detailed application of the energy principle to specific configurations is omitted, but references are given to such results in the literature. I believe the extra space required for some applications would certainly have been justified.

There are shorter chapters on finite-conductivity instabilities, microinstabilities, toroidal equilibria and stability, nonlinear theory of electrostatic waves, and gas discharge theory. In addition, there are some interesting applications of asymptotic methods in differential equations to boundary layer problems and adiabatic invariants of charged particle motion.

Quite a number of new books on plasma physics have been published during the past few years, but most of them have been of an introductory nature, suitable for a first course. The few exceptions have concentrated on special topics such as plasma waves. There has been a real need for a book to bridge the gap between the introductory treatments and the ever increasing number of research papers in plasma theory. Such an undertaking is rather risky because of the rapid development of the field. By concentrating on the problems of high-temperature plasmas in the presence of magnetic fields, primarily the stability question, this course succeeds in preparing the reader to delve into the current literature. This is a remarkable achievement because the lectures were given nearly 3 years ago. Surveys can easily be out of date by the time they are published. The success of this book is due to the selection of topics and to the fact that the lecturers are authorities. The theories presented have stood the test of time and in fact are now the basis for current research. For example, in the past 2 years there has been substantial progress in the search for stable confinement geometries, and the calculations accompanying these developments depend on theory derived in this book.

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## Applied Mathematics: Physics, Astronomy, Engineering

**Math and Aftermath**. Robert Hooke and Douglas Shaffer. Walker, New York, 1965. xii + 233 pp. Illus. $5.95.

*Math and Aftermath* by Robert Hooke and Douglas Shaffer is a well-written account of elementary applied mathematics. The reader whose background includes only high school mathematics will find the book accessible and informative if he skims many of the formulas, but he cannot skip them all. A reader with some traditional college mathematics can, especially with the help of the appendix, read the book in detail.

The subject is research in physics, astronomy, and engineering, and, although research in applied mathematics is hinted at, research in pure mathematics is gently disparaged in these words: " . . . steps that need to be made before mathematics is anything more than self-contained logical exercise" (p. 16). The authors examine separately two modes in the application of mathematics: (i) the formulation of theories with deductions from them to be tested by observation and (ii) the statistical treatment of data from the processing of which structure can be observed and predictions made. The choice of examples is well suited to illustrate these modes, and they appear to be consistently of about the same standard of difficulty.

The book has a refreshing flavor of honesty about it, revealing that the authors are experienced and at the same time humble about the power of mathematics in view of its limitations. A respect is clearly shown for the successes in classical mechanics which have now been sorted out and evaluated by history, and a rather cautious wait-and-see attitude is evident with respect to the newer statistical methods and the computing machinery that, it is observed, gives promise to them. The reader comes away with a sober enthusiasm for applied mathematics and a realization that mathematicians in this area are essential, and that their sense of humor is somewhat dry but not above whimsey in the selection of chapter titles. This volume should be in every high school library. It should be read by lay people who are concerned about engineering in the broad sense, but it cannot be expected to illustrate 20th century mathematics per se.

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## Applications and Techniques

**Fundamentals of Vacuum Science and Technology**. Gerhard Lewin. McGraw-Hill, New York, 1965. xiv + 248 pp. Illus. $11.50.

This volume is addressed to persons with scientific training who must use vacuum technique in their research work, but who are not vacuum experts. Lewin attempts to treat all important aspects of the subject. This is done in a concise way that will often send the reader to other references for more details. A good bibliography is provided for this purpose.

The first two chapters are brief statements of important formulas from the kinetic theory of gases. This material is well known, but is presented here in a convenient form in a space of 20 pages. The third chapter, "Surface effects," is the longest in the book, which is appropriate because of the importance and complexity of such effects, especially in the ultrahigh-vacuum range. This chapter contains many useful graphs and tables and is a generally well-organized summary of a difficult field. The chapter on vacuum measurements contains brief descriptions of the most common total-pressure gauges and of various types of mass spectrometers used for partial pressure measurement. Curiously, no mention is made of the Schuemann suppressor gauge, which has important applications in the ultrahigh-vacuum range. There is also a brief discussion of the measurement of pumping speed and conductance. The remaining chapters treat pumps, components such as flanges and valves, materials and methods of preparation and joining, and several examples of complete vacuum systems.

The author has been directly involved in the development and application of new techniques in the Plasma Physics Laboratory at Princeton University, and the fruits of this experience, which are dispersed throughout the text, constitute what is distinctively new in this book. In this respect, the book will interest even the expert in this field.

The question of the temperature requirements for bake-out to reach ultrahigh vacuum could have been discussed more fully. There is firm evidence that temperatures near 200°C, rather than 400°C, are adequate. This has important consequences for system design and choice of materials.

Although the Orbitron gauge is briefly mentioned, the Orbitron pump apparently was announced after the publication deadline. Nor is there any mention of the stainless-steel-to-glass Housekeeper seal, which is now in rather widespread use. Brevity of prose style occasionally leads to statements that are intelligible to an expert, but possibly not clear to a novice. All in all, these are minor defects.

During the past two years, at least six books on this general subject have been published in the United States. Several of these emphasize one part of the field, such as ultrahigh vacuum, new pumping techniques, or commercial applications. The Dushman-Lafferty book remains the most thorough treatment of the scientific foundations. For those who want a more concise treatment, a good guide to the literature, and the inclusion of the most recent developments, this volume by Lewin, *Fundamentals of Vacuum Science and Technology*, can be recommended as a first choice.

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## Crystallography: Winter School, University of Madras

**Advanced Methods of Crystallography.** G. N. Ramachandran, Ed. Academic Press, New York, 1964. x + 279 pp. Illus. $10.50.

This book is a report of the lectures delivered at the Winter School on Advanced Methods of Crystallography held at the University of Madras in January 1963. The nine lectures can be divided into two internally related groups of three lectures on crystal structure analysis and three lectures on imperfections and disorder and a group that contains three miscellaneous talks. The first group consists of "Image methods in crystal-structure analysis" by M. J. Buerger, "Fourier syntheses for partially known crystal structures" by G. N. Ramachandran, and "The use of anomalous scattering in crystal structure analysis" by S. Ramaseshan. Buerger's lecture is a brief presentation on some aspects of image methods, a subject that is covered much more intensively in his book *Vector Space and Its Application in Crystal Structure Investigations.* The second lecture presents a good discussion of Fourier transforms and the effects of various modifications on the Patterson and electron density functions. The final lecture in the first group presents a good, concise discussion of anomalous dispersion in structure determination. These lectures are of primary interest to the specialist in crystal structure analysis. It is unfortunate that, for completeness, there were no lectures on phase determination and automatic devices.

The three lectures in the second group, "Diffuse x-ray reflections from crystals" by W. A. Wooster, "Diffuse disorder scattering by crystals" by H. Jagodzinski, and "Imperfections in crystals and their effect on x-ray diffraction by crystals" by Leonid V. Azároff, are written in a more general vein and as a unit can serve as an introduction to disorder effects. Wooster makes extensive use of optical transforms which are not only experimentally useful, but an excellent pedagogical device.

In the lecture "Group theory and crystal properties" S. Bhagavantam discusses the relationship between crystal symmetry and physical properties, with particular emphasis on photoelasticity as an example. "Elementary theory of neutron scattering by crystals," by I. Waller, is a very concise presentation, and the uninitiated would do well to use a more extensive source such as the book *Neutron Diffraction* by G. E. Bacon. "Aberrations and line broadening in x-ray powder diffractometry," by A. J. C. Wilson, is mainly a discussion of the effect of physical aberrations on line positions and widths. Wilson also presents a very short interpretation of diffraction broadening.

The majority of work presented in these lectures is available in more detailed analysis in books in the various fields. However, within its limitations, this book can serve as a brief and readable introduction for the crystallographer who desires a nodding acquaintance with work in related fields beyond his immediate specialty. Each lecture has a list of references and, at the end of the book, there are author and subject indices.

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## Polymer Chemistry

**Determination of Molecular Weights and Polydispersity of High Polymers.** S. R. Rafikov, S. A. Pavlova, and I. I. Tverdokhlebova. Translated from the Russian edition (Moscow, 1963) by J. Eliassaf. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. viii + 357 pp. Illus. $14.

**Synthetic Hetero-Chain Polymides.** V. V. Korshak and T. M. Frunze. Translated from the Russian edition (Moscow, 1962) by N. Kaner. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. x + 564 pp. Illus. $17.95.

Both of these books on polymer chemistry were originally published by the Academy of Sciences of the U.S.S.R. and both were translated into English by the Israel Program for Scientific Translations, Jerusalem. Do the treatises merit translation?

I think they definitely do. The first book is of wide interest, and the second is more specialized. Both are serious and scholarly works that deserve respect and should be of definite value as reference texts. They have to some extent a flavor that is intermediate between a true textbook and an advanced review article. They are useful because of their comprehensive nature, but fall short of excellence because discrimination is sacrificed for comprehensiveness.

What is quite surprising to me is how eclectic these works are. We are accustomed to think of Russian science as being rather xenophobic. These books reveal an intensive study of American, British, German, French, and Belgian literature amongst others. We have thought of the Japanese as being always willing to learn from the best that the world has to offer. It seems that Russian polymer scientists may be beginning a similar trend in their country. There may come a time when the best way for polymer scientists in America to keep up with work originally published in English will be to have Israelis translate Russian texts, based largely on American papers, into English. Stranger things have happened in the course of world history. In the United States the monetary motivation for writing advanced and specialized scientific texts is not always very great, and the prestige value of such texts is sometimes less than the author could obtain by