoritative reference manual for anyone working in, or simply interested in, the solid-state sciences.

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Excitons: Their Properties and Uses

D. C. Reynolds, T. C. Collins
291 pp. Academic, New York, 1981. $36.00

This book aims to present the basic properties of excitons to graduate students of the solid state and to scientists in materials technology. In fact, it treats only the Wannier exciton (a positronium-like bound state of an electron and a hole, describable in the effective mass approximation). Most of the book is devoted to the energy levels and Zeeman effect of free and bound excitons in semiconductors. In particular, the authors present in great detail their own theoretical and experimental results and those of their colleagues. They devote considerable space to many-body theory, to the electron–hole liquid, and to donor–acceptor pairs, none of which has much to do with excitons. On the other hand, there is very little on exciton dynamics, even on such fundamental properties as mobility and nonradiative decay. Outside the specialized area on which they concentrate, the treatment is sketchy and often out of date. For example, the chapter on the excitonic polariton (an exciton and photon so strongly coupled together that they lose their separate identities) ignores the work on "spatial" dispersion and light scattering that transformed this subfield in the mid 1970s. Even where they have devoted their greatest efforts they hardly discuss the physics behind the theoretical formulae or what the data signify. However, the book ends with a useful compilation of the materials properties of silicon, germanium and many binary semiconductors.

The exposition is awkward and obscure. For example, the vital factor $1/\epsilon$ (ϵ is the dielectric constant) is omitted from the exciton Hamiltonian until it suddenly appears, without explanation, in the complicated Hamiltonian for an anisotropic exciton in a magnetic field. The authors' obscurity misleads as well as puzzles; for instance, in one section they seem to imply (incorrectly) that the electron–hole liquid is stable even in the Hartree–Fock approximation. When a statement is unambiguous, it is often incorrect. For example, the electric dipole operator transforms in T_d as Γ_5, not Γ_4 as they state. The book has not been edited carefully. Misprints are so abundant that one loses all faith in the formulae. The notation is not consistent, even from page to page. Many symbols are defined, if at all, long after their first appearance (there is no table of symbols). Figure and table captions are often incomprehensible. Many names are misspelled.

In 1965 David Dexter and Robert Knox published an excellent little book *Excitons*, which is now, regrettably, out of print. Since then the subject has grown so vast that books on it tend to be multi-authored collections of specialized review articles. We badly need a new synthesis, a concise and unified book accessible to nonspecialists that, in John Ziman's phrase, will "turn

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HANDBOOK OF PLASMA PHYSICS

Basic Plasma Physics - Vol. 1

edited by A. A. GALEEV *and* R. N. SUDAN

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This course in statistics, written by a statistician and four high-energy physicists, addresses itself to physicists (and experimenters in related sciences) in their task of extracting information from experimental data. The authors have attempted to give a course which is reasonably short, yet sufficient for experimental physics, which obviously requires a compromise between theoretical rigour and amount of useful methods required. Therefore some results are stated without rigorous proof and many theoretical concepts, which may at first not seem immediately useful to the experimenter, are introduced.

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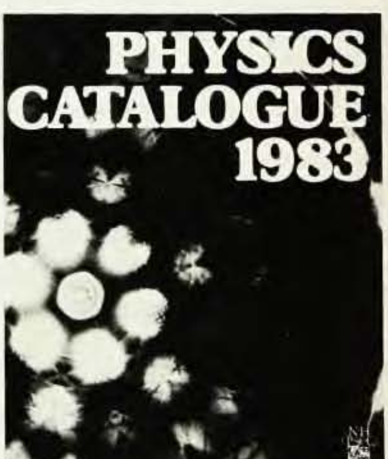

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information into knowledge." This is not that book.

MICHAEL STURGE
Bell Laboratories
Murray Hill

Introduction to Comets

J. Brandt, R. Chapman
246 pp. Cambridge, New York, 1981. $45.00 cloth, $11.95 paper

"Scarfed in a Filmy Bit of It, We'll Whirl On In Our Dance Through Space, Unharmed, and Most of Us, Unheeding." This delightful subheadline from *The New York Times* was referring to the Earth's impending passage through the tail of Halley's comet in May 1910. When it returns in 1986, Halley's comet will again be largely unheeded. This is particularly true in the United States, which has seen fit not to risk scarfing even a space probe in the comet's tail; and since this celebrated member of the solar system will be far to the south at its brightest and best, the US public will be doubly denied the pleasure of witnessing it with any clarity.

Introduction to Comets is one of the better entries in a field in which works are rapidly multiplying as Halley quickens its own pace toward perihelion passage on 9 February 1986. Its senior author is one of the world's leading authorities on the processes that take place in the plasma tails of comets. It is thus not surprising that the book should include a description of the enormous accelerations and other curious motions observed in plasma tails, Karl Wurm's 1943 acknowledgment that the traditional concept of repulsion due to solar radiation pressure would not account for the observed accelerations, Ludwig Biermann's introduction of the concept of the solar wind and momentum transfer with the tail of a comet, and Hannes Alfven's consideration of the role played by magnetic fields in this interaction. There is a detailed examination of the whole cometary phenomenon, from the information obtained from studies of their orbits, through suppositions concerning the structure of cometary nuclei, to the chemistry involved in the formation of the gas coma, and the dynamics of particulate matter released from the nucleus to develop into the dust coma and tail. The authors also discuss various theories of cometary origin and the relationship of comets to other bodies in the solar system. Special chapters are devoted to new observational results from the bright comets of the 1970s and to plans for cometary space missions in the 1980s.

In short, much of the Brandt–Chapman book is an excellent, mathematically rigorous text for the beginning and advanced student of cometary astronomy. This serious material is curiously intermingled, however, with accounts of less "scientific" studies of comets. Here we can read of the attribution to a comet of an "epidemic of sneezing sickness among the cats of the Rhenish areas of Westphalia," how Edward Emerson Barnard earned enough money to build a house, and just what the Christmas Monster of 1973 was expected to bring. The authors deliberately divided their work into four "perspectives"—the historical, the current, the future and the lay—and they are to be commended for their attempt to bring together in the hoped-for Golden Decade of cometary research all the various ideas ever promulgated on the subject. But it doesn't work. The armchair reader intrigued by the comet lore of chapter 10 is not going to want to wade through the treatment of molecular collisions and vaporizing flux and the integration of Clapeyron's equation on page 131. On the other hand, it is but a disconcertingly small step from the above-mentioned feline sneezes (page 218) to the seemingly serious Hoyle–Wickramasinghe conclusion (page 212) that influenza germs are brought on wings of comets; from the Daumier cartoon on the anticipated breakup of the world in 1857 by collision with a comet (page 220) to Van Flandern's theory of comet formation by planetary breakup (pages 152–154); from the *Book of Joel's* description of heavens filled with "fire and pillars of smoke" (page 218) to Vsekhsvyatskij's views of comet production by volcanic eruptions from Jupiter and its satellites (page 41).

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