Imperfections in Crystals. By H. G. Van Bueren. 676 pp. (North-Holland, Amsterdam) Interscience Publishers, Inc., New York, 1960. \$16.75. Reviewed by R. Smoluchowski, Princeton University.

THE main reaction to the book is an admiration of the author's courage in tackling the seemingly intractable field of crystalline imperfections. The reviewer knows of several overoptimistic authors, including himself, who blithely embarked upon manuscripts dealing with this subject and soon gave it up. The present book fulfills admirably the goal which the author set himself. To use his own words:

The attention in this book is primarily focused on the phenomena related to the physical lattice imperfections such as dislocations, vacancies, interstitial atoms, and on their combinations, e.g. vacancy pairs and larger clusters of point defects, dislocation arrays such as grain boundaries, etc. It did not seem practical also to include in the book a discussion of chemical imperfections in crystals. Consequently, the variety of effects that are caused by the introduction of foreign atoms (in more than very small traces) are not systematically dealt with. For instance, the phenomenon of fluorescence remains undiscussed, the fluorescence of crystals being intimately related to the presence of foreign atoms. Again, the important electrical properties of donor and acceptor elements in the semiconductors germanium and silicon are only briefly mentioned and not treated in detail. Even those phenomena peculiar to metallic alloys, such as ordering processes, nucleation and growth of precipitates etc., are only very briefly described.

Similarly certain electronic imperfections are omitted. The omissions and limitations of the scope of the book are justified by the existence of rather full treatments elsewhere. This choice permitted the author to fill the biggest gap in the broad spectrum of imperfections literature in a highly satisfactory manner. One might perhaps question the relative amounts of space assigned to various topics or point out misprints or incomplete references, but to dwell upon these minor drawbacks would be out of place in comparison with the positive qualities of the book. The book is written without the need for theoretical sophistication on the part of the reader and is therefore suitable as a reference for a wide variety of scientists and engineers. It is also eminently suitable as a base for a course in a curriculum in the now suddenly popular "materials sciences" (whatever this term is supposed to mean). Excellent illustrations and many references add to the value of the book which is heartily recommended to all inquiring minds.

An Introduction to Statistical Thermodynamics. By Terrell L. Hill. 508 pp. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1960. \$9.75. Reviewed by J. Gillis, The Weizmann Institute of Science.

THERE is at least one distinguished precedent for the idea that an author, having produced a difficult and excellent book on statistical mechanics, should follow it with an excellent but easier work suitable for the use of chemists. And comparison of the book under review with Fowler and Guggenheim brings out quite dramatically the enormous increase in the range of problems which have since been brought within the domain of statistical mechanics.

Prof. Hill's work is intended for chemists, but many of these may find it somewhat difficult going. However, provision is made even for them. The material has been skillfully chosen and judiciously arranged, so that courses of varying degrees of difficulty can be built up by selecting appropriate sections of the book. Three such courses are suggested in the preface, but an experienced teacher could easily make up many more and adapt them to the needs (and capabilities) of his classes.

Part 1 of the book is devoted to a careful exposition of basic postulates and ideas, starting from ensembles and leading up to the third law of thermodynamics.

Part 2 deals with systems composed of independent molecules or subsystems. The coverage is not intended to be complete, but the selection of problems dealt with is sufficient to bring the reader within reasonable distance of most of the subject. The mathematical treatment is simplified as far as the facts of nature can possibly permit, while adequate and up-to-date references are given to more sophisticated work. The subjects include not only such standard problems as ideal monatomic, diatomic, and polyatomic gases, specific heats and vibrational frequencies of crystals, and chemical equilibrium and reaction rates in ideal gas mixtures, but also some less usual topics, such as the behavior of an ideal gas in an electric field.

Part 3 covers systems of interacting molecules. Here the mathematics becomes harder and the selection of topics necessarily less complete. The actual choice of what to put in must have posed quite a problem for the author, and he is to be congratulated on the result. There is a discussion of lattice statistics, but almost entirely from the approximate point of view. For the more exact mathematical treatment of Onsager and others, the reader is referred to Hill's Statistical Mechanics, Imperfect gases and their virial expansions follow. Liquids, and especially dilute solutions, take up the next four chapters. All the useful approximate theories are given, the Debye-Hückel theory of electrolytes and Kirkwood's theory of solutions in some detail. This is especially welcome since the concepts are of great interest in the study of plasmas, a problem of such wide current attention. The business part of the book ends with a discussion of concentrated solutions, polymer and polyelectrolyte solutions, and gels.

The last chapter, on quantum statistics, is by nature more of an appendix and is followed by seven further appendixes on various special mathematical topics.

In a book of this sort there is always the difficulty of judging how much mathematics to put in. There is indeed the danger of giving enough to bewilder the nonmathematician while still failing to satisfy the



### Research

Non-Classical Optics. Image assessment, lasers, detectors, thin films, physical optics.

Fiber Optics. Solid state and infra-red, dielectrics, waveguide studies, techniques.

### Systems

Infra-Red. Spacial filtering, background studies, signal processing. Reconnaissance and communications.

## Manufacturing

**Instrumentation.** Refractometers, spectrophotometers, fringe counters, analytical and measuring instruments.

Thin Films. Interference filters, band-pass filters, optical coatings, bicolor and multicolor reticles.

**Fiber Optics.** Fused face plates, flexible aligned bundles, image dissectors, light funnels, special fiber optics devices.

**Detectors.** Ultra-violet photon counters, visible spectrum photocells.

Call us to discuss your requirements.

Engineers, scientists: Demanding but rewarding opportunities with expanding organization are open for qualified men. Exceptional living, educational, recreational facilities within minutes on the San Francisco Peninsula. Please write Dr. N. S. Kapany, Director of Research.



OPTICS TECHNOLOGY, INC

248 HARBOR BOULEVARD • BELMONT, CALIFORNIA • LYTELL 1-0358 (Area Code 415)

### A checklist of new Interscience books in physics

#### Techniques of High Energy Physics

edited by DAVID M. RITSON, Department of Physics, Massachusetts Institute of Technology 1960 544 pages \$16.75

#### Physics of the Solar Chromosphere

by RICHARD N. THOMAS, Boulder Laboratories, National Bureau of Standards, and Grant Athay, High Altitude Observatory, University of Colorado

1961 416 pages \$15.50

#### Fast Neutron Physics

#### Part 2: Experiments and Theory

edited by J. B. Marion, Convair, and J. L. Fowler, Oak Ridge National Laboratory 1961 In press

#### Part 1: Techniques

1960 1007 pages \$29.00

#### Introduction to the Theory of Ionized Gases

by J. L. Delcroix, University of Paris, translated by Melville Clark and D. J. BenDaniel 1960 162 pages paper: \$2.50/cloth: \$4.50

#### An Introduction to Celestial Mechanics

by T. E. Sterne, Smithsonian Astrophysical Observatory, Cambridge, Mass.

1960 218 pages paper: \$2.50/cloth: \$4.50

#### General Relativity and Gravitational Waves

by J. Weber, University of Maryland 1961 Approx. 208 pages paper: \$2.50/cloth: \$4.50

#### Introduction to Elementary Particle Physics

by R. E. Marshak and E. C. G. Sudarshan, University of Rochester

paper: \$2.50/cloth: \$4.50

#### Physics and Archaeology

1961

by M. J. Aitken 1961 194 pages \$6.00

#### Atomic Energy Waste Its Nature, Use and Disposal

212 pages

edited by E. GLUECKAUF, Atomic Energy Research Establishment, Harwell 1961 432 pages \$14.00

#### Basic Principles of Fission Reactors

by W. R. Harper 1961 300 pages \$7.50

# INTERSCIENCE PUBLISHERS, INC.

250 Fifth Avenue, New York 1, N.Y.

mathematician. For example, there is a discussion on pp. 264–5 of the validity of an argument which is crucial to the calculation of the virial expansion for an imperfect gas. The problem raised is a real one, but the answer given does not solve it. The difficulty is not how to calculate the coefficients, given that the expansion (15.7) exists. That is a purely formal question and one can assume |z| to be as small as we please. The question is whether the expansion (15.7) exists at all, and the answer to that is assumed in the mathematical justification. No actual harm is done, and the expansion is certainly correct. But it is an example of the difficulties which must be extra any author in the narrows between Scylla and Charybdis.

The introduction to Mayer's cluster diagrams is beautiful and simple. Although the actual estimation of the integrals is beyond the scope of the book, we are given an idea of the basic idea behind the approximation. There is a misprint in diagram (15–37) which might confuse students encountering the idea for the first time.

This is an excellent and beautifully produced book, probably the best of its kind so far. It is very strongly recommended to chemists who are prepared to invest enough work to be able to understand what they are doing, and to physicists who seek a wider picture of the problems of statistical mechanics.

Le Bruit. No. 855 of "Que sais-je" Series. By René Chocholle. 128 pp. Presses Universitaires de France, Paris, 1960. Paperbound 3.70 NF. Reviewed by R. Bruce Lindsay, Brown University.

ALL thoughtful persons agree that one of the great hazards of modern civilization is the increasing noise to which advancing technology is exposing the human race. Someone has said that during a large part of our waking hours most of us are immersed in a sea of unwanted sound. The problem has not gone without attention by acousticians and an increasing literature is available on the subject of noise and its prevention. The little book under review is a popular French survey of the principal aspects of the subject which any educated person ought to know for his ultimate good. It is one of the latest in a very large series of short, popular paperbacks with the general title "Que sais-je?". If they are all as well written as this, they can be highly recommended.

In the short space of a little more than 100 small pages, the author has compressed an admirable little treatise containing a clear account of sound and the ear, the general characteristics of noise, the measurement of noise levels, the effects of noise on living organisms, the supportable limits of noise, methods of noise prevention, the protection of the ear against noise and possible cure of auditory injury due to noise, and finally the necessity for legislation against unnecessary noise in all phases of life.

The book does not pretend to be a scientific treatise, but the presentation is clear and accurate and illustrated