

Principles of Adaptive Optics

Robert K. Tyson

Academic, San Diego, Calif.,
1991. 298 pp. \$49.95 hc
ISBN 0-12-705900-8

Most of the adaptive optics research in the last 20 years has taken place within the strategic defense community and related industry. (See the news story on page 17.) Robert Tyson has been active within this community as a senior systems engineer at United Technologies Optical Systems and more recently as a senior scientist at W. J. Schafer Associates. The publication of this book, the first on adaptive optics, occurs at a transition point for the field. The defense community is scaling down its efforts while the astronomy community is scaling up (albeit with a much smaller budget).

Astronomical science stands to benefit enormously from the application of adaptive optics to the new generation of 8-meter-class telescopes (see *PHYSICS TODAY* March 1991, page 22), which will see first light in this decade. The Astronomy and Astrophysics Survey Committee, commissioned by the National Research Council to prioritize research programs in astronomy for the 1990s, recommended adaptive optics as the highest-priority, moderate-sized ground-based program of this decade. "The prospect of improving the angular resolution of optical and infrared observations by 2 orders of magnitude over the span of a decade would be nothing short of revolutionary." (For a summary of the committee's working papers see the April 1991 issue of *PHYSICS TODAY*.)

As a researcher working on astronomical adaptive optics, I was both pleased and disappointed with this book. My mixed review reflects somewhat the multidisciplinary nature of adaptive optics and the fact that the author has had to cover a lot of ground in a single book. Tyson has brought to the book his experience as an instructor of an adaptive optics short course and as a developer and analyst of adaptive optics components and systems. *Principles of Adaptive Optics*, with the addition of certain articles referenced by the author, could be used as a textbook, although researchers in this field will probably find it most useful as a reference book. As John Hardy, one of the pioneers in adaptive optics, points out in the foreword, "today's practicing engineer is fortunate indeed to have a compendium of this hard-won knowledge." Tyson has compiled in this single source a large number of the

equations and techniques useful in adaptive optics and a valuable bibliography of over 400 articles which are referenced in the text. Unfortunately, titles of the articles are not included, many of the references are not easily accessible (this is also a comment on the history of adaptive optics) and often a conference proceeding rather than the appropriate journal article is cited. The quality of the graphics is not very satisfying, and the only photographs are of deformable mirrors.

This book is strongly influenced by Tyson's background in laser-beam propagation, although he does attempt to deal on an equal footing with astronomical applications of adaptive optics. That Tyson is not as familiar with astronomical problems and research does show from time to time, and many of the issues critical to astronomical adaptive optics, such as atmospheric characterization and laser guide stars, receive inadequate coverage.

A constant frustration for researchers in—and potential users of—adaptive optics is the scarcity of corrected images in the literature, and you won't find any in this book. The book is therefore not intended to convince people that adaptive optics work or to provide information on recent developments, especially those of a classified or proprietary nature. (The book was written prior to the May 1991 declassification.) Tyson has succeeded, however, in providing a much needed reference on the basics of the various disciplines used in adaptive optics.

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Five Billion Vodka Bottles to the Moon

Iosif Shklovsky
(Translated and adapted
by Mary and Harold Zirin)
Norton, New York, 1991.
268 pp. \$19.95 hc
ISBN 0-393-02990-5

Iosif Shklovsky was one of the first scientists to recognize the importance of the new astronomical discoveries being made outside the traditional atmospheric window of optical astronomy. With remarkable insight and unencumbered by modern computing machines, Shklovsky used simple and elegant arguments to investigate a wide range of problems in science and life. He gave innovative interpretations of the newly discovered radio and x-ray emission from neutron stars, supernovas, galaxies and qua-

sars. Applying similar simple logic he also estimated the amount of vodka drunk each year in the Soviet Union—five billion bottles, enough to reach to the Moon—and the number of citizens being held captive in Soviet prisons. Both quantities were closely guarded state secrets.

Shklovsky loved to tell stories, especially about people he admired, like Andrei Sakharov, and those for whom he had little respect, like his boss at the Shternberg Institute, Dmitri Martinov, whom he described as a "weak-headed belligerent functionary and malicious bureaucrat." *Five Billion Vodka Bottles to the Moon* is a collection of Shklovsky's stories about the Soviet scientific establishment, bureaucracy, anti-Semitism and the daily hardships of life in Soviet society. Although copies of these essays were circulated privately in the USSR, it seemed unlikely that they would ever be published in the Soviet Union. After Shklovsky's death in 1985, his former student Nikolai Kardashev together with Shklovsky's longtime friend, x-ray astronomer Herbert Friedman, arranged for the translation and publication of Shklovsky's manuscript in English. Following the unexpected changes that have occurred in the USSR in the past few years, these essays have now also been published in the Soviet Union under the title *A Collection of Short Stories*. The English-language edition, which has been translated and adapted for English-speaking readers by Mary Zirin and Caltech solar astronomer Harold Zirin, contains 24 essays, mostly about people—close friends and detested enemies—who passed through Shklovsky's life. Herbert Friedman supplies an introduction that gives background information on Shklovsky's many contributions to astronomy and relates revealing personal experiences they shared.

Iosif Shklovsky, who was both Russian and Jewish, was outspoken about Soviet bureaucracy and politics, especially during his infrequent foreign trips. He was one of the most admired Soviet scientists in the West and received a number of foreign honors. But to his disappointment, he was denied full membership in the Soviet Academy of Sciences, remaining only a corresponding member. For much of his scientific career Shklovsky was restricted from travel abroad. Organizers of scientific symposiums often would not know until after the start of the conference if Shklovsky would receive an exit visa in time to deliver an invited paper. His book tells of the time he arrived in Paris near the end