these two volumes a complete and comprehensive survey of the technical aspects of the bubble-chamber field. While adequate quantitative information is contained, the presentation is mainly descriptive, and this work is reminiscent of an "encyclopedia." It must be mentioned that the editor and the 13 authors he has selected have all pioneered in the construction or use of bubble chambers and are among the leading experts in the field. The material is carefully chosen and presented clearly and precisely.

The major part of the book is devoted to bubble-chamber problems. Information that until now has existed only in scattered review articles is presented in coherent form. Some examples of subjects thus treated are the theory of bubble formation and the intricacies of cryogenic engineering and chamber illumination, so frequently taken for granted by the users of bubble-chamber film. In the second volume the problems involved in retrieving the pertinent information from the film are discussed; by necessity this can be done only in a very descriptive fashion. An excellent chapter on the design of particle beams suitable for feeding high-energy experiments is written by J. Sandweiss. J. W. Cronin wrote the one chapter devoted to spark chambers; it is complete and thorough.

The authors have justly avoided mixing the physics results obtained with bubble and spark chambers with their presentation of the technique. Therefore the book will be of greatest use to the many students and high-energy experimenters who are not already experts in the field. However, the experts also will find this book quite valuable to consult whenever facts or references are needed.

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Plasma Chemistry

The Application of Plasmas to Chemical Processing. RAYMOND F. BADDOUR and ROBERT S. TIMMINS, Eds. M.I.T. Press, Cambridge, Mass., 1967. xviii + 206 pp., illus. $12.50.

A glance at the contents of this book immediately conveys the interdisciplinary nature of plasma chemistry. To achieve an overall, coherent, and usable description of the subject, the editors have drawn upon the expertise of recognized authorities in various fields.

The authors of the nine chapters have effectively woven the threads of gas-discharge physics, plasma-reactor design, and plasma diagnostics into the broad fabric of chemical reactions suited to plasma processing. Chapters entitled "The physical characteristics of electric discharges," by A. Bell, and "Techniques for the generation of continuous high-temperature gas flows," by R. R. John, illustrate these disciplines. From the point of view of scientists engaged in research and development aspects of plasma processes, the chapter "Plasma diagnostics," by J. C. Ingraham and S. C. Brown, represents perhaps the least familiar of the nonchemical aspects of the work.

Six chapters are devoted to the application of d-c, radiofrequency, and microwave plasmas to chemical reactions and processes. Comprehensive reviews of specific chemical systems involving largely the results of d-c plasma studies are given in "Nitrogen fixation," by R. S. Timmins and P. R. Ammann, and "Fluorine reactions in plasma," by B. R. Bronfin. These authors clearly show the importance of kinetic and thermodynamic considerations in planning and effecting successful plasma processes. Important uncertainties inherent in the related thermochemical calculations are indicated. In "Reaction of graphite and hydrogen above 2000°K," by J. T. Clarke, data from studies utilizing resistivity-heated solid carbon and carbon vapor generated in a high-intensity arc are employed to elucidate the kinetics and mechanism of acetylene formation.

In "Chemical uses of induction plasmas," T. B. Reed makes a lucid comparison of electrode- and induction-generated plasmas and summarizes the demonstrated applicability of the latter to gas-solid reactions at near-atmospheric pressures. Again for the case of a "thermal" plasma, the design criteria and application of a radiofrequency plasma torch to gas-phase reactions are given by C. P. Beguin *et al.* in "Chemical syntheses in radio-frequency plasma torches." Characteristics of a low-pressure or "cold" microwave plasma and the commercial limitations of this type of discharge are realistically described by R. F. Baddour and P. H. Dundas in "Chemical reactions in a microwave discharge."

Based on the available published data, a definitive and highly readable work on plasma chemistry has been produced. One would hope that similar efforts in the future might mirror the authors' access to the now large backlog of unpublished results in this field.

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In Honor of Struve

Modern Astrophysics. A Memorial to Otto Struve. M. HACK, Ed. Gauthier-Villars, Paris; Gordon and Breach, New York, 1967. 360 pp., illus. $19.50.

Otto Struve combined skill in research and in administration to an extraordinary degree. Thus it was that, in serving successively as director of the Yerkes Observatory and chairman of the Department of Astronomy at Chicago, as chairman of the Berkeley Astronomical Department of the University of California, and as director of the National Radio Observatory at Greenbank, he collaborated at one time or another with a large fraction of the astronomers who contributed to the growth of astrophysics between 1920 and 1960. For this same reason it was inevitable that there should be rivalry between editors eager to bring contributions by these authors together in volumes that would serve as lasting memorials to Struve. Nevertheless, the editor of the present work, Margherita Hack of the Osservatorio de Trieste, has succeeded in including 29 papers, including 15 that are from European astronomers.

To dispose of an obvious criticism quickly, so many cooks tend to produce an *olla podrida* in which not all the ingredients blend equally well. Thus there are a few papers by authors who had little contact with Struve, or who have written reports on whatever they happen to have been working on recently even if it has only remote connection with anything with which Struve was closely concerned. In answer the editor would doubtless point out that there was scarcely an area in modern astronomy in which Struve had no interest, as is shown by the wide range of the series of survey articles that he wrote for *Sky and Telescope*. Yet it remains true that readers are most likely to turn to this volume in the expectation of learning of recent work on those astrophysical

problems that Struve himself did so much to define.

Among the contributors who have attempted to trace such links explicitly are F. E. Roach and B. T. Lynds, in separate papers. In the early 1930's a simple photoelectric sky photometer was set up by Struve, Roach, and Elvey on the side of Mount Locke in Texas in order to measure the surface brightness of the night sky and of galactic nebulae. In the present volume Roach discusses new observations of the intensity of the light from the stars as diffused by interstellar matter, and Lynds develops further the theory of scattering in diffuse nebulae in order to study the surface brightness of two of the "dark" nebulae. This was one of the problems in which Struve was intensely interested, but even with the improved photometric data of today there remains ambiguity in defining the material density, the source of illumination, and the distance of the nebulous matter.

One of the most important papers in this book is contributed by E. Böhm-Vitense of the Institut für Theoretische Physik at Kiel. It is known that in most of the peculiar A-stars (distinguished from the other Ap stars in the Henry Draper Catalogue by Struve and Morgan), the magnetic fields, line intensities, and radial velocities usually vary with the same period. Of the several models proposed to explain this behavior, Böhm-Vitense prefers the simplicity of the one suggested by A. Deutsch, in which the star rotates slowly about an axis inclined obliquely to the magnetic axis.

It has been objected that no simple dipole field would predict all the effects observed, but Böhm-Vitense merely computes the actual field pattern that is needed to account for the variations measured from the Zeeman patterns of seven stars. Assuming only that the fields are cylindrically symmetrical about the magnetic axis, she finds that they must have maxima near magnetic latitudes $\pm$ 20°, and points out that these are nearly the latitudes at which the sun shows maximum prominence and spot activity. Whatever the significance of this coincidence, the oblique rotator with a field of this shape would show broad, flat maxima when we are looking at one of the polar regions. Since Eu II lines in several variables show their maximum at the times of the broad magnetic maxima, the implication is that Eu II lines are formed chiefly in the polar regions, while Cr II lines originate predominately in the equatorial regions. Although explanations of these phenomena and of the origin of such magnetic fields remain to be given, it does appear that the computations of Böhm-Vitense increase the plausibility and the interest of the oblique rotator model.

Although there is not space to describe the papers in some of the other fields, such as spectroscopic binaries and stellar evolution, which are closely associated with the name of Struve, it would not be just to omit the two chapters on β Cep (or β CMa) stars. After Struve and Swings had collaborated in a discussion of the spectrum of β CMa in 1941, Struve turned again to the problems posed by those enigmatic variable stars, and wrote a series of papers in collaboration with his students at Berkeley between 1950 and 1955. In the current volume McNamara and Matthews discuss the absolute brightness of these stars, while van Hoof returns to one of the questions that most intrigued Struve—the presence of "beat periods" in their light curves and the relation of these to the periods of rotation of the stars.

From these examples it is clear that most of the papers in this volume are research papers rather than summarizing reviews. Whether this is an advantage or otherwise depends upon the reader's needs, but it can be said that almost every student of astrophysics would find some material of great interest and value in this volume, which is well printed and carefully edited.

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Avian Biology

Proceedings of the Fourteenth International Ornithological Congress. Oxford, England, July 1966. D. W. SNOW, Ed. Blackwell Scientific Publications, Oxford, 1967. xxiv + 405 pp., illus. $14.50.

Although the editors of this volume and the officials of the 14th International Ornithological Congress were successful on several scores, they were faced with a problem that they have solved only partially. As these congresses have expanded and the number of papers delivered has increased, the volumes of the proceedings have become larger and larger until two volumes were needed to contain the papers presented at the 13th Congress in 1962. For the 14th Congress the decision was made to publish only the papers delivered at the plenary sessions. These papers were prepared by the president of the congress, David Lack, and 16 invited specialists in various currently important aspects of fundamental ornithological research. The general subjects covered are ethology and breeding biology (D. Lack and N. Tinbergen), systematics and taxonomy (W. Bock and E. Stresemann), avian physiology (J. Aschoff, D. S. Farner, and R. A. Hinde), population ecology (L. von Haartman, D. L. Serventy, and G. Zink), vocal communications (J.-C. Bremond, P. Marler, W. H. Thorpe, and F. Nottebohm), and orientation and navigation (F. Bellrose, C. Walcott, M. Michener, and H. G. Wallraff).

All the papers in the volume are valuable contributions in one way or another and should be of permanent interest. However, the eminence of the authors does not automatically make every paper the most up-to-date treatment of its subject. Indeed, there are serious defects inherent in all programs with invited speakers. When an expert is asked to give a major address at an international congress or other scientific gathering he feels he must comply even though he may have already summarized his knowledge of his subject at other recent symposia. The amount of new research that he himself has to report depends on fortuitous circumstances, that is, on whether he happens to conclude a phase of his own investigations at a time that coincides with his address.

More often than not what we end up with is a rehash that contains little that has not already been provided by the same author. Such reviews may be of immense value to nonspecialists and those with a peripheral interest in the subject, but they are not likely to be very stimulating to specialists. In brief, notable research discoveries and breakthroughs are seldom announced in proceedings of symposia. They are more likely to appear in journals, into which they find their way after slow, deliberate maturation that does not often coincide with a congress and an invitation to give a guest lecture.

Although the present proceedings contain excellent review articles, such as the one by Farner on the control of avian reproductive cycles, the specialist will probably find the papers by Aschoff on circadian rhythms in birds