Book Reviews

The Origin of the Planets

Protostars and Planets. Studies of Star Formation and of the Origin of the Solar System. Papers from a meeting, Jan. 1978. TOM GEHRELS, Ed. University of Arizona Press, Tucson, 1978. viii, 756 pp., illus. $17.50.

The riddle of the origin of the planets has challenged thinkers since earliest times. A rational assault on the problem in the present epoch is complicated by the fact that it requires a high degree of interaction between disciplines: astrophysics, which analyzes the interstellar medium and models processes by which it might be transformed into stars (with, presumably, planets as by-products); chemistry and mineralogy, which assess the evidence in meteorites of condensation and other complex processes in the hypothetical primordial solar nebula; dynamics, which considers why and how an orbiting swarm of small particles would collect itself into a small number of planets and satellites; and nuclear physics, which tries to read from the meteorites a record of pre-solar-system element formation and details of the time scale of deployment and degree of mixing of newly formed elements in the infant solar system. Workers in the field have accommodated themselves to this requirement in varying degrees, but the need to be interdisciplinary usually comes as a rude surprise to students.

Protostars and Planets is intended to serve as a source book on the subject, bringing together authoritative reviews and a selection of more topical papers that are all up to date, are comprehensible (perhaps with some effort) to a graduate student, and cover the required range of disciplines.

The book contains three major review papers and 35 shorter, more focused papers, organized into five topical sections. The review papers, averaging about 20 pages in length, are concerned with interstellar matter and pre-solar-system nucleosynthesis (D. D. Clayton), star formation (R. B. Larson), and planet formation (W. K. Hartmann). The topical sections address observational and theoretical aspects of interstellar grains and chemistry; the collapse and fragmentation of interstellar clouds, an early stage of star formation; the relationship between supernovae, nucleosynthesis, star formation in general, and solar-system formation in particular; the solar nebula and planet formation; and observations of stars in the process of formation.

Clearly each paper could not contain all the introductory material needed to make it understandable to a nonspecialist, so the editor thoughtfully included a cross-disciplinary glossary of terms, printed on gray-toned paper at the end of the book. Here one finds defined (to take the C's as an example) *c*, C3V, CAI, CCF, chondrite, chondrules, CIS, cm, comminution, *Copernicus*, Coriolis effect, CPM stars, and CRVS. It is hard or impossible to make such a compilation comprehensive, however; I tested it with a few terms from the book and found photoheating, homologous contraction, and T_K missing.

The review papers are comprehensive and well written. They are at the right level, and they take a broad view. Quite a large proportion of the topical papers are also appropriate to the purpose of *Protostars and Planets*: they address major questions, are written for nonspecialists, and are reasonably objective. In the astrophysical sector, the selection of topics and authors seems to me well balanced and remarkably comprehensive. The book is by no means a loose and uneven collection of divergent points of view. It is carefully edited and nicely produced, its price puts it within easy reach, and it is as up to date as publishing technology allows.

Those are its good points. The one bad one is that it is deficient in coverage of the chemical, mineralogical, and isotopic side of the subject. Hartmann's review largely omits these aspects, and the four papers that are concerned with chemical processes in the solar nebula address specific points and grind particular axes. They do not add up to a comprehensive treatment. The very nature of the problem—meshing the evidence in meteorites of condensation and other high-temperature effects with astrophysical models of star formation and the solar nebula—is never clearly stated. There is no paper by a mass spectrometrist descriptive of the recent important discoveries of stable isotope anomalies and very short-lived radioactivity in the solar system, though several papers refer to the data and attempt to rationalize them. This is not a trivial omission; the community and literature of cosmochemistry are substantial, and the properties of meteorites are our principal source of evidence (enigmatic though it may be) of events in the solar nebula.

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A Nucleic Acid

Transfer RNA. SIDNEY ALTMAN, Ed. MIT Press, Cambridge, Mass., 1978. xviii, 356 pp., illus. $29.95. Cell Monograph Series, 2.

Transfer RNA has always occupied a large share of attention in nucleic acid research. There may be several reasons for this, including the small size of tRNA molecules and the relative ease of isolation of large amounts of pure isoaccepting tRNA species, which have made tRNA the nucleic acid most amenable to biophysical structural studies. The determination of the high-resolution crystal structure of yeast phenylalanine tRNA by several laboratories within the last few years and the probable generality of this structure have dramatically stimulated and refocused tRNA research. The book *Transfer RNA*, a group of ten papers edited by Sidney Altman, is a timely effort to review the results of various types of investigation of this molecule in the era immediately following the elucidation of its three-dimensional structure.

Many of the functions of tRNA are by no means obvious from its crystal structure, and the main concern of the book is with a reanalysis of tRNA function in the light of this structure. There are chapters on sequence comparisons, biosynthesis, messenger RNA and ribosome interactions, modified nucleosides, suppression, "other roles" of tRNA, and possible modes of specific discrimination of individual tRNA species by aminoacyl-tRNA synthetase enzymes. The fine details of the crystal structure are reviewed by Kim, and Crothers and Cole contribute a provocative chapter on the functional implications of tRNA conformational changes in solution. The book is given an elegant send-off by an interesting account of the "coming of age" of tRNA from a personal and historical point of view by Hans Zachau, who has been engaged in research on tRNA since