



Nineteenth-century Japanese swordguide made of nonferrous metal. The cherry blossom design was achieved by cutting away the surface plane of a composite sheet. Illustrated in *A Search for Structure*, the object is in the Bigelow Collection of the Museum of Fine Arts, Boston.

Japanese metal sword guard containing a delicate design of cherry blossoms floating on water. The guard was made by first layering several different metals, then hammering this stack to form dimples in the desired pattern, and finally slicing the stack flat. Smith contends that most of the early fundamental advances in materials science were motivated not by scientific ends but by aesthetic ones—by immediate sensuous responses to the materials. In short, aesthetic curiosity is the mother of invention; necessity is merely the mother of improvement.

As its title suggests, *From Art to Science* explores this progression. The book is a catalog for Smith's 1978 exhibition of artifacts that illustrate the

nature of discovery of scientific principles that were first formulated or at least exploited by artists and artisans. Although photographs cannot fully capture the individual sensuous qualities of materials, or the three-dimensionality of the objects from the exhibition, the sumptuous color photographs in the book nearly succeed. Short descriptions and analyses of each of the artifacts reveal the ingenuity and insight of their creators.

These two books provide much for both the mind and the eye, especially for those wishing to place science and technology in a broad, human perspective.

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Weather and Climate on Planets

K. Kondratyev, G. Hunt

755 pp. Pergamon, New York, 1982. \$95.00

In 1951 Seymour Hess and Hans Panofsky, active in an imaginative program of analysis of observations taken at the Lowell Observatory at Flagstaff, Arizona, wrote in the *Compendium of Meteorology*: "The study of planetary atmospheres is a relatively new field of meteorology. Its main impetus comes from the likelihood that the behavior of the several planetary atmospheres, with their varying masses, rotations, constituents and other physical parameters, may yield important evidence bearing on the general laws which govern our own atmosphere." These prophetic comments have been verified

by the explosive increase in planetary observations during the past 30 years. Many of the observations were made from new and improved ground-based telescopes. The most dramatic source of new information, however, has been the various space platforms launched over the last two decades. Since 1962 there have been about 20 US and USSR space missions to the planets.

In addition to providing new factual information, both ground-based and space-derived observations exposed problems of interpretation that led inevitably to consideration of the similarities and differences among the planets. It is natural that most of these interpretations are based on experience with observed terrestrial processes. The planetary observations and theories are summarized, reviewed and dis-

cussed in the monograph *Weather and Climate on Planets* by K. Y. Kondratyev and G. E. Hunt, meteorologists of international repute. The book is an encyclopedia of information on the surfaces and atmospheres of the most intensely observed planets: Venus, Mars and Jupiter.

The authors describe the physical and chemical properties of these three planets (with occasional references to other planets), including recent ideas of their origin and evolution. Some of the main problems they treat in the book are the composition and structure of the cloud layers on Venus, Mars and Jupiter; the greenhouse mechanism for establishing the high surface temperature on Venus and the "anti-greenhouse" mechanism involving the dust storms on Mars; the importance of water vapor on the photochemistry of ozone on Mars and the contributing roles of water vapor and carbon dioxide in the periodic advance and retreat of the Martian polar caps; the origin and color of the Great Red Spot of Jupiter; the fundamental differences among the fluid dynamical properties of the three planets and comparison of these properties with those of the terrestrial atmosphere. The three planets involve basically different distributions of energy sources and sinks and rotation rates, so that the driving and modifying influences on their large-scale planetary circulations are distinct. The discussion of these influences by Kondratyev and Hunt is, in many ways, unique and represents an important contribution toward understanding the meteorology of these planets.

The authors seem to have read and reviewed everything that has been written about Venus, Mars and Jupiter over the past 20 years. It is particularly pertinent that much of the summarized information comes from Russian publications. Of the almost 1400 reference citations, approximately 20 percent are to papers published in Russian.

Despite the publisher's disclaimer concerning "typographical limitations" in the interest of rapid distribution, there are too many needed corrections to go unnoticed. These include incomplete sentences, misspelled or incorrect words, inconsistent tables and diagrams without reference to the original source. In addition, a lack of editing has resulted in the persistent misuse of the definite and indefinite article so characteristic of raw translations from Russian into English. The book also suffers somewhat from redundancy. Much of the material could profitably have been combined or more succinctly summarized to reduce the text to about two-thirds of its present size with no loss of information.

Although this book must have been

written for research workers and advanced graduate students already active in planetary science and space research, it would have been helpful to have included appendices listing the various planetary space missions along with their dates of operation and principal experiments, and a single table of the physical characteristics of the planets. (Although some tables containing these data are scattered throughout the book, they are not always consistent.) The book is a complete review of observational results, yet there is no adequate discussion of the different measurement techniques involved. There is also liberal use of scientific jargon with no indication of where a reader can get background material. (For example, how many planetary scientists know the meaning of "conditional instability of the second kind"?)

Physical scientists interested in current ideas about the planets, but not themselves specialists in the subject, may have difficulty separating the most important information from the large amount of detailed data contained in the book. Up-to-date background material for the nonspecialist can be found in the recent textbook *Exploration of the Solar System* by W. J. Kaufman. For a more extensive treatment of the results of recent planetary investigations, the reader might also want to refer to *The New Solar System*, edited by J. K. Beatty, B. O'Leary and A. Chaikin, which contains contributions by a number of experts in the field and summarizes the latest information about the planets derived from the US space program, but is not as exhaustive in detail as *Weather and Climate on Planets*. These books are available at a fraction of the cost of the volume under review.

The unedited typescript format of *Weather and Climate on Planets*, along with the unreasonably high price, will probably discourage an extensive audience even of specialists in the planetary sciences. This is unfortunate since the book does include a good deal of useful information derived from the USSR planetary space program not easily available elsewhere.

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Stellar Paths: Photographic Astrometry with Long-Focus Instruments

P. Van De Kamp

155 pp. Reidel, Boston, 1981. \$34.95

One of the most exciting "new" efforts of modern astronomy aims at the detection and study of the planetary systems of nearby stars. Newcomers to this seemingly infant field, which employs the latest in electronic technology, are

often surprised to learn of pioneers such as the author of *Stellar Paths*. Peter Van De Kamp began his efforts to detect "unseen companions" of nearby stars with a relatively small visual refractor and yellow-sensitive plates more than 40 years ago. Severely limited by the precision of the techniques then available, he achieved his most outstanding successes with several lower-end main-sequence stellar companions. In at least one instance, Barnard's star, he found evidence of what may turn out to be the first planetary system ever discovered beyond our own star's. *Stellar Paths* is an account of the techniques used and the results obtained for Barnard's star by Van De Kamp and his colleagues at the Sproul Observatory staff.

For those casually interested in this field who do not have access to the present book's earlier version, *Principles of Astronomy* (1967), the new text is a good introduction to narrow-field astrometry. Some of the techniques described are no longer used today, for example, the short-cut algorithm called "dependences" that was long ago replaced by plate-constant techniques and later, with the advent of fast number-crunching computers, by overlap algorithms that simultaneously relax all of the statistical parameters involved in the determination of stellar positions and motions. But those who would begin with the latest techniques are forced to obtain their information from sources not written primarily about this subject—for example, *Astronomy of Star Positions* by H. Eichhorn, *Spherical and Practical Astronomy as Applied to Geodesy*, by I. Mueller, W. Heintz's text *Double Stars*, and many recent articles by these and other current astrometrists. Thus, this text provides something generally not found elsewhere, a reasonable first book in astrometry. However, those who do have access to Van De Kamp's earlier text or who are already versed in the subject, will find little new in this latest addition. They will find that the older book both is better written and covers a broader range of relevant subjects.

The present text appears to have been generated by filling in the outline provided by the table of contents; little effort has been made to make one subject area flow smoothly into the next. The book begins with a review of astrometry up to about the time of the author's efforts in the mid-1930s. The second chapter briefly describes the techniques used in photographic astrometry and the photographic measuring machines at the Sproul and US Naval observatories. No mention is made of the more flexible, microdensitometer-based, measuring machines such as the well-known PDS machine or the APM

at Cambridge, England (the latter is quite remarkable for the speed at which data are gathered, processed and stored). The third chapter details errors (both accidental and systematic) encountered in photographic astrometry. Some of those described are peculiar to the method of dependences and the Sproul 24-inch visual refractor. Van De Kamp only mentions in passing such error sources as the distribution of reference star magnitudes and colors as well as the distortion caused by coma, which is present in most visual refractors. These problems are difficult to study unless numerous reference star images are obtained and measured (a practice not followed in the Sproul program). In any event, considering the extreme precision for which modern astrometry strives, a four-page discussion of error sources is too cursory. Unfortunately, the bulk of the chapter is given over to a discussion of "not explained systematic behavior."

Chapters 4 through 11 concern the method of dependences and an analysis of stellar motions, including parallax and secular acceleration (from which a star's radial velocity can be determined without reference to the Doppler effect). The last chapter describes the studies of several stars, including Barnard's star, by the Sproul Observatory staff.

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Windows on the Mind: Reflections on the Physical Basis of Consciousness

E. Harth

285 pp. Morrow, New York, 1982. \$15.50

Windows on the Mind offers a good meeting place for those wishing to join physics with neuroscience: for physicists who wish to learn about the brain; for neuroscientists who wish to understand the physicist's approach to the brain; and also for those who are neither and wish a sound introduction to the present state of knowledge about the brain.

This book supplies what we have been waiting for. Its scientific terminology is reasonable and not overbearing. Eric Harth defines technical terms clearly as he introduces them and provides a thorough glossary at the end of the text. Frequently neurologists and physicists have entirely different approaches to their respective fields, and the vocabulary of the biologist drowns the abstract physical scientist; Harth has reached a welcome, understandable mean. He presents the rudiments of quantum mechanics as well as information theory for nearly everyone to understand.