

## New Books **FREE**



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I recommend this book. Because of its good writing, its reliability, its choice of material, and its excellent degree of coverage, it is a good text for beginning annihilators and a handy reference for their professors.

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## Photonics: Linear and Nonlinear Interactions of Laser Light and Matter

▶ Ralf Menzel  
*Springer-Verlag, New York, 2001.*  
\$89.95 (873 pp.).  
ISBN 3-540-67074-2

Ralf Menzel's ambitious *Photonics* aims to "assemble the necessary knowledge ranging from the basic principles of quantum physics to the methods describing light and its linear and nonlinear interaction with matter, to practical hints on how the different types of lasers and spectroscopic and other measuring techniques can be applied." This self-description is accurate. The result is almost a handbook, reviewing in a single author's voice the basic properties of light and its linear and nonlinear interactions with matter, both in the absence and in the presence of absorption. A final section on nonlinear optical spectroscopy follows a section reviewing principles and properties of lasers.

Many people expect a book titled "photonics" to include those properties of light and its applications that are relevant to engineering applications. This book is about spectroscopy, and not what I personally would call photonics.

The subtitle describes its focus more accurately. While the propagation of Gaussian beams and diffraction of light are presented at length, light propagating down waveguides or fibers is not covered. Nor is coupled mode theory. With respect to the interaction of light with semiconductors, only nanocrystals merit inclusion. The author loves spectroscopy, but focuses on the visible and ultraviolet portions of the spectrum. (Those of us working at long wavelengths envy his ability to rely on CCD detector arrays.)

Menzel has compiled a vast amount of information relevant to spectroscopy. This interesting mix includes everything from how to calculate stiff rate equations numerically, to Feynman diagrams for nonlinear optical processes, to such practical issues as converting intensity to electric field strength and transmission spectra of neutral den-

sity filters. So encyclopedic a trove can be a useful reference book, reminding readers of forgotten information. In a book that attempts to treat so many fields, of course, some areas will be missing. For example, ultrashort pulses (femtosecond spectroscopy) are barely touched, with no discussion of the important differences in the execution and interpretation of experiments in this time domain.

The downside of such a book is that, on any one topic, the information does not suffice as a primary source. For example, Menzel discusses *Q* switching but never defines the "quality" (*Q*).

Introductory chapters review much of the material found in a traditional optics course, but with most theorems stated and not derived. This may be a useful compendium, but the reader had better already understand the material. For example, Menzel's Kramers-Kronig relation sums experimental data rather than providing the conceptually simpler integral. The eclectic nature of the book's information means that Raman-Nath scattering theory was derived from first principles (although not by name), while Bragg scattering was minimally introduced. The section on Gaussian pulses had at least one misprint, but, in general, misprints seemed few.

The index could be much more complete. For example, it includes neither "relaxation oscillations" nor "transient behavior" relating to lasers, but includes "spiking." All three appear in the section referenced by the term "spiking." The index includes both a topic and its acronym (such as "stimulated Brillouin scattering" and "SBS"), but most references appear only under the acronym, which is confusing.

One-third of the book is bibliography. I wish I could say that it is useful. For example, there are 579 references on nonlinear spectroscopy, 2041 references on lasers, and 1592 on nonlinear optics. This daunting list has very little description in the text, and is typically an eclectic mix of one or two classic papers each (usually not the original source) and a very large number of papers published within the last three years.

The references (not surprisingly) reflect the author's interests. Under "photorefractivity," for example, there are 30 references, but none on photorefractivity in semiconductors, an important subfield. Most people will find library searches more useful than this book's bibliography.

I noticed very few errors in the physics, but a number of misleading points. For example, the author presents the nonlinear absorber as an

example of a bistable optical device (p. 308), even though experimental devices operate on nonlinear refractive index (because nonlinear absorbers have too much residual loss).

Menzel's native language is not English, and much of the phrasing has a Germanic flavor. Nonetheless, grammatical errors are rare. The result is a clear compendium of useful information, giving quick snapshots of concepts in linear and nonlinear spectroscopy.

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