Journal of Statistical Physics, Vol. 61, Nos. 1/2, 1990

Book Review: *Statistical Theory of Heat*

Statistical Theory of Heat: Nonequilibrium Phenomena. Wilhelm Brenig, Springer-Verlag, New York, 1989.

This book is divided into three parts: correlation functions and kinetic equations; irreversible thermodynamics; and calculation of kinetic coefficients. The author uses correlation functions a a unifying approach to all of the topics treated. On the whole this is a good idea, but in some cases complicated manipulations have to be used in situations where other approaches are simpler and more straightforward.

The author is to be commended for the large number of topics treated in Parts II and III. The treatment in these parts is, in general, brief, but the salient features are discussed and a sufficient number of references are given for further study. The nonspecialist can learn a great deal by careful reading of these parts.

Part I introduces the concepts of correlation functions and their properties, response theory, Langevin equations, Brownian motion, and an interesting discussion of entropy and irreversibility. In my opinion, Part I is the weakest part of the book and can be confusing for students. The first equation in the book, (2.1), gives an expression for the quantum statistical average value of an observable $\langle A(t) \rangle = \mathrm{Tr}(A(t)\,\rho(t))$. To be sure, discussions of Schrödinger, Heisenberg, and Dirac pictures follow this equation, but the beginner is bound to be confused. There is no notational distinction used between nonequilibrium averages and equilibrium averages. The local equilibrium distribution function is introduced in Eq. (2.21), but no rationale for its use is presented aside from the fact that it is simple. Brownian motion is first discussed without the use of the Langevin equation and needless complications arise. There are a few misprints: e.g., the limit of integration in Eq. (3.6) should be ∞ instead of t and there is a factor of 2 missing in Eq. (38.4). I presume that Greenwood in the caption to Fig. 2.2 should be Green.

0022-4715/91/0100-0499$06.50/0

In summary, this is a useful book to peruse, but I would not recommended it as a text except for advanced special topics courses in statistical mechanics.

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