Book Reviews

Statistical Mechanics

Introductory Statistical Mechanics for Physicists. D. K. C. MacDonald. Wiley, New York, 1963. x + 176 pp. Illus. $6.75.

Statistical Mechanics. Kerson Huang. Wiley, New York, 1963. xiv + 470 pp. Illus. $10.75.

D. K. C. MacDonald's book, *Introductory Statistical Mechanics for Physicists*, is not so much a book on statistical mechanics as it is a book that tells about how to apply elementary statistical mechanics to simple problems. The treatment is based on the Boltzmann-Planck hypothesis which relates the entropy of a system to the number of microscopic states consistent with a given macroscopic state. The book is clearly written and has a pleasant flavor, seasoned here and there with interesting comments and quotations.

MacDonald seems to feel that the use of the grand ensemble lies "outside the immediate province of physics." In my opinion it would be regrettable for students of physics to acquire such a prejudice, since apart from the foundations of the subject a great deal of the modern work in statistical mechanics makes extensive use of grand ensembles.

The author's use of the term "real chemical gas" is somewhat misleading, since the term "real," as it is used in statistical mechanics, customarily implies that interactions between the constituent molecules are taken into account. When the same type of argument as that used by the author is applied to ensembles, it leads, of course, to results of general validity for "real" systems. There is an interesting appendix on intermediate statistics, which is based on the author's own work.

MacDonald's book can be recommended to those who wish to acquire quickly a working knowledge of elementary applications of statistical mechanics.

Frequently one hears the complaint that in this country the experts do not take time to write texts or treatises on their own subjects, or that when the expert does write, the result is incomprehensible to all but a handful of elite in the field. Kerson Huang offers as evidence to the contrary his book *Statistical Mechanics*. Huang, one of the leading experts on the subject, has written a clear and comprehensive book directed to graduate students in physics, but certainly highly worth reading by anyone who has any interest in statistical mechanics. The book is divided into three parts: (i) Thermodynamics and Kinetic Theory, (ii) Statistical Mechanics, and (iii) Special Topics in Statistical Mechanics.

The first six chapters are devoted to ". . . a brief but self-contained discussion of thermodynamics and the classical kinetic theory of gases . . . ." Huang argues that, from the pedagogic point of view, this presentation is imperative, since it is the aim of statistical mechanics to explain thermodynamics. On the other hand, the classical kinetic theory "nearly" explains, on a molecular basis, the approach to the equilibrium or thermodynamic state. The presentation is to the point, precise, accurate, and readable. This first section is concluded by a short but clear account of the Chapman-Enskog method for solving the Boltzmann equation.

The next nine chapters consider the fundamentals of statistical mechanics and provide enough examples and applications to illustrate the general principles. Here one finds the various ensembles, both classical and quantum, treated in a comprehensive and straightforward manner. The presentation is postulational, a method that seems appropriate for a text of this nature; as the author points out, the general laws of statistical mechanics, including the approach to equilibrium, have not yet been derived rigorously from first principles.

The last four chapters are devoted to the special topics: the Ising model, liquid helium, and the hard-sphere Bose gas. These topics are interesting examples of some present-day problems in statistical mechanics, and in this book they are presented in a way that makes it possible for the student to profit from a study of the current literature. One can hardly quarrel with Huang's choice of topics, but one could hope that a later edition would contain a chapter on the interacting electron gas.

With the exception of chapter 6, on the Chapman-Enskog method, the first 14 chapters have exercises to be worked by the student. There are appendixes on the N-body problem, the pseudopotential, and two theorems of Lee and Yang.

This book is recommended without reservation to students and scholars, to physicists young and old, and to those of sufficient maturity in other fields who wish to learn something in depth about this fascinating subject.

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Fourier Transformations

Direct Analysis of Diffraction by Matter. R. Hosemann and S. N. Bagchi. North-Holland, Amsterdam; Interscience, New York, 1962. xxi + 734 pp. Illus. $21.75.

In a penetrating paper written in 1940, P. P. Ewald observed: "For discussing x-ray diffraction the reciprocal lattice has found general application, but it is not generally realized that the reciprocal lattice is only an incomplete representation of the Fourier transform of the crystal and that much clearness of discussion can be gained by making full use of the conception of the Fourier transform." Despite Ewald's illustration of the potentialities inherent in this approach to structure analysis, the associated techniques have been used very little in research, and there has been no detailed formal presentation of diffraction from this powerful point of view. As the present authors