state physicists, but also by any other physicist who wants a relatively painless introduction to these techniques.

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Foundations of Laser Spectroscopy

S. Stenholm
268 pp. Wiley, New York, 1984.
$36.95

Since the invention of the laser some 25 years ago, the number of uses that spectroscopists have found for it is, to say the least, large. Not only have conventional spectroscopists benefited, but whole new fields have come into being through laser technology. The subject matter is therefore extensive. To expect to cover it comprehensively in a single, readable book is unreasonable. Stenholm, realizing that the field is a mature one with many books already published on the subject, has instead chosen to write a book that focuses on selected topics in this field. Designed as a textbook for readers with knowledge of quantum mechanics and classical electrodynamics, the work's emphasis is on applying density-matrix techniques to the derivation of the observable properties to be expected from two- and three-level systems under the influence of strong, monochromatic electromagnetic fields. In addition, the book deals with the effects of laser-field fluctuations on measured signals. This choice of emphasis allows the self-contained treatment of, for example, laser theory, saturation spectroscopy, Doppler-free spectroscopy, power broadening and multiphoton effects.

On the whole, we feel the book is valuable both as a textbook and as a reference for researchers working with lasers. In large part this value derives from the detailed and thorough derivations that allow one to follow closely the mathematical developments. In addition, the extensive examples of the application of the density matrix serve as a guide to the use of this powerful device in optical spectroscopy. Another valuable feature is a section at the end of each chapter giving a bibliography and original references pertinent to the subject matter of that chapter.

There are, however, two features of this book that prevent it from being an account of the foundations of laser spectroscopy in the broad conventional sense that most texts address. First, the heavy mathematical emphasis sometimes tends to suppress details of the physical importance of the quantities derived. Second, the book selects topics in laser spectroscopy that pertain to strong interactions between the radiation field and matter. Nonlinear optical processes, such as coherent anti-Stokes Raman spectroscopy, are not discussed in the book. With this in mind, the reader will find that the book gives a very good account of the foundations of selected topics in laser spectroscopy.

All in all, the book is a welcome addition to the field of lasers and their modern applications. We also recommend it for anyone wishing a detailed and thorough exposition of many important aspects of lasers and coherent laser spectroscopy.

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Introduction to Plasma Physics and Controlled Fusion Volume 1: Plasma Physics, Second Edition

Francis F. Chen
(421 pp. Plenum, New York) 1984.
$24.50

The controlled-nuclear-fusion program is, after three decades of intensive research, on the verge of achieving its first major goal—the creation of well-confined, hot plasmas that satisfy Lawson's criterion. The path from this first step to commercial energy production is still long and thorny: Extremely complex engineering and material problems must be solved, and ways must be found to improve the economic aspects of present reactor designs. A major obstacle is the fact that the plasma physics of fusion devices is still insufficiently understood.

Frank Chen's book is an undergraduate text on the plasma physics that underlies controlled thermonuclear fusion and space physics. It is a revised and expanded version of his *Introduction to Plasma Physics*, published in 1974. There exist a variety of fine textbooks on plasma physics for graduate students, but only a few undergraduate books are available. Actually, I can think of only one other book presently in print: Weston Stacey's *Fusion* (Wiley, New York, 1984). However, Stacey's excellent little monograph is radically different from Chen's, both in format and in content. Stacey concentrates on fusion reactor technology, whereas Chen deals with plasma physics.

The seven main chapters of Chen's book deal with single-particle orbits, fluid equations, plasma waves, diffusion and resistivity, plasma equilibrium and stability, kinetic theory and nonlinear plasma phenomena. In a broad field such as plasma physics, no text can be complete, particularly at the undergraduate level. The selection of material seems well balanced and covers the standard range of topics for a plasma-physics course. Occasionaly oscillograms from actual experiments or a discussion of fancy soliton solutions of nonlinear equations provide for lively reading. The first edition is known for its tutorial qualities; the second retains them: It is easy to read, it is well thought out, and it has all those neat illustrations. There are many simple physical models, and the mathematics is always kept transparent. I often find our first-year graduate students secretly reading Chen when they become disgusted with their aloof professors.

A comparison with the 1974 edition shows that drastic changes have been made to the chapters on kinetic theory and on nonlinear phenomena. New sections were added on the plasma dispersion function, the hot- and cold-plasma dielectric tensor, Bernstein waves, the Korteweg–de Vries equation and the nonlinear Schrödinger equa-