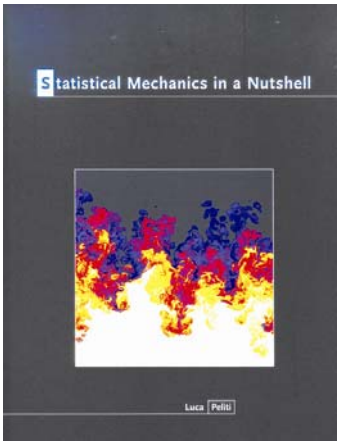

Statistical Mechanics in a Nutshell. Luca Peliti. (Translated from the Italian by Mark Epstein.) Princeton University Press, Princeton, New Jersey, 08540, USA. 2011. 398 pp. Price: US$ 75.00/ £52.00.

This book, by the well-known statistical physicist Luca Peliti, was published originally in Italian as *Appunti di meccanica statistica*. This translation, by Mark Epstein, has now been brought out by Princeton University Press in its *In a Nutshell* series, which is a '...new series of concise, accessible, and up-to-date textbooks for advanced undergraduates and graduate students on key subjects in the physical sciences'. The book aims to be '...both a beginner's and an advanced course...'; it succeeds in achieving this goal, to the extent that is possible within the confines of a nutshell format.

The first five chapters, which are devoted to (1) An introduction, (2) Thermodynamics, (3) The fundamental postulate, (4) Interaction-free systems and (5) Phase transitions, constitute the part of this book that is for beginners. Chapter 1 lays out the basic subject matter of statistical mechanics; this is a brief overview; a serious student must augment this with the discussion in other books (some of which are listed in the recommended reading at the end of this chapter). Chapter 2 contains a good discussion of thermodynamics; the author mentions that he follows quite closely the treatment in the textbook of Callen[1]. Chapter 3 introduces fundamental postulates and definitions, such as phase space, entropy, quantum states and various ensembles. Chapter 4 contains fairly standard discussions of several non-interacting systems, e.g. harmonic oscillators, photons and phonons, Bose and Fermi gases, and Bose–Einstein condensation (the author insists on calling this Einstein condensation). Chapter 5 consists of a good discussion of phase transitions, at a level that is considerably more sophisticated than in an average, beginner's text on statistical mechanics; e.g. this chapter includes symmetry breaking, order parameters and the Peierls argument. These five chapters, on the basics of statistical mechanics, give a good overview of the subject. However, they have two limitations: (a) As in many texts on this subject, the perspective and the presentation of material here is distinctly theoretical; there are hardly any plots with data from experiments. (b) The author has chosen '...to include only a brief introduction to the kinetic theory of gases...' and he does '...not even mention Boltzmann's equation...'; these exclusions are hard to defend.

The remaining chapters, which comprise the advanced part of the course, cover (6) The renormalization group (RG), (7) Classical fluids, (8) Numerical simulations, (9) Dynamics and (10) Complex systems. The author's efforts here are commendable. The chapter on the RG covers succinctly real- and momentum-space RGs and the basic theory (e.g. relevant and irrelevant operators). Chapters 7 and 8 give adequate introductions to classical fluids and numerical simulations, but the coverage of the material here is limited, perhaps because of the constraints of the nutshell format. Chapter 9 on dynamics provides a good introduction to Brownian motion, the fluctuation–dissipation theorem, Onsager reciprocity and related topics. Chapter 10 has discussions of linear polymers in solution, percolation, and disordered systems at a level that is rarely encountered in such textbooks.

The book ends with brief discussions of Legendre transformations, the saddle-point method, elements of probability theory and Markov chains in Appendices A, B, C and D respectively.

In summary, the author has written a good, modern text on statistical physics. However, it is expensive (a list price of US$ 75), especially for students in India. Furthermore, several other good texts have appeared in this area over the last decade or so[2–14]; many are available in inexpensive Indian or South-Asian editions; and excellent notes on this subject are available free on various websites (see, for example, ref. 15). Serious students of this subject would do well to consult all these books and sources.

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