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Book Review: *Statistical Mechanics and Thermodynamics*

Statistical Mechanics and Thermodynamics. Claude Garrod, Oxford University Press, Oxford, 1995.

This book is novel in the approach that it takes to the discussions of statistical mechanics and thermodynamics, in the applications covered, and in the distribution of material. There are approximately 320 pages of text, 250 pages of supplement and exercises, and 20 pages of computer programs. The book contains a computer disc with programs on Monte Carlo calculations.

Whenever an author departs from the traditional mode of presentation, the assessment of his or her success depends on whether new insights are obtained, whether the approach is better from the pedagogic point of view, and whether the selection of material is more useful. This is particulary true if the book is intended to be a next for undergraduate and graduate courses. The author has used this material in manuscript form at the University of California, Davis.

The discussion of the fundamentals of statistical mechanics and thermodynamics oscillates between segments which are considerably more rigorous than usual and portions which are less rigorous and complete. There is a detailed discussion of probability theory, but relatively little discussion of classical mechanics, the quasiergodic theorem, and Poincaré reccurrences. The thermodynamic limit is treated in detail, but the differences of the factorization properties of distribution functions at large coordinate separations in the various ensembles are not emphasized. The foundations of thermodynamics are presented as a set of axioms (similar to the treatment of Callen). However, the fact that thermodynamic calculations can be carried out only for equilibrium states—subject to various constraints—is not emphasized. There seems to be no distinction between quasistatic irreversible and reversible processes. The discussion of nonequilibrium

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statistical mechanics is brief but throught-provoking, particularly with respect to entropy increases and the arrow of time.

The selection of the applications of equilibrium statistical mechanics that should be treated in a text is, to a certain extent, a matter of taste. In this book there is relatively little discussion of the properties of distribution functions, gases and liquids, and crystals (except for Debye theory). On the other hand, there are nice treatments of magnetic systems and critical phenomena and renormalization theory.

The most valuable portions of this book are the supplement and exercises. If the reader studies these carefully she or he will learn a great deal about subjects that are only briefly treated in the text. This portion of the book is an excellent pedagogic tool.

I am not sure that I would recommend this book as a text for either undergraduates or graduates. I do recommend that students and researchers look through the supplements and exercises since they contain many interesting nuggets.

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