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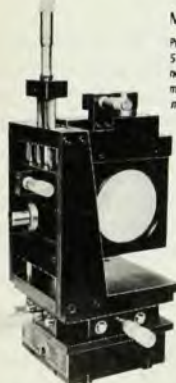
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between groups I and IIa will, of course, inevitably continue. Were it not for this fact, one might be tempted to call Marder's book the last word on the subject.

* * *

Banesh Hoffmann is a Professor of Mathematics at Queens College of the City University of New York. He worked with Einstein and Infield and has recently completed a book with Helen Dukas, Einstein's secretary, entitled *Albert Einstein, Creator and Rebel*.

Lens Aberration Data

By J. M. Palmer

118 pp. American Elsevier, New York, 1971. \$17.00

Palmer's little volume, *Lens Aberration Data*, is the first book of a new series, "Monographs in Applied Optics." The projected titles include *The Optical Transfer Function*, *A Study of Specular Reflection*, *Optimisation Techniques in Lens Design*, and *Metal-Dielectric Multilayers* and if these volumes meet the scientific standard of the first, they will indeed find a wide use in the optical field.

The title, *Lens Aberration Data*, is somewhat misleading and does not really convey the nature of the contents of this volume. No tables of data are included; rather it is the goal of the author to present a discussion of the aberrations of optical systems and the methods of evaluation of any data generated relative to these aberrations.

The first chapter is devoted to ray tracing and the methods of presenting the image defects. He then continues with a discussion of aberration tolerances including a brief discussion of the optical-transfer function and the Strehl intensity ratio. Interferograms are discussed from the point of view of the lens designer, and a program is outlined for the generation of the interferogram to be expected from a system on the basis of the initial design. Finally he presents an appraisal of the methods of analysis and a short consideration of the problem of tolerances in the specification of lens systems.

One of the more interesting aspects of this work is the indication of the computer work that has been done in this analysis and the presentation of results from computer prediction. This represents a somewhat new approach in a monograph and a rather interesting one. With the extensive use of computers today, and with so much information on optical systems

presented in various forms of computer output, one can be sure that these statements of the author will receive considerable attention on the part of the readers.

This will be a very useful book to a diverse audience within the optical community. Certainly engineers concerned with the design of systems that include optical components have needed a survey of this sort for a number of years, and they will find this (and I suspect, the remaining volumes of this series) occupying a prominent position on their shelves. Students will find this review useful and handy in their work and I suspect that many professional opticians will want to dip into it from time to time.

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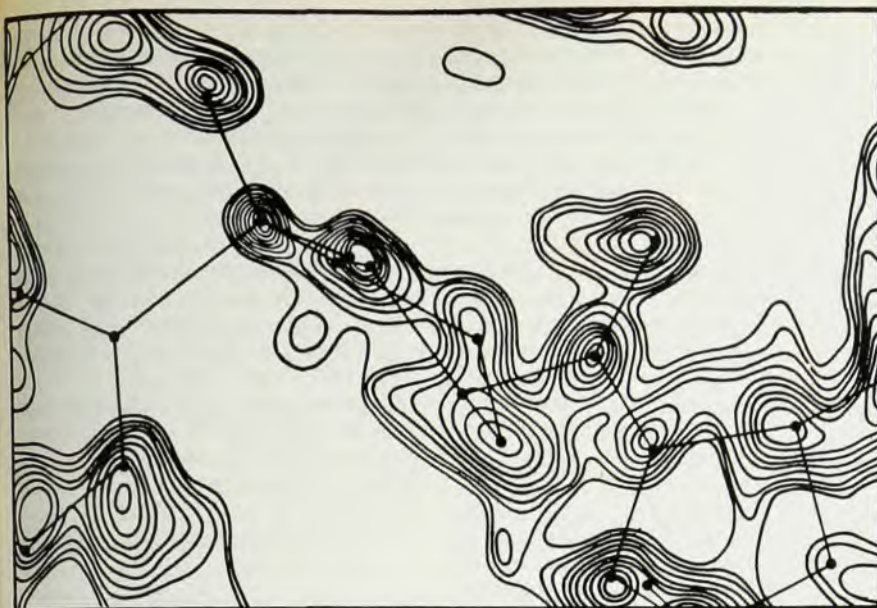
Fourier Methods in Crystallography

By G. N. Ramachandran, R. Srinivasan

259 pp. Wiley, New York, 1970. \$15.95

Crystallography has become a field that is highly productive in the determination of three-dimensional molecular structures. The advent of computers and improvements in instrumentation have made it possible to determine crystal structures routinely from x-ray and neutron diffraction data. One of the fundamental problems in this field of structure analysis is the determination of the structure-factor phase, which cannot be directly measured. As a result, a number of methods have evolved over the years for the estimation of structure-factor phases. The practising crystallographer today has a Gladstone bag filled with a variety of phasing schemes. Some of the methods are specialized, others are applicable generally. Probably the major phasing methods deal with interpretation of Patterson functions or rely on direct methods. The monograph on Fourier methods by G. N. Ramachandran and R. Srinivasan deals with phasing methods that are rather specialized.

As promised in the preface, the book is an account of phasing procedures that have been developed by Ramachandran and his group at the University of Madras over the last 15 years. In a mathematical context, the book is complementary to Martin Buerger's book, *Vector Space*. The methods covered up through chapter 8, however, are not particularly viable or widely used, so that much of the monograph is supplementary to Buerger's work on Patterson functions. In the first three



Fourier synthesis of the centrosymmetric projection of tosyl-L-propyl-L-hydroxoprolin monohydrate ($C_{17}H_{24}O_7S$). Illustrated is a weighted sum function carried out geometrically on the Patterson function. From *Fourier Methods in Crystallography*.

chapters the authors develop and discuss Fourier syntheses of various functions related to x-ray diffraction intensities. Their discussion is made particularly clear by the use of convolution principles. This allows the reader to visualize easily the salient features in the maps that result from the several Fourier syntheses.

The authors do not cover the subject of quantitative electron-density maps from accurate diffraction data. On the contrary, the monograph addresses itself to structure determinations by revealing salient peaks around atomic positions through Fourier synthesis. The importance of phase angles is strikingly illustrated in chapter 4. Large errors in the structure-factor amplitude can be tolerated if one only desires the sites of the atoms.

Chapters 6 through 8 develop types of synthesis that are based on partially known structures. This is really a "boot-strap" operation, which in practice has had some success. Again by use of the convolution theorem, the authors set down the expected strength of the several peaks in the Fourier map. Although the β_{gen} synthesis appears to be the method of choice, it does suffer from singularities that can occur in the Fourier coefficients, so that various ad hoc weighting schemes have been invoked. This is probably why β_{gen} syntheses have not been widely used for structure determinations.

The last part of the book, chapters 9 through 13, is an excellent treatment on phasing utilizing isomorphism and anomalous scattering. Ramachandran was one of the early workers in developing these techniques, which have been of value to the protein crystallo-

grapher. A combination of isomorphous replacement data and anomalous dispersion data can lead to a unique solution of the phase problem. The theory of these two techniques is well illustrated with appropriate figures and the algebra is clearly laid out. The use of anomalous dispersion phenomena in analyzing neutron diffraction data is a bonus topic in chapter 13.

The crystallographer devoted to solving natural products, inorganic structures, minerals or organic molecular crystals will probably find a small niche in his Gladstone bag for this monograph. A protein crystallographer, particularly a student, may well find this book an invaluable reference work. The bibliography although not exhaustive, is sufficiently complete and of value to one in search of Fourier phasing methods.

ROBERT F. STEWART
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Elementary Particle Theory

By A. D. Martin, T. D. Spearman

527 pp. American Elsevier (North-Holland), New York, 1970. \$27.50

There are two reasons why this is more or less the best textbook available to a novice for learning the concepts and techniques useful in phenomenological high-energy physics. The first is that the authors successfully resist the temptation to quote lots of results without adequate detailed explanation;

New Books

Vacuum Metallurgy

Edited by O. Winkler, Blazers Ltd. for High Vacuum Technique and Thin Films, and R. Bakish, Bakish Materials Corp., New Jersey

This vast undertaking represents the first comprehensive review of vacuum metallurgy, described by specialists in both scientific research and industrial application.

CONTENTS: Thermodynamics and kinetics in vacuum metallurgy. Vacuum engineering. Use of vacuum techniques in extractive metallurgy and refining of metals. Vacuum degassing. Vacuum melting. Determination of the gas content of metals by vacuum degassing methods. Vacuum sintering. Vacuum heat treatment. Joining. Vacuum coating. Effect of high vacuum on some important properties of metals and alloys. Conversion table. Author index. Subject index. 1971, 906 pp., 165 tables, 536 illus., \$85.00

Grain Boundaries and Interfaces

Edited by P. Chaudhari and J. W. Mathews, IBM, Thomas J. Watson Research Center in Yorktown Heights, New York

This book contains the proceedings of an international conference on the structure and properties of grain boundaries and interfaces, at the IBM, Thomas J. Watson Research Center, August 23-25, 1971. Contribution to the conference was by invitation only and the contributors represent the outstanding scientists in the field. Post-paper discussions have been printed in full. 1972, approx. 650 pp., \$48.50

Vacuum Technology

An Introduction

By L. G. Carpenter, Consulting Physicist

CONTENTS: Vacua and vacuum technology. Conductance and pump speed. Vacuum pumps. Measurement of pressure, materials and the design of apparatus. Ultra-high vacuum. Applications of vacuum technology. Appendices. Author index. Subject index. 1970, 144 pp., 16 diagrams, \$9.75

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