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Book Review

A Modern Course in Statistical Physics. L. E. Reichl.
University of Texas Press, Austin, Texas, 1980.

This book is a very ambitious and, on the whole, an extremely successful undertaking. It is designed as a text which will lead students from the foundations of statistical mechanics to the frontiers of developments in this field. It contains numerous examples and problems to aid the student's understanding. Because of the breadth and depth of the advanced material presented, the book is also useful as a reference book for workers in the field.

Chapters 2–4 contain an introduction to thermodynamics and a fine discussion of the thermodynamics of phase transitions and critical exponents. Chapters 5 and 6 discuss probability theory and the master equation. Chapters 7 and 8 discuss the foundations of statistical mechanics and ergodic theory.

The discussion of the applications of statistical mechanics to equilibrium and nonequilibrium systems is the strong point of this book. In most cases, the discussion starts with classical development and brings the reader up to modern, sophisticated treatments.

Chapter 9 is entitled Equilibrium Statistical Mechanics: Soluble Models. One might wish that the Born–von Karman theory of heat capacities were discussed here. Chapter 10 on Equilibrium Fluctuations and Critical Phenomena is excellent and treats scaling and renormalization group theory as well as more elementary topics. Chapter 11 on classical fluids and Chapter 12 on quantum fluids are well done, although there should be a longer discussion of Chandler–Anderson–Weeks theory.

The remainder of the book is devoted to time-dependent phenomena and treats elementary transport theory, hydrodynamics and Onsager's relations, the fluctuation–dissipation theorem, long-time tails, and nonequilibrium phase transitions. I know of no other text (and few monographs) that treats these subjects as well as the treatment here.

In general, the book improves as one moves from foundations to modern applications of statistical mechanics. Most of the negative com-

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ments that I would make have to do with the thermodynamics and probability theory chapters. The definition of an insulating wall on p. 19 is not correct and the definition of an extensive property on p. 31 is confusing. The most important negative comment has to do with the fundamental equation given in Eq. (2.65):

$$TdS \geqslant dU - YdX - \sum_j \mu_j' \, dN_j$$

where U is the internal energy, Y a generalized force, and X a generalized displacement. If Y is a state function, as is implied by Eq. (2.67b), then only the equality in this equation is correct. The inequality holds only if Y is an external force which is not balanced by the corresponding state function. The treatment of the entropy of mixing is also not clear. Finally—a minor point—it is not true, as stated on p. 143, that a probability density is determined if all its moments are known.

Despite these few negative comments, I am very impressed with this book and strongly recommend it to research workers and teachers of statistical mechanics.

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Book Review

Thermodynamics and Statistical Mechanics. Peter T. Landsberg. Oxford University Press, New York, 1979, 461 pp., $26.00

Despite its general title this book is rather personal both in the style of writing and in the selection of topics. It covers the standard subjects succinctly but intuitively; extended treatment of the author's favorite subjects, such as energy conversion and cosmology, might be an extra bonus for more enterprising students. Use of the text as a teaching instrument is greatly enhanced by the extensive set of problems throughout the book, and, better yet, solutions at the end. One negative feature is appearance. In these days of word processors, minicomputers, electronic text editors, and automated typesetting, it should not be necessary to print a book from camera-ready typescript.

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