

ume a fertile field for cultivation, for a variety of tools of modern mathematics are essential for the understanding of the problems. Topics treated are the existence and uniqueness of solutions, solution stability, and general transient behavior. There is also some discussion of the corresponding problems in biological systems, and one would hope that mathematical biologists would dip into these two volumes.

A word should be said about what is absent. There is little or no mention of the multicomponent diffusion case, in which the diffusion of the various species is coupled. Aris considers the uncoupled case, which holds for Knudsen flow. For catalysts with larger pores bulk diffusion prevails, and some recent research indicates that it is essential in some cases to consider the more general and considerably more difficult multicomponent diffusion problem. Problems in which there is Stefan flow are not considered, as is consistent with the Knudsen hypothesis.

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High Energy Astrophysics

X-Ray Astronomy. RICCARDO GIACCONI and HERBERT GURSKY, Eds. Reidel, Boston, 1974. x, 452 pp., illus. Cloth, \$50; paper, \$24.50. Astrophysics and Space Science Library, vol. 43.

This is the first comprehensive review of x-ray astronomy to appear in book form, and it achieves a good balance among experimental technique, observation, and theory. The only recent comparable works have been the International Astronomical Union symposium volumes. The book not only fulfills well its stated purpose of providing a unified textbook for advanced undergraduates, it also contains much material that will be useful to workers in the field. Since each topic is introduced with an overview, often historical, the book will also be useful for nonspecialists. Certain sections should even be of interest to engineers and managers developing the instruments or spacecraft on which future observations in this field will depend.

The book is a series of chapters by various members of a group that, while at American Science and Engineering, made consequential contributions to the development of the field and was responsible for the Uhuru x-ray astronomy satellite. Most of the authors, who in addition to the editors include Blumenthal, Gorenstein, Kellogg, Tananbaum, Tucker, Schwartz, and

Vaiana, are now at the Harvard-Smithsonian Center for Astrophysics. Many of the chapters emphasize the techniques, observations, and discoveries made at American Science and Engineering, and previously unpublished material appears frequently. Although the authors have made some attempt to include the results of others and acknowledge the institutional bias, one gets the impression that outsiders have made only peripheral contributions on many of the topics. Inside knowledge of the personalities and events is particularly useful when reading Giacconi's "History of x-ray astronomy—A personal view."

The chapter on observational techniques is some 70 pages long and includes discussion of both nonfocusing and focusing devices and of ancillary topics such as telemetry, pointing controls, and aspect solutions. The next chapter is a theoretical review of x-ray production mechanisms in cosmic sources. Starting from elementary ideas, the various approximations and regions of validity are indicated, and often a result directly applicable to interpretation of results is expressed in convenient numerical form.

The chapter on solar x-ray emission contains an unneeded review of the general features of the sun and seems not as well focused or as comprehensive as many of the others, although it contains some early results from Skylab. Several theoretical speculations and models are presented as facts. The chapter on supernova remnants, while also of a more general nature, contains a nice table of remnants observed in x-rays and their properties. The chapter on compact x-ray sources, where the discoveries by Uhuru have indeed been outstanding, is excellent. It contains an up-to-date table of the binary x-ray sources, reproductions of the published data that indicated the presence of many of the sources, and a section on theory adapted from a previous review by one of the authors. That Her X-1 and Cen X-3 are discussed more extensively than Sco X-1 indicates a bias toward more recent (and interpretable) results. Even Cygnus X-1, the "black hole" source, is discussed from the viewpoint of the data, and the more speculative interpretations and their bizarre consequences are hardly mentioned.

The interstellar medium is discussed from the viewpoint of x-ray astronomy, but the treatment of the soft x-ray background, the importance of this component in terms of astrophysics, and the difficulties in interpretation of the data is rather short. The chapter on extragalactic sources is based mostly on Uhuru work, much of which is unpublished, and is now somewhat out of date. The final chapter, on the cosmic x-ray background, is much

more comprehensive and attempts an evaluation of the various observations and theories. This chapter also contains previously unpublished work. Finally there is a set of appendices that includes the 3U catalog of x-ray sources, which unfortunately contains several typographical errors.

In addition to the institutional bias in the presentation of certain topics, some bias is also evident in the selection of topics: hard x-rays are hardly mentioned, and one gets the impression that all x-ray astronomy is done in the 1- to 10-keV range. In fact the spectral data, important for many sources, are rarely given, and when given they are often expressed only in the mysterious units of Uhuru counts per second. The contributions of balloon x-ray astronomy are often ignored.

Some of the material will be rapidly superseded by results from the latest generation of x-ray astronomy spacecraft, but the view the book provides of the subject as it stood late in 1974 is detailed and nearly complete.

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Books Received

Acute Aortic Dissections. Constantine E. Anagnostopoulos with Constantine L. Athanasuleas, Thomas R. Garrick, and Robert Paulisian. Illustrated by Charles S. Welck. University Park Press, Baltimore, 1975. xvi, 256 pp. \$24.50.

Advances in Communication Systems. Theory and Applications. A. V. Balakrishnan, Ed. Vol. 4. A. J. Viterbi, Ed. Academic Press, New York, 1975. xiv, 312 pp., illus. \$19.50.

Advances in Cyclic Nucleotide Research. Vol. 5. Papers from a conference, Vancouver, Canada, July 1974. George I. Drummond, G. Alan Robison, and Paul Greengard, Eds. Raven Press, New York, 1975. xiv, 872 pp., illus. \$46.

Analytical Chemistry of Platinum Metals. S. I. Ginzberg, N. A. Ezerskaya, I. V. Prokof'eva, N. V. Fedorenko, V. I. Shlenskaya, and N. K. Bel'skii. Translated from the Russian edition (Moscow, 1972) by N. Kaner. P. Shelnitz, Transl. Ed. Halsted (Wiley), New York, and Israel Program for Scientific Translations, Jerusalem, 1975. xii, 674 pp. \$60. Analytical Chemistry of the Elements.

Annual Review of Biophysics and Bioengineering. Vol. 4. L. J. Mullins, William A. Hagins, Lubert Stryer, and Carol Newton, Eds. Annual Reviews, Palo Alto, Calif., 1975. x, 604 pp., illus. \$15.

Applications of Algebraic Topology. Graphs and Networks, the Picard-Lefschetz Theory and Feynman Integrals. S. Lefschetz. Springer-Verlag, New York, 1975. viii, 190 pp., illus. Paper, \$9.50. Applied Mathematical Sciences, vol. 16.

Basic Linear Partial Differential Equations. François Trèves. Academic Press, New York, 1975. xx, 470 pp. \$29.50. Pure and Applied Mathematics.

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