

opment of optical information processing is a succinct presentation on the optical diffraction phenomena, the Fourier transform and imaging properties of lenses, and the spatial frequency response of optical imaging systems. Lee analyzes both the coherent and incoherent systems, presents the more important mathematical expressions in concise and clear form, and discusses the various geometrical arrangements and the effects of lens aberrations on the performance of the processing systems. This chapter succeeds in providing a comprehensive review and useful summary on the background materials for the subsequent chapters.

Lee also contributed a chapter on coherent optical processing, treated on the fundamental level of how to manipulate the Fourier spectrum directly. He discusses filter synthesis, diffraction efficiencies and classification of spatial filters. He includes simple filters, grating filters (amplitude, phase, complex, transmission and reflection), computer-generated filters, and coherent optical feedback systems. He also gives a review on the alternative designs of optical processors, including joint transform processors, two-lens and one-lens coherent optical processors, and alternative coherent feedback processors. Finally, he reviews briefly several methods for coherent noise suppression.

W. T. Rhodes and A. A. Sawchuk contributed a chapter on incoherent optical processing. Following a discussion on the relative advantages of incoherent processing systems over their coherent counterparts they analyze the basic characteristics of three major classes of incoherent systems: diffraction-based incoherent spatial filtering systems; plane-to-plane imaging systems in the geometrical optics sense; and systems that are based on diffractionless geometrical optics shadow casting. They also discuss the inherent difficulties and the limitations of incoherent systems.

G. R. Knight describes the various interface devices and memory materials in a chapter divided into two rather lengthy sections. In the first, Knight gives an excellent summary of the characteristics of the seven main categories of input devices, the optical or electronically addressable spatial light modulators. In the second section, he discusses the various memory materials based on photon-induced or thermal effects, mainly from the requirements for optical recording and storage applications. As a consequence, the connection between this section and the rest of the book appears to be relatively weak.

D. P. Casasent wrote the chapter on hybrid processors, viewing them as the most promising devices for future optical processing systems. Casasent gives

a comprehensive survey on the existing hybrid processors, with emphasis on the design philosophy for the optical/digital interface and on illustrating the advantages of these hybrid devices over the purely optical or digital systems. Included in the survey are the most developed and simplest—but the least powerful—diffraction-pattern sampling system; the optical preprocessor system, which uses extensive digital analysis of optical light distributions; and the most powerful system, which uses hybrid correlators, where Casasent has made significant contributions.

J. W. Goodman reviews the basic properties of linear space-variant operations and discusses a variety of techniques for the realization of these operations, among them the development of the matrix multiplication technique to which Goodman has made some very important contributions. This appears to be one of the promising building blocks for the development of future optical computers.

Editor Lee contributed the final chapter on nonlinear optical processing. He describes the several presently available schemes, devices and systems for the implementation of various nonlinear operations. He discusses the half-tone screen process, theta modulation, and a variety of nonlinear devices and systems with and without feedback. Lee's own work on nonlinear devices is among the prominent contributions in this subject and is another promising area for developing digital optical processors.

This book is an excellent reference for workers in the field of optical processing. It is also an appropriate introductory treatise for anyone who wishes to enter this field. For a graduate course in optical processing, this book and its companion mentioned previously would be a nice pair of references. Due to the evolving nature of many of the processing techniques, the book may not be suitable as a standard text. Finally, the book would be even more useful if an author index were added.

T. K. LIM

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Waterloo, Ontario, Canada

The Milky Way

B. J. Bok, P. F. Bok

Fifth Edition. Harvard U. P., Cambridge, Mass., 1981. \$20.00

The outstanding series of introductory-level books known as "The Harvard Books on Astronomy" has influenced several generations of interested readers. It is a tribute to the enthusiasm and vigor of Bart Bok that *The Milky Way* is the only one of the series to have been revised as many as five times (all but the last written with his

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wife Priscilla). Luminous matter in the universe is found concentrated in vast assemblages called galaxies. The *Milky Way* is the descriptive, historical name of the galaxy in which our Sun and its planets are contained. We have learned that the Milky Way contains some 100 billion stars, distributed over dimensions of about 100 000 light years. We know that the Milky Way also contains gas and dust, that it is rotating about a nucleus located some 30 000 light years distant from the Sun.

and that some stars, especially the younger and more luminous ones, are distributed in a flat, spiral pattern. These and other discoveries and further questions are all described in this splendid book. The fifth edition is not a reorganization of the material but rather an updated version of the fourth edition, which was published in 1974. Bok says that the book is aimed at "beginning college students and at bright boys and girls of high-school age." I feel it is more appropriate for

advanced college students and educated people without much astronomical background. The book presupposes no background and introduces the necessary basic astronomical concepts in the first few chapters. Subsequent chapters deal with stellar populations, clusters, galactic rotation, the galactic nucleus, interstellar gas and dust, spiral structure and, finally, a bit of galactic evolution.

The writing style is clear, fresh and personal; indeed, at times one can almost hear Bart speaking. Those (many!) conjectures that are not yet definitely established are always qualified with phrases such as "most likely," "in all probability," and "we think that." I like this because I feel it is important to distinguish between what we know and what we don't know. Too often astronomers present as facts what are really only currently accepted (fashionable) theories.

The only negative comment I have about this latest edition is that I find the format (type face, double columns, larger-scale illustrations) of the fourth edition more attractive. If you don't have a copy of the fourth, and are interested in learning about our galaxy and current galactic research, the fifth edition of Bok's *The Milky Way* is the finest introduction available.

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