

niques that allow the extension of ray theory beyond its theoretical limits: the Maslov approach, Born scattering theory, and the Kirchhoff surface-integral method—each of which helps solve a different shortcoming of ray theory. An appendix provides additional useful mathematical background.

Chapman's book is most suitable for a graduate theoretical course in high-frequency seismology and could be compared with *Quantitative Seismology: Theory and Methods* (W. H. Freeman, 1980) by Keiiti Aki and Paul Richards. Chapman's text may serve a similar role for high-frequency seismology as *Theoretical Global Seismology* (Princeton U. Press, 1998) by Francis A. Dahlen and Jeroen Tromp does for normal-mode theory. Both texts expand beyond the already sophisticated basics of the field as presented in Aki and Richards's book.

Fundamentals of Seismic Wave Propagation covers more or less the same ray-theory material found in Brian L. N. Kennett's two-volume *The Seismic Wavefield* (Cambridge U. Press, 2001 and 2002). Yet Chapman stresses more the mathematical elegance of seismic wave propagation and places little emphasis on actual

observations. Nonetheless, mathematicians and mechanicians will certainly appreciate the author's elegant presentation of the field.

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Rubber and Rubber Balloons: Paradigms of Thermodynamics

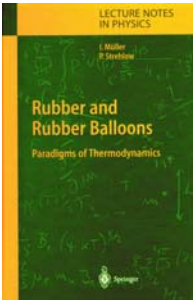
I. Müller and P. Strehlow
Springer-Verlag, New York, 2004.
\$59.95 (123 pp.). ISBN 3-540-20244-7

Books on physics are rarely amusing—which is probably a bad thing. Perhaps if the work of physicists revealed more of the thoughtful irreverence that many display in person, the discipline would not be quite so dry and imposing to the general public. So I mean it as praise when I say that the small volume *Rubber and Rubber Balloons: Paradigms of Thermodynamics* by Ingo Müller and Peter Strehlow is amusing. To get a sense of the authors' playful spirit, one has only to turn to the end of chapter 8, where a photo-

graph of 20 balloons dangling off the sides of a Lucite tube looks like a bid for installation at New York City's Museum of Modern Art. At the same time, the book's serious subtitle signals the authors' intention of using a whimsical topic to illustrate deep and general physical principles.

Rubber and Rubber Balloons is not only amusing, it also has a narrative. It begins with a very simple account of the physics involved in blowing up a balloon; a set of puzzles having to do with the way the pressure changes as the balloon expands is then posed. While reading through the chapters, one travels with the authors as they are tripped up by inconsistencies in the literature and false interpretations of data. They eventually resolve an old problem that concerns a symmetry-breaking state of rubber. The physical point in question is unfortunately not especially significant in itself; yet the account, complete with cliffhanger at the end of chapter 3, is engaging.

The technical level of the book, however, oscillates wildly. Chapters 1, 8, and 10 have almost no equations and are practically suitable for high-school students.



Chapter 3 introduces the formalism of nonlinear elasticity, and chapter 9 presumes knowledge of differential geometry. Students attempting to learn the more advanced subjects from the book will likely run into difficulties. For example, one of the most important facts about rubber is that it is nearly incompressible. That fact first appears in chapter 2 and is then invoked as needed without ever being explained. In chapter 3, the authors mention that “an arbitrary pressure may be added to the stress without affecting the motion of an incompressible body.” That point is true but similarly unexplained. To my taste, the theory in chapter 3 is harder to follow than the comparable discussion by L. R. G. Treloar in his third edition of *The Physics of Rubber Elasticity* (Oxford U. Press, 1975), which is not explicitly mentioned in the bibliography. (A paperback reissue of Treloar’s classic text is scheduled for publication in the US this coming winter.) Also, chapter 9, titled “Stability of the Spherical Shape,” for which the authors apologize as it contains only a negative result, is quite difficult to follow; but with a nicely readable history of rubber in chapter 11, Müller and Strehlow redeem themselves.

One of the intents of the authors is

to use balloons as the occasion to study certain fundamental ideas, including hysteresis and spontaneous symmetry breaking. Those ideas do arise in the investigation of balloons. Symmetry breaking emerges in the authors’ discussion of how rubber behaves when one stretches it along two axes. Hysteresis shows up somewhat less naturally through their examination of many balloons attached to a column at a fixed pressure. By the time the book gets around to hundreds of interacting balloons, the ideas are obscured by an artificial setting. For a study of hysteresis, the Preisach model in ferromagnetism is simpler and more standard.

Other shortcomings of the book, which include occasional bits of ungraceful English, are probably due to its origins in lecture notes. The publisher is selling the book, which was written, illustrated, and probably largely typeset by the authors, for \$60—or 50 cents a page. I find myself wondering how long the physics community will continue to support spending so much on such volumes when the proceeds do not go to the authors, high prices limit access to the work, and researchers support a distribution network that the internet is making obsolete.

Price aside, *Rubber and Rubber Balloons* is an engaging supplement for courses on statistical mechanics or soft condensed matter physics. It provides a simple and familiar setting in which to explore some of the most important ideas of those subjects.

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Equilibrium and Non-Equilibrium Statistical Thermodynamics

Michel Le Bellac, Fabrice Mortesagne, and G. George Batrouni
Cambridge U. Press, New York, 2004. \$75.00 (616 pp.). ISBN 0-521-82143-6

As a physicist who has spent several decades in industry and only used statistical mechanics occasionally, I have lost track of new textbooks on the subject. For 25 years I was president of Data Transport Systems Inc in New York City and occasionally held visiting positions at many research organizations, including the Institute for Advanced Study in Princeton, New Jersey, and CERN. Now, retired to resume an academic life, I find it a pleasant task to browse new books.