



“Physics in Canada”
Book Review

“La Physique au Canada”
Critique de livre

An Introduction to Chaos in Nonequilibrium Statistical Mechanics, Edited by J.R. Dorfman, Cambridge University Press, 1999, pp: 287, ISBN 0-521-65589-7 (pb); Price: US\$35 (pbk).

While equilibrium statistical mechanics is a standard part of the undergraduate physics education, nonequilibrium statistical mechanics and chaos are rarely included in the curriculum. This book gives a taste of the problems facing the unsuspecting student venturing beyond the comfortable realm of equilibrium.

What are the limits of applicability of the “ergodic hypothesis”? How does “irreversibility” occur? How does one obtain the “Green-Kubo formulae” non-perturbatively? How can I calculate the transport coefficients in various cases and how do fractals and chaos fit in with all this? *An Introduction to Chaos in Nonequilibrium Statistical Mechanics* provides a broad overview of these and other interesting topics at a level appropriate for upper-undergraduate and graduate students.

The book starts by spending a considerable amount of time putting things into perspective: it discusses Boltzmann's ergodic hypothesis, the derivation of the Boltzmann equation, Kac's ring, Liouville's equation, the definition of a “mixing system”, etc. It then goes on to derive the Green-Kubo formulae, to analyze the Lyapunov exponents and the Kolmogorov-Sinai entropy and eventually it tackles the subject of chaos using the array of tools constructed in the preceding chapters. It then goes back full-circle to reanalyze Boltzmann's equation on a new level.

Chaos in Nonequilibrium Statistical Mechanics is written in a very engaging way, unusual for such a “dry” topic. References to Woody Allen, the inclusion of nice illustrations (e.g. pictures of a cat's face subjected to a variety of transformations) and ample discussion of where the author is going with a particular derivation all serve to make the reader's life a lot easier. Each chapter is concluded by a set of exercises that lets the reader verify his or her understanding of the material.

This book (or even its first nine to twelve chapters) ably serves as useful supplemental reading for any course in nonequilibrium statistical mechanics.

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