

vague and unconvincing, as usually happens when the “principle” is invoked without making precise its exact meaning.

A technical shortcoming of the book is the poor resolution of the three-dimensional plots. Moreover, those plots have no axis labels, so interpreting them may be quite difficult for some readers. Some of the 2D plots are also missing axis labels; absent as well are calculational details such as units or masses that are necessary for reproducing or interpreting the displayed curves. I have detected name misspellings and, in chapter 5, displaced reference numbers.

All in all, though, I enjoyed *Quantum Theory of Tunneling* and think that it will be useful for students and researchers alike. The main strength of the book is Razavy's concise summaries of the many techniques he reviews. It would be easy to adapt part or all of the material for various graduate courses—not necessarily about tunneling—because several of the methods discussed in the book are applicable to a wide range of phenomena.

Juan Gonzalo Muga

*University of the Basque Country
Bilbao, Spain*

Compact Blue-Green Lasers

William P. Risk, Timothy R. Gosnell, and Arto V. Nurmikko
Cambridge U. Press, New York,
2003. \$130.00, \$60.00 paper
(540 pp.). ISBN 0-521-62318-9,
ISBN 0-521-52103-3 paper

It has been interesting, in fact downright amusing, to witness how in a mere span of four decades the laser has turned from a technology “in search of a problem” into one that many other technologies cannot do without. In that respect, the laser has truly become a gift to humanity that keeps on giving. Equally remarkable is the almost bewildering number of ways in which lasers (or coherent light sources, to the purists) can be made. The accounts in *Compact Blue-Green Lasers* prove once more the time-honored aphorism that “if you hit it hard enough, it will lase.”

The designation blue-green in the context of the book really extends to the violet and beyond. These lasers are widely sought in diverse applications ranging from optical data storage, color reprographics, and color display to high-resolution spectro-

scopy and DNA sequencing. To present the material embodied in the approximately 1000 references they mention, authors William Risk, Timothy Gosnell, and Arto Nurmikko organized the book into three parts along the lines of the principal approaches to blue-green generation: nonlinear frequency mixing, upconversion pumping of rare-earth doped materials, and direct excitation of semiconductors. Those approaches correspond to the areas in which each author, respectively, has established himself as a leading researcher.

The chapters on nonlinear optics—that is, second-harmonic generation and sum-frequency mixing—as a means to produce blue-green light occupy a little more than half of the volume. This section amounts to a self-contained presentation of the history, basics, and latest developments in the field. Following an introductory chapter on the physical principles of nonlinear frequency mixing and the properties of the most promising materials for implementing it, the authors discuss in depth the various ways to accomplish second-harmonic and sum-frequency generation. Those methods include the simple focused single-pass geometry, the more elaborate resonator-enhanced and intracavity arrangements, and the guided-wave approach. The emphasis of this section is on developing a quantitative understanding of real devices and, using numerous examples, providing the readers with the necessary tools to analyze the prospect of potential new devices. Readers who desire more information on the fundamentals of nonlinear optics can find additional notes online at <http://publishing.cambridge.org/resources/0521521033>.

The second part of the book is on so-called upconversion lasers, which exploit what can be thought of as “ladder-climbing” processes to pump the upper laser level. This part begins with a chapter on the spectroscopy and nonradiative processes of rare-earth ions; the authors spared no details in laying that groundwork, especially in the theoretical justification of the widely used Judd–Ofelt expression, which permits the calculation of the radiative rates of arbitrary transitions based on a few experimentally determined parameters. The next chapter catalogs essentially all the upconversion lasers that had been demonstrated up to the early part of 2001. The authors provide insightful comparisons of the different materials

and excitation schemes used in the implementation of these lasers in both bulk and fiber forms. However, the very limited attempt to explain quantitatively the operation of upconversion lasers within the theoretical framework developed in the preceding chapter underscores the tremendous complexity of such devices. Further background material for this portion of the book has also been made available online.

The final part of the book, on blue-green semiconductor lasers, departs in spirit from the first two in that the presentation is entirely descriptive and relatively brief. Such a treatment is somewhat puzzling given that, by all appearances, the diode lasers are poised to eventually outshine the other blue-green lasers in importance. Because of the success they have enjoyed, indium gallium nitride lasers are put center stage in this section, and discussions of the zinc selenide laser serve to elucidate some of the materials issues. As the book states repeatedly, the analysis is hampered by the proprietary nature of much of the critical data. Although the prognosis is not good for extending the wavelength range of III–V devices to the red of violet, the authors failed to point out that it is far easier to down-convert than to up-convert.

The references are current through about the summer of 2001. The completeness of the citations should make this book a valuable resource for those working in the field. The book can also serve as an up-to-date secondary text for a course on lasers or nonlinear optics. With its unusual mix of science and engineering, *Compact Blue-Green Lasers* should be welcomed by practitioners in both camps.

Nicholas Djeu

*University of South Florida
Tampa*



New Books

Astronomy and Astrophysics

Astronomy, Cosmology and Fundamental Physics. P. A. Shaver, L. DiLella, A. Giménez, eds. *ESO Astrophysics Symposium*. Proc. symp., Garching, Germany, Mar. 2002. Springer-Verlag, New York, 2003. \$54.95 (501 pp.). ISBN 3-540-40179-2

Astrophysical Techniques. 4th edition. C. R. Kitchin. IOP, Philadelphia, 2003 [1998]. \$55.00 paper (493 pp.). ISBN 0-7503-0946-6

Asymptotic Giant Branch Stars. H. J. Habing, H. Olofsson, eds. *Astronomy and Astrophysics Library*. Springer-Verlag, New York, 2004. \$89.95 (559 pp.). ISBN 0-387-00880-2