be misled by the work's four lines (and one word more) on "Rubin, Vera Cooper (1928–)," the contemporary investigator of velocity fields in galaxies, but neither will you be well informed on this much-honored astronomer's accomplishments. The 21-line entry on "Sandage, Allan Rex (1926–) has no room for the famous controversy over the Hubble constant in which Sandage was a central figure, or for the discovery of blue stragglers, reported in his PhD thesis. In the latter case, fortunately, what is not mentioned in the biographical entry can be found in the main article, "Blue Stragglers."

If this four-volume work were magically compressed into a single manageable volume, the myriad short entries would make more sense; the book would be "one-stop shopping" for astronomical and astrophysical reference reading. But since almost all copies of the *Encyclopedia of Astronomy and Astrophysics*, at four volumes and $650 for the set, will necessarily be found in reference libraries, why include the short entries? If you are in the library, it's a lot easier to pick up a single volume appropriate to meteor showers, Mitton's *Dictionary*, Zimmerman's *Chronological Encyclopedia of Discoveries in Space*, or a current college text. I'd still go to the library to consult the main articles in Murdin. They're a splendid resource, but his *Encyclopedia* would have been more user-friendly if the short stuff had been omitted.

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East Asian Archaeoastronomy: Historical Records of Astronomical Observations of China, Japan and Korea

Zhentao Xu, David W. Pankenier, and Yaotiao Jiang
Gordon and Breach Science, Amsterdam, the Netherlands, 2000. $115.00 (430 pp.)
ISBN 90-5699-302-X

The earliest preserved records of astronomical observations come from two principal cultures: Mesopotamia and China. The Mesopotamian records are found in cuneiform writing on clay tablets that have been recovered from the ruins of Nineveh, Babylon, and other cities in the Near East. They date primarily from the last seven or eight centuries BC, and are superior in detail and accuracy to their Chinese counterparts of the same period.

However, the Chinese records have two great advantages over the Mesopotamian material to astronomers and historians today: (i) whereas the latest cuneiform records date to the first century AD, more or less continuous records of Chinese astronomical observations are preserved up to the present, and (ii) the Chinese records are of a wider range of celestial phenomena; there is, for example, no specific interest in cyclical phenomena.

In total, East Asian sources contain more than two and a half thousand years' worth of records, providing the historian with an abundance of material to use in tracing the development of astronomy in China, and offering a long baseline of data for the astronomer to search for events that occur very rarely (such as nearby supernovas) or change very slowly (such as the Earth's rate of rotation).

Chinese astronomy can be divided into two main parts, one observational, the other theoretical. The observational material includes records of eclipses, comets, guest stars (novas), and other celestial phenomena visible to the naked eye. Because most of these could be—and were—interpreted astrologically for the emperor, Chinese astronomy was essentially an official activity, conducted by scholars employed by, and under the control of, the government. This was a double-edged sword as far as scientific progress was concerned: At some periods official interest led to the development of new theories and instruments, while at others it forced astronomy into a retrograde step. Chinese astronomy dominated East Asia up until at least the seventeenth century, and its basic methods and goals were followed, often slavishly, in Korea and Japan from the late first millennium AD.

East Asian Archaeoastronomy, by Zhentao Xu, David W. Pankenier, and Yaotiao Jiang, aims to collect all known observations of certain astronomical phenomena from East Asian sources and translate them into English. This is a laudable aim, and undoubtedly, by translating the records, the authors are opening up a field that has previously been accessible in the west to only a handful of people. However, the project is not without its dangers, as we shall see.

In choosing to concentrate solely on observations, the authors are presumably aiming their book towards astronomers rather than historians. Indeed, the astronomer can learn much from the observations collected here. For example, the past viewings of Halley's comet can be traced back to 240 BC with only the return in 164 BC missing, and the many hundreds of observations of lunar and solar eclipses provide essential information on the long-term changes in the Earth's rate of rotation.

Unfortunately, by quoting only the lines of the text in which these observations are recorded, the accounts can often be misinterpreted. In the worst case, what may in fact be a calculated event can be interpreted by the unwary as an observation. Many early eclipse records, for example, do not correspond to real events. Some are genuine predictions, but others are apparently "fake" events which, because of their astrological interpretation, were inserted into the record for political purposes. Some observations were omitted for the same reason. In order to safeguard against using such a polluted dataset, one must understand the context in which the records were written. Unfortunately, selective quotation by the authors, and their failure to provide any information about the various sources from which the records are taken, prevent this.

It is disappointing also that the authors have decided to omit most of the astrological material in the translations. Comparisons made by the Chinese astronomers between the observations they made and the results of calculations using the theories they developed are also omitted in the translations provided. This is a pity, for these both provide very interesting material for study by historians of Chinese science and its role in Chinese society.

Bearing in mind these reservations, *East Asian Archaeoastronomy* is still a useful reference book, but one that should be used with great caution, and as a starting point for locating material in the original sources, not as a definitive work in itself.

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Atom, Molecule, and Cluster Beams

Hans Pauly
Volume 1: Basic Theory, Production and Detection of Thermal Energy Beams
$82.00 (344 pp.).
ISBN 3-540-66945-0
Volume 2: Cluster Beams, Fast and Slow Beams, Accessory Equipment and Applications
$79.95 (374 pp.).
ISBN 3-540-67673-2
Springer-Verlag, New York, 2000

In *Atom, Molecule and Cluster Beams*, Hans Pauly has emphasized areas in

the field that were just emerging when the last significant work on the subject was published—*Atomic and Molecular Beams Methods*, edited by Giacinto Scoles (Vols. I and II, Oxford U. Press, New York, 1988, 1992). The applications of cluster, fast translational, and slow atomic beams, the trapping and cooling of atoms, and the use of atomic optics were among Pauly's chosen topics.

Pauly is the retired director of atomic and molecular physics at the Max Planck Institute for Flow Research in Göttingen, Germany. He has the perspective and expertise to undertake such a book. While the books by Scoles and the recent monograph *Atomic and Molecular Beams: State of the Art 2000*, edited by Roger Compargue (Springer, 2001) contain contributions from a large number of authors, Pauly clearly states that his contribution "reflects the tastes and inclinations of the author." This enables him to present each topic with a degree of uniformity and consistency that is very hard to achieve in a compendium volume. Pauly's treatment of each chapter is thorough, from the adequate and accurate presentations in volume I of the basic theories and principles of gas kinetics and dynamics that form the foundation of the field, to the numerous applications and examples of methodology in volume II.

Beams provide a unique view of the fundamental properties of atoms and molecules, a view that cannot be duplicated under condensed-phase conditions. Major advances have occurred in the field since the Scoles volumes were published, particularly in the areas of metrology, atom optics, and the use of cluster beams to bridge the gap between isolated atoms and molecules and the condensed phase. The potential impact on a diverse range of areas (materials, environmental, chemical, and biological sciences) is enormous. There is more than ample justification for publishing a new source that would benefit both established researchers and those wishing to gain an introduction to and understanding of the field. Pauly is successful in many, but not all aspects of this undertaking.

The first volume has some overlap with Scoles's counterpart volume. However the benefits of single authorship are quite clear. The common topics are presented more completely and with focus, excellent accuracy, and superb references. The chapters on gas kinetics and dynamics as applied to molecular beams are among the best available. The extensive compilation of thermal beam sources contained a number that were new to me, which I

noted for further consideration. While the strengths of this volume were apparent, it left me with a slight concern that only a small portion was related to spectroscopy, where molecular and atomic beams have had and continue to have a significant impact.

The second volume clearly reflects the author's tastes and inclinations. The presentations on fast beams, velocity measurement and selection, and state selection, while accurate, place more emphasis on methods and techniques that are not widely used today in the molecular beam community. This is perhaps most clearly shown in that only a brief discussion of optical methods in state selection is given. There are literally tens of approaches using incoherent or coherent methods, not only for state selection in atoms or molecules but for size- or composition-selected clusters as well. The treatment in Scoles's first volume placed considerable emphasis on spectroscopic techniques, although they are now somewhat dated. The remaining portions of Pauly's second volume on cluster beams, slow atom beams and traps, and atom optics are more modern and useful. While the latter topics are covered extensively by a number of contributors in the first section of the book edited by Compargue, I preferred the chapter by Pauly. The single-author approach again had a decided advantage.

At the risk of sounding ethnocentric, Pauly's effort reflects a traditional European view of atom and molecular beams. There is a decided emphasis on the physics behind the techniques and applications, with less emphasis on both spectroscopy and chemistry; the approach from the US seems to be the complement.

The two volumes by Pauly clearly belong on the shelf for individuals interested in beams. The reasons are that the first volume presents a unified description of the basic theory and principles, while the second contains a recollection of the past and present methods, with the promise of new techniques for the future.

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For Better or for Worse: The Marriage of Science and Government in the United States

Alfred K. Mann
Columbia U. Press, New York, 2000. $27.50 (240 pp.). ISBN 0-231-11706-X

"Marriage" is the metaphor that Alfred Mann uses to describe the last half-century relationship between two willing partners: the US federal government and the science establishment.

It was "Love at First Sight: 1939 to 1945" when science and engineering inventions enabled the winning of the "physicists' war," World War II, with inventions such as radar, code-breaking techniques, bomb sights, and nuclear weapons. The relationship of the government and the science establishment has its roots in the successful Manhattan Project partnership.

Although the basis for the relationship was contributions to the war effort, Mann dismisses the Department of Defense, claiming, "DOD is not recognized as a major funder of basic scientific research in colleges and universities." This is a surprising claim, because the basic and applied research funds that DOD sent to universities, say in 1999, roughly equaled the combined total funding from DOE and NASA. However, the author focuses only on civilian agencies.