It is a unique potpourri of historical anecdotes, philosophical arguments, mathematical derivations, and physics jargon. And it is a great bargain.

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Star Formation

Protostars and Planets II. DAVID C. BLACK and MILDRED SHAPLEY MATTHEWS, Eds. University of Arizona Press, Tucson, 1985. xx, 1293 pp., illus. $45. From a meeting, Tucson, Jan. 1984.

The transformation of an interstellar cloud to a star or a planet involves an increase in gas density by a factor 10^{25}. The range of physical problems faced by astronomers trying to understand this transformation covers a correspondingly broad spectrum, ranging from instabilities caused by galactic shock waves 10^{22} centimeters long to the coalescence of dust particles 10^{-4} centimeter in diameter. This book is a courageous attempt to bring together all the main threads in a single volume of 43 review chapters based on papers presented at a conference. Major themes discussed in the book include the instability and fragmentation of molecular clouds, the dynamics of disks and jets discovered around young stellar objects, the chemistry of meteorites and of the interstellar medium, and the origin and evolution of the giant planets and of the protoplanetary nebula.

Broadly speaking, the contributors to this volume can be identified either as astrophysicists interested in the signs of recent and incipient star formation in interstellar gas clouds 10^{20} centimeters or more distant or as planetary scientists looking within the confines of our own 10^{15} centimeter diameter solar system for clues to the origin of the sun and planets. The gap between these approaches is wide and is largely attributable to the enormous technical difficulty of detecting or studying planetary systems around any star apart from the sun. Can the gulf between the disciplines be effectively bridged in a single volume such as this? An encouraging answer comes from an examination of the differences between this volume and the proceedings of the first Protostars and Planets conference held in 1978. There are signs that the gap has narrowed considerably in the intervening six years. Because of improvements in the sensitivities of infrared and millimeter-wave telescopes, galactic astronomers are now able to study the progenitors of sunlike as well as high-luminosity stars. The success of the Voyager flybys, meanwhile, has drawn the main attention of planetary astronomers away from the terrestrial and toward the giant planets, the evolution of which bears strong resemblances to those of stars. Both groups of astronomers are faced with new problems involving the dynamics of flattened rotating systems; planetary astronomers are addressing the newly discovered complexities of Saturn's rings, while galactic astronomers are exploring the connections between collimated outflows and circumstellar disks around young stellar objects.

The editors of *Protostars and Planets II* have produced a thick volume that will be of considerably greater durability than the average collection of conference proceedings. Authors have been allowed, if not encouraged, to expand their papers into full-length reviews, which in two cases are over 90 pages long. The book is elegantly typeset and includes an extensive index, a glossary, and an 85-page list of references. A penalty for this approach is that the book has been two years in preparation. These two years have been eventful: the IRAS satellite has found dust rings around the sun and signs of planetary material around Vega, there have been flybys of Uranus and Comet Halley, and a large planet-like companion to the star van Biesbrock 8 has been discovered. It will soon be time for Protostars and Planets III.

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Precision Measurement

The Fundamental Physical Constants and the Frontier of Measurement. B. W. PETLEY. Hilger, Bristol, England, 1985 (U.S. distributor, International Publishers Service, Accord, MA). x, 346 pp., illus. $49.

Metrology and the determination of the fundamental constants are an important but little recognized field of science to which all scientists are indebted. The major participants in the field are a few individuals located principally in national standards laboratories and university laboratories who have been seduced by the "romance of the next decimal place" and who enjoy the challenge of measuring physical quantities to a higher precision with a stated uncertainty. Occasionally new science is found in the next decimal place.

Brian Petley, whose home is the National Physical Laboratory in England, is a long-time participant in this endeavor who has worked on many different metrological problems. In this book he has provided a broad survey of the field that will be useful to participants, to students, and to curious bystanders.

The first part of the book provides a historical summary discussing what is meant by a fundamental constant, the evolution of what have been regarded as fundamental constants, and the increased role in metrology of measurements of time, frequency, and wavelength. Familiar examples of fundamental constants are the speed of light, the Boltzmann constant, the Planck constant, the charge of the electron, the Rydberg constant, and the Faraday constant. The major advances in this century have been in the measurement of time and frequency and the replacement of arbitrary prototype standards, such as the distance between two scratches on a platinum-iridium bar, by standards based on the properties of simple physical systems. The second, for example, is now defined in terms of a cesium atomic clock rather than the somewhat variable rate of rotation of the earth.

Coupled with the issue of measurement is the issue of units and standards for measurement. To measure the velocity of light requires a unit for measuring length and a unit for measuring time. To measure voltage requires some form of voltmeter that has been calibrated against a standard for voltage. One shortcoming of the book is that it does not summarize the original definitions of such Standard International units as the meter, the kilogram, the second, and the ampere or provide a description of the techniques initially used to realize them. One problem that has plagued metrologists is that during this century the standards for the volt, the ampere, and the ohm have changed.

In the view of many scientists the most important constants are dimensionless constants or dimensionless combinations of constants. The most well-known example of these is the fine-structure constant that is a measure of the strength of the electromagnetic interaction. The most famous constant is the speed of light. It has been the subject of increasingly precise measurements since Galileo's first attempt to measure it using lanterns on adjacent hills. The theory of relativity elevated the speed of light to a particularly high status in that it has the same value in all inertial frames. The availability of the laser has made it possible to define the meter as the distance traveled by light in a time period measured with respect to a cesium clock. Thus the velocity of light is no longer a constant to be measured but an ingredient in the definition of the unit of