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-