Book Reviews

Cometary Physics

Comets. Papers from a symposium, Tucson, Ariz. LAUREL L. WILKENING, Ed. University of Arizona Press, Tucson, 1982. x, 766 pp., illus. $29.95. Space Science Series.

Comet Halley is coming. A total of five spacecraft (none of them American) are being prepared to fly by comet Halley in March 1986. A small army of professional and amateur astronomers are already making their observing plans. As comet Halley's 1985–1986 apparition draws closer, interest in comets grows. The publication of this book is a timely response to the increasing interest.

A great deal of planning must have gone into the book. There are 29 papers, each of which thoroughly covers a specific aspect of cometary science, and there is very little overlap between them. There are also very few gaps. Each contribution is well integrated into the book's overall design, with numerous referrals to other papers in the book and copious references at the end of each paper. The result of this preplanning is an up-to-date and thorough compilation of current views of cometary physics. Beginning with an overview by S. Wyckoff, the book is sectioned into contributions on cometary nuclei (eight papers), dust (five), comas (five), ion tails and solar wind interactions (four), and origins, evolutions, and interrelations (four). An appendix by B. G. Marsden and E. Roemer gives basic information and references for quick usage, and an index and glossary add to the book's usefulness as a reference work or graduate textbook.

In a paper on the chemical composition of cometary nuclei, A. H. Delsemme outlines the reasons for believing in undifferentiated cometary nuclei. The dust-to-gas ratio is about the same for old, periodic comets and new, single-apparition comets. The new, fresh comets that are recent arrivals from the depths of space have a dust and gas mixture similar to that of the older periodic comets that have lost many outer shells of material as they pass by the sun again and again. Though the reasons for the fragmentation of several comets are not clear, old and new comets seem to fragment at the same rate, an indication that they have the same structural strength. In addition, spectroscopic observations of old and new comets suggest that they have common molecular emissions. P. D. Feldman, in a paper on ultraviolet spectroscopy of cometary atmospheres, notes that in the ultraviolet spectral region all cometary spectra are remarkably similar despite differences in visual appearance, gas production rate, and heliocentric distance.

From infrared observations of bright comets, E. P. Ney concludes that the dust observed in the atmospheres and tails of many comets is composed mostly of small (less than five microns) silicate particles. The particles are constantly released from comets in sufficient quantities to maintain the zodiacal dust cloud in a steady state. P. Fraundorf, D. E. Brownlee, and R. M. Walker present their results from laboratory studies of interplanetary dust samples collected in the earth's stratosphere. These likely cometary dust samples appear to be of fine-grained materials with primitive undifferentiated solar compositions. The dust particles appear similar in size and absorptivity to soot, so that even though cometary nuclei are likely to be composed of ices the embedded dust would give the cometary material a low albedo.

The picture of a comet that emerges from this book is that of a mostly water ice nucleus a few kilometers in size with dark micron-sized meteoric dust uniformly embedded throughout. The interaction of the sublimating ices (and released dust) with the solar radiation creates the comet's atmosphere (coma) and tail phenomena. However, some very basic questions concerning comets remain. Though the mid-life of comets may be fairly well understood, their births and deaths certainly are not. Apart from a successful radar echo from comet Encke's nucleus in November 1980, and from comet Grigg-Skjellerup in May 1982, no one has detected a comet's nucleus. A close look at a comet's nucleus and inner coma will have to await spacecraft observations of comet Halley. When comet Halley does make its long-awaited return, it's a safe bet that many within the army of observers will have this useful book within easy reach.

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Planetary Science

Uranus and the Outer Planets. Proceedings of a colloquium, Bath, England, April 1981. GARRY HUNT, Ed. Cambridge University Press, New York, 1982. x, 308 pp., illus. $34.50.

The planet Uranus earns special attention for several reasons. It was the first planet discovered after antiquity, an event celebrated by this bicentennial volume and the symposium it records. Its system of at least nine rings was only discovered in 1977. With its axis almost in the orbital plane, Uranus has by far the most intense seasons of any planet. The mean densities of Uranus and Neptune put them in a class distinct from Jupiter and Saturn; evidently Uranus and Neptune have a much poorer endowment of hydrogen and helium. Uranus is the next target of Voyager 2, which will arrive in January 1986.

Somewhat more than half the book is devoted to ten current reviews and a concluding summary. Uranus is definitely the focus of these papers, with other planets appearing in comparisons. A shorter section contains six historical chapters on Herschel's various contributions to astronomy, including a facsimile of his 1781 paper reporting the first sighting of Uranus. Two chapters discuss the kinds of results to be expected from the Space Telescope and Voyager missions. The best available image of Uranus, discussed by B. A. Smith and H. J. Reitsema, shows a few fuzzy spots, emphasizing how important these missions will be. Most of the material in the book should be readily accessible to nonspecialists; specialists will find it useful that the book has summaries and plenty of references, as well as an index.

Our ideas about the composition and internal structure of Uranus depend on a few data points, mainly the density, the figure, and the rotation rate. As R. M. Goody discusses, the rotation rate that has been accepted for more than half a century is wrong. There is evidence for a rate of 16.3 hours, but not all observers agree. Well-developed theoretical proce-

dures permit us to construct rather detailed models of how the rocky and icy components of Uranus are distributed. The visible atmosphere of the planet is so cold that everything but hydrogen, helium, and some methane is frozen out. Presumably the clouds we seem to see in the telescopic image are of frozen methane. Ideas about the nature of a possible magnetosphere and of the meteorology of Uranus are entirely theoretical, apart from analogies that can be drawn with other planets. Considerably more is known about the five satellites, at least four of which show the signature of fairly pure water ice. Their diameters seem to range from 300 to 1000 kilometers, if the inferred albedo (fairly high) is correct.

When we come to the rings, the quantity of information suddenly becomes much larger, for they can be studied by stellar occultation. The two chapters on this topic are satisfyingly detailed. One, by James Elliot, the discoverer of the rings, offers a nice complement to the paper by Herschel. Theories of strange behavior of the rings are discussed by A. Brahic. The theories tend to lean heavily on the idea that the rings are guided by a few relatively large bodies, as did theories of Saturn's rings between the two Voyager encounters. Let us hope that the observations at Uranus are as constraining as those of the second Voyager encounter with Saturn.

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A European Insect Species

Large White Butterfly. The Biology, Biochemistry and Physiology of *Pieris brassicae* (Linnaeus). JOHN FELTWELL. Junk, The Hague, 1981 (U.S. distributor, Kluwer Boston, Hingham, Mass.). xxvi, 536 pp., illus. $98. Series Entomologica, vol. 18.

In a time when most of us are struggling to keep up with the literature in our own fields, a resource such as *Large White Butterfly* is of immense value. Feltwell has sifted through thousands of references on *Pieris brassicae*, the large white, and presents not only an impressive number of references discussed in the text but also an annotated set of additional references. Such a compilation is valuable both for specialists working on this species and for researchers interested in more general entomological subjects such as pest control or the physiology of development. Because *P. brassicae* has been used extensively in Europe as an experimental animal, there are many disciplines into the literature of which this book provides an entry.

An attempt is made to consider all aspects of the biology of *Pieris brassicae*. There are chapters ranging in subject from nomenclature and life history to hormones, sensory systems, and biochemistry. Also included are chapters on distribution, breeding, food plants, development, morphology, physiology, and migration. There are especially good chapters on parasitic control, pathogenic control, predators, and chemical control. Each chapter is written like a review article on the role that *P. brassicae* has played in the research in a particular field such as development. Unfortunately, there is usually not much of an introduction to the field in general, and at times this can be a problem. Other chapters would have benefited from introductions such as that by M. R. Shaw to the chapter on parasitic control.

Although one of the strong points of this book is its massive literature review, this is also the cause of some of the problems. Too often a paper is characterized by a statement such as "Oogenesis was studied by . . ." (p. 140), with no information on what was found out. Or information from a paper is pulled out with no explanation, as in a reference to "a chemical repellent-tolerant hypothermia" that explains feeding in *P. brassicae* larvae (p. 113). At least the references are there, however. Another problem is a lack of evaluation for most of the papers. In particular, it is clear that some of the older papers are outdated, inaccurate, or wrong, yet the reader is not informed about these problems.

The choice of figures is sometimes a bit of a mystery. It would have been helpful, for example, to see the variation exemplified by some of the subspecies, or a series on the life history. Yet the only illustration of *P. brassicae* is a plate from 1815, which, although detailed, does not show the underside or give a very good picture of the larva. The figures were redrawn from original publications and have some imperfections, for example unequal spacing of numbers on the axes of graphs. The tables, on the other hand, are very helpful; they are well referenced and well put together and provide a succinct summary of work on a particular topic, such as host plants.

Feltwell has undertaken and executed a truly impressive piece of work. In general the problems are associated with the ambitious scope of the book. The success of the book lies in its immense list of references and the entry it provides into the literature and particularly, for readers in the United States, into the European literature. It provides an initial sorting of an immense volume of books, articles, and theses and is a source of information not only on *Pieris brassicae* but on the whole field of insect biology.

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Physiology: A Supplement

A Companion to Animal Physiology. Papers from a conference, Sandbjerg, Denmark, July 1980. C. RICHARD TAYLOR, KJELL JOHANSEN, and LIANA BOLIS, Eds. Cambridge University Press, New York, 1982. xvi, 366 pp., illus. Cloth, $35; paper, $13.95.

Knut Schmidt-Nielsen has been a leading figure in comparative physiology for approximately three decades. This book honoring him on the occasion of his 65th birthday aspires to be more than a mere conference summary. It does present the papers solicited for the Fifth International Conference on Comparative Physiology, which was convened to honor Schmidt-Nielsen, but it has also been designed to serve as a companion to his well-regarded textbook *Animal Physiology: Adaptation and Environment* (Cambridge Univ. Press, ed. 2, 1979), allowing students to pursue in greater depth some of the topics introduced there.

The contributors were asked to provide perspectives on what they consider interesting and important in their respective areas. Their papers have been organized into five groups: Oxygen; Food and Energy; Temperature; Water; and Movement and Structure. This organization is congruent with that developed by Schmidt-Nielsen, save for the last part, which in *Animal Physiology* is entitled Movement, Information and Integration. I have found Schmidt-Nielsen's book attractive for its coverage of the physiology and structural-functional relationships of invertebrates. In the companion volume, attention is especially directed toward these topics in papers by P. W. Hochachka on anaerobic metabolism, S. Maddrell on osmoregulation in insects, R. McN. Alexander on running and flight, and S. A. Wainwright on structural systems, but the emphasis is overwhelmingly on the vertebrates.

The 23 chapters constituting the companion volume include at one extreme an attempt by D. Bellamy to develop a