

Spectroscopy, laser physics and their interaction

Atomic and Laser Spectroscopy

A. Corney
763 pp. Oxford U.P., New York, 1977. \$34.95

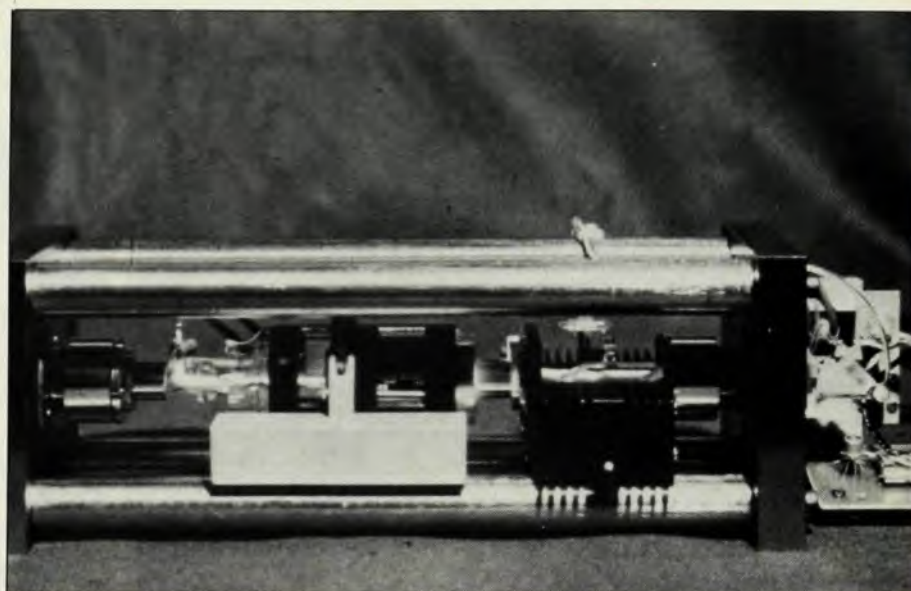
Reviewed by Richard D. Deslattes

Alan Corney has produced a study guide for his teaching of the "Final Honour School of Physics at Oxford" which appears effective and useful. The focus is on atomic spectroscopy, laser physics and how these areas interact with each other. The book appears suitable for self-study by graduate students as well as by those who have foregone the pleasures of this field until later years. It also appears to this reader to be a good text adjunct to a teaching enterprise in this area.

Corney begins with concise recapitulations of the foundations of this century's key concepts in atomic mechanics and with reviews of classical electrodynamics and of elementary and not-so-elementary quantum mechanics. Although one could have reservations about so lengthy a recapitulation, the effectiveness, accuracy and occasional insight save this from tedium. Corney has carefully selected and formulated a reasonable fraction of this review material in anticipation of the requirements of the second half of the book, where he brings lasers and laser spectroscopy to the fore.

In the historical and conceptual review of laser physics and atomic spectroscopy I found general satisfaction. I believe that his path, as one can judge from his use of the literature, is well chosen. Corney guides the attentive reader toward the key literature, and good background references as well, providing a well-defined sense of what is to be expected there.

In one other way, namely that of timeliness, Corney's book has much to offer. Evidently, the use of photo-lithographic printing has permitted a rather short publication cycle. Thus one finds a publication dated 1977, with an author's preface dated July 1976, containing references published as late as the latter part of 1975. Among other things, this currency permits treatment not only of Doppler-free saturation spectroscopy in general but, most significantly, Doppler-



Iodine-stabilized helium-neon lasers described in Alan Corney's *Atomic and Laser Spectroscopy*, reviewed on this page, have a frequency reproducibility of 1 part in 10^{10} . Thus they provide extremely useful secondary wavelength standards for work in the visible region of the spectrum.

free two-photon spectroscopy. The cut-off appears to be just between H(1s-2s) and the first demonstration of Ramsey fringes with lasers. This is a remarkable performance for a text-type publication. Lithographic reproduction of a text about at the level of typewriter composition found in *Physical Review* is not a particularly graceful example of the printer's art. On the other hand, the quality of reproduction is generally quite good and the benefits of evident timeliness, to this reader, outweigh the stylistic loss.

I found the text generally free of error but containing a number of points that may be taken as curious. On page 320 there is an initial description of optical resonators that can be read as excluding unstable ones. A masterful understatement occurs on page 372 where a minimal laser bandwidth estimate of about a millihertz precedes a statement that "In many lasers, this theoretical limit is never reached . . ." The concept of "high-finesse" interferometry occurs on page 387 without, it appears, precedent or explanation. Finally, a limiting performance of 2×10^{-8} /day (page 420) for passively stabilized lasers is probably overly pessimistic. On the other hand, most refer-

ences of which I am cognizant were approximately cited and their context well summarized.

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Richard D. Deslattes, of the National Bureau of Standards, has worked on stabilized lasers, their wavelength standardization and applications thereof to fundamental physical measurements.

Introduction to Plasma Physics, revised edition

B. M. Smirnov
174 pp. Mir, Moscow (US distributor: Imported, Chicago), 1977 (Russian edition, 1975). \$3.25

The aim of this book is to provide "a concise yet general description of the physics of weakly ionized plasmas." Thus the generality of the title is somewhat misleading, since many topics dealing with highly ionized plasmas (of interest, for example, in controlled thermonuclear fusion research) are not em-