

# DEPARTMENTS

## BOOK REVIEWS

### OSA CD-ROM Series, Volume I

Optics Index 1917–1994 and *Optics Letters* 1994. ISBN 1-55752-364-9. Optical Society of America, 2010 Massachusetts Avenue NW, Washington, DC 20036-1023 (1995) \$85 for members, \$125 for non-members.

**Reviewed by Vincent G. Dominic**, University of Dayton, Center for Electro-Optics, Dayton, OH 45469-0245.

The Optical Society of America (OSA) has collected 75 years of optics publication citations onto a single compact disk (CD). The CD contains full bibliographic citations for all articles published in OSA's peer-reviewed journals from 1917 through 1994. The CD includes citations for all of *Applied Optics*, *JOSA A*, *JOSA B*, *Optics Letters*, and the *Journal of Lightwave Technology*. The citations are searchable by subject, author, and key words in titles. Also included in the CD index is a full year of *Optics Letters* (1994, Vol. 19). This CD is described as a part of OSA's ongoing research and development effort on electronic journals.

The first section of the citation database, Optics Index 1917–1994, presents the citations for all of the articles published by OSA up until December 1994. Each citation gives a complete list of the authors, the title of the paper, the type of paper (regular, communication, etc.), and the subject terms covered in the article. The abstracts are not included. Provided with the database is the DynaText browser that allows searches based on author name, title words, subject words, patent number, page number, volume number, and year. The search engine recognizes simple Boolean operators (and, or, etc.) in searches and provides for proximity searches (a word or phrase within so many words of another word or phrase). The proximity search is particularly useful when different phraseology describes the same thing.

In our era of rapidly exploding publication volume, it is sometimes difficult to decipher from the title and author information alone whether a certain article is pertinent. This problem can be eliminated by inclusion of abstracts in the index. This is particularly easy to implement in electronic form, since the abstract may be hidden until the user has narrowed the list of relevant articles. The user can then selectively read abstracts to refine their list.

Unfortunately, in my Mac environment, the search engine reported frequent nonfa-

tal errors, crashed relatively frequently, and the page/volume number searches refused to work. Also, the browsing software apparently lacks a simple way to store or print the results of a search. The user is stuck with paging through the results and writing down references. Also, the user cannot combine types of searches (e.g. specifying a particular author and a title word).

The second part of the database is *Optics Letters* 1994. This electronic form of the journal is quite useful and exciting. All the figures and mathematics contained in the hard copy version are captured and displayed in the electronic form. After finding the paper of your choice, you can print it for archival storage. The search possibilities are quite broad and include: title, author, abstract, figure legend, reference, issue section heading, and also the proximity search. The ability to search complete articles for phrases or references to other works is a very powerful way to follow a line of research. Hypertext links allow one to click on a reference to immediately go to either the citation or the article itself (if it is in Vol. 19). The user can also insert personal annotations. For example, you might want to insert a note reminding yourself that an article is similar to the presentation you heard the authors give at a specific conference so that you can remember to check the proceedings for additional information about the work.

The searchability of the journal in electronic form is a great improvement over the hard copy journal. For instance, one can search for all articles concerning cascaded second-order nonlinearities, read the abstract to decide the relevance of the work, and follow the references to learn more. Unfortunately, the figures and equations do not print as nicely as they are represented in the original journal paper copy, but the searchability and enormous space savings of the electronic form are such wonderful features that I wish all journals were available in this form. Indeed, OSA has made an impressive initial step toward the all-electronic journal.

One minor complaint about the software with regard to *Optics Letters* 1994 is the figures do not always print. When a figure extends across two pages of the printer output, the figure disappears. This can usually be overcome by printing the preceding article along with the current one. The printing problem is known and OSA promises a fix in the future.

In summary, the Optics Index database

is useful but incomplete. Inclusion of abstracts would greatly enhance its usefulness. The browsing software is clunky and a means for saving search results is lacking. I continue to use the Internet CARL Uncover database for journal articles published in recent years, and resort to Optics Index only for older, more historical articles. The electronic form of *Optics Letters* 1994 is quite enticing and shows the future of scientific publishing. The convenience and space savings will certainly move all journals in this direction. I will gladly recover the space from my shelves as electronic journals become more available and the browsing software improves. As a first foray into electronic journals, OSA should be applauded for overcoming the sticky problem of making equations and figures displayable in many different environments (PC, Mac, Unix). Overall, my impression of the first CD release from OSA is lukewarm, mostly because of browser software problems. I believe that future generations of such releases will justify the cost.

*Note from the publisher: Since the writing of this review, OSA has developed a new version of the disk that is reported to address many of the indicated problems. The reviewer and editors have not seen this disk and therefore cannot endorse it without proper review. It will be available in early 1996.*

### The Physical Principles of Magneto-Optical Recording

Masud Mansuripur, 776 pages, illustrations, problems, index, and references. ISBN 0-521-46124-3. Cambridge University Press, Trumpington Street, Cambridge CB2 1RP, United Kingdom (1995) \$99.95 hardbound.

**Reviewed by Terry W. McDaniel**, International Business Machines Corporation, Storage Systems Division, MS H42/013, 5600 Cottle Road, San Jose, California 95193.

Looking back on my graduate training in physics and subsequent industrial education in data storage technology, I must marvel at the service Mansuripur has provided the current generation of science and engineering students and technologists embarking on projects or careers in optics, magnetics, data recording, or allied fields. In the single volume, *The Physical Principles of Magneto-Optical Recording*, Mansuripur has conveyed a remarkably complete account of the results of his encyclopedic and

pioneering research program of the past fifteen years at Xerox, Boston University, and the University of Arizona on optical data storage and related topics.

Fortunately for readers, the author has demonstrated an increasingly uncommon faithfulness to his professorial role as educator in tailoring a presentation reflecting all the best characteristics of an excellent textbook. Here we find a pathway to guide the developing physical scientist or engineer (as well as the seasoned professional) to broader and deeper appreciation of the extreme technical richness of data storage technology. As one who experienced the process of learning the necessary elements of applied magnetism and optics in order to function professionally in an industrial research and development setting in the era preceding formalized multidisciplinary training in universities, it is easy to appreciate the wealth of information and insight delivered by this treatise. Twenty years ago, the only alternative was to study many special topic texts, consult dozens of papers in the literature, and seek out the specialists in a hit-and-miss self-education process.

In my view, Mansuripur's contribution represents the culmination of what is arguably the most encouraging development in American technical education of the past fifteen years—the adoption of information recording technology by leading universities as a vehicle to further interdisciplinary applied science and engineering training. The well-known results heretofore have been the establishment of multidisciplinary centers at Carnegie Mellon, the University of California (San Diego and Berkeley), Arizona, Minnesota, Alabama, Stanford, and elsewhere, and of course the graduation of a first generation of students at home in the complex and vital world of information technology engineering. The final evidence of the stability and maturity of this initiative is the emergence in recent years of a host of textbooks conveying the principles of recording technology—a species that was virtually nonexistent 15 to 20 years ago.

The distinguishing feature of Mansuripur's contribution is the breadth and depth of the treatment, and this is particularly remarkable in a single author volume. The coverage would be notable in a multi-author handbook (of which a few in this field have appeared and more will do so shortly), but here it is astonishing to grasp the range of topics in the emerging technology of magneto-optical (MO) recording to which the author and his research collaborators have made seminal contributions. In crafting his presentation, two serious potential pitfalls were very effectively avoided by the author.

He successfully conveys the tenor of an objective, unbiased review of the central topics of a field to which he has in fact made dominant contributions. We find a balanced offering of work Mansuripur originally published alongside generous references to the classic texts of optics, magnetism, and the vast literature of published articles on data storage materials, methods, and systems. Furthermore, the author's concepts are discreetly interwoven with the conventional wisdom of optical storage and basic magnetism, and so the reader enjoys the best of both worlds—a research leader's best work set in a framework of the preceding and developing knowledge necessary to integrate the new contributions.

This book beautifully complements a prior noteworthy (albeit shorter) contribution, *Optical Recording—A Technical Overview* by Alan B. Marchant, and avoids redundancy. Mansuripur adheres to the promise of the title by focusing on the physical principles underlying MO recording. Thus he is able to deliver on his stated goal of using an indepth treatment of MO recording as a means of illuminating a broad range of fundamental topics in physical science and engineering from a multidisciplinary viewpoint. The emphasis throughout is on the fundamental physical principles rather than specific engineering solutions or applications, while Marchant's book, with its origins in an industrial setting, concentrates more on engineering aspects of optical recording and the specific embodiments that have arisen in the realization of devices and systems.

Following an introductory chapter that provides an overview of optical data storage, the book's organization breaks out broadly into Chaps. 2 through 10 on topics associated with readout and Chaps. 12 through 18 more related to writing. Chapter 11 provides a bridge between the readback and recording processes by treating the thermal aspects of MO recording, a phenomenon common to both data storage and retrieval. Again, one is struck by the range of considerations dealt with in both halves. Being a volume centered in optical engineering issues, the early chapters appropriately deal with properties of Gaussian beams, diffraction theory, and a natural integration in the diffraction of Gaussian beams from sharp features.

The formulation of diffraction utilized is satisfactorily narrow to avoid undue complexity while providing enough power to treat realistic practical problems involving the vectorial nature of the electromagnetic (EM) field. It is essentially scalar diffraction theory by plane wave decomposition, with consideration of the essential limits

(near- and far-field) and practical realization (treatment of lens and the role of aberration). A "quasi-vector" extension of scalar theory (explained on pages 249–250) enables handling of vector components of the EM field without bogging down in the computational complexity of full vector diffraction theory. Impressive and accessible computational power is enabled by implementation of this theoretical formulation in software. Numerical examples illustrative of the material presented are utilized liberally. The thoughtful structure of the development of the theory of diffraction (Chap. 3) is very representative of an approach used successfully in several other chapters—a presentation drawing on the student's intuition and prior experience is fortified with a computational tool of extraordinary power and range, and whose full utility is demonstrated with many practical examples. The combination of the theoretical development and detailed examples leaves the reader with a firm grasp of the material presented; the teaching is effective.

From this optical framework, Mansuripur proceeds to treat in considerable depth the optics of multilayer thin film structures, and extends this to the behavior of high numerical aperture polarized beams that interact with film media. Additional insight into MO readout comes with analysis of the propagation of polarized light through the optical elements of the read head and of the diffractive interaction of the focused beam with the tracking servo features and magnetic domains of the disk. The full complexity of the readout problem is further revealed by introducing the reader to the characteristics of noise for the MO disk application and the elements of communications theory inherent in modulation and error correction coding.

Heat transport is naturally central to a technology involving laser beam interaction with a spinning disk coated with thin film materials, and this thermal analysis is important to writing, erasing, and reading. Appropriately, this problem is visited twice (Chaps. 11 and 17), but the coverage of MO recording in the second half of the book is more centrally a story about temperature-dependent, thin film magnetism. A 77-page review of classical and quantum magnetism is easily the most conventional offering in the book, but it properly sets the stage for subsequent chapters detailing magnetostatics, magnetodynamics, mean field theory, and origins of coercivity for amorphous rare earth-transition metal (RE-TM) alloys, the mainstay recording material of MO recording systems to date. These topics form the necessary basis for coverage of the complex process of

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thermomagnetic recording in Chap. 17. The book closes with a chapter on MO media characterization that focuses predominantly on experimental contributions of the author's research group at the University of Arizona.

It is difficult to do justice to the technical range, depth, and overall quality of this work in a brief review. And it is virtually impossible to convey an appreciation of the visual appeal of a book, which contains over 130 color figures ("nanomagnetism" magnetization dynamics computer simulation output) and high quality black and white graphics and typesetting throughout. Nearly 120 classroom-tested problems challenge the reader to absorb, apply, and extend the text material. The editing is of extraordinarily high quality—I found one misspelling and perhaps three or four trivial mistakes (presentation rather than content) in a volume running nearly 800 pages in length.

The presentation is not perfect despite the extremely high quality. This reviewer would have hoped for more discussion of

the phenomenological and quantum mechanical origins of magneto-optical effects in solids, a physical effect central to the subject of the book. The terse documentation on page 47 of the relative role of the transition metal and rare earth constituents of RE-TM alloys is inadequate for this purpose. It was also mildly disappointing to note in Tables 1, 2, 3, and 5 in Chap. 11 the use of bulk material thermal conductivities for thin films when it is quite well known that the latter can be as much as an order of magnitude lower than the former. It is perhaps fortunate that this oversight would only modify the quantitative details in the examples, albeit significantly in some instances. Two other minor errors include a claim on page 3 that an international standard "5.25 inch" MO disk radius is 67 mm, when in fact it is 65 mm, and a reference on page 140 to a 3×3 identity matrix which should be a 2×2 matrix.

There is little doubt in my mind that this book will long stand as the standard treatment of and reference for the basic and applied scientific principles underlying optical recording. My hope is that it will provide an impetus for further expansion in the use of this successful model involving selection of a multidisciplinary technology as the vehicle for broad-based education of advanced students in technical fields. The majority of engineering and applied science students would greatly benefit from exposure to work of this quality.

### BOOKS RECEIVED

**Properties of Narrow Gap Cadmium-based Compounds**, edited by Peter Capper. xxi + 618 pp., illus., subject index, references at end of each chapter, list of contributing authors, abbreviations. Volume 10 from the EMIS Datareviews Series from INSPEC. ISBN 0-85296-880-9. Institute of Electrical Engineers, Michael Faraday House, Six Hills Way, Stevenage, Herts. SG1 2AY, United Kingdom (1994) \$295 hardbound. The editor has drawn upon 53 researchers from Europe and the USA to review both MCT and its substrates: CdTe, CdZnTe and CdTeSe. The properties, growth and exploitation of each of the four substances is examined within a highly structured framework and all 102 contributions ('Datareviews') have been refereed by at least one independent expert.

**Instabilities in Laser-Matter Interactions**, by Sergei I. Anisimov and Viktor A.

Khokhlov. 147 pp., illus., subject index, references at end of each chapter. ISBN 0-8493-8660-8. CRC Press, Inc., 2000 Corporate Blvd. NW, Boca Raton, FL 33431 (1995) \$99.95 hardbound. In the first four chapters, a survey of the basic processes of nonresonant laser-matter interactions is given. Laser-induced breakdown of transparent dielectrics is considered in Chap. 2, as an example of instability of "thermal explosion" type. Chapter 4 contains a brief analysis of the effects produced by ultrashort (picosecond and femtosecond) laser pulses. In Chaps. 5 to 8 thermal and hydrodynamic instabilities are considered.

**Spontaneous Emission and Laser Oscillation in Microcavities**, edited by Hiroyuki Yokoyama and Kikuo Ujihara. 374 pp., illus., subject index, and references following each chapter. From the CRC Press Laser and Optical Science and Technology Series. ISBN 0-8493-3786-0. CRC Press, Inc., 2000 Corporate Blvd. N.W., Boca Raton, FL 33431 (1995) \$189.95 hardbound. This book aims to give the basics of optical microcavities rather than describing advanced theoretical topics or the most recent experimental reports or fabrication technologies. Therefore it is usable as a textbook for graduate and postgraduate students, as well as researchers beginning to study the field.

**The Handbook of Surface Imaging and Visualization**, edited by Arthur T. Hubbard. xv + 909 pp., color illus., subject index, and references following each chapter. ISBN 0-8493-8911-9. CRC Press, Inc., 2000 Corporate Blvd. N.W., Boca Raton, FL 33431 (1995) \$159.95 hardbound. This book is about characterization of surfaces. Emphasis is given to experimental techniques for the imaging of solid surfaces (structure probing) and theoretical strategies for visualization of surfaces (conceptualization). A wide variety of the latest experimental and theoretical approaches are included.

*Optical Engineering is currently seeking reviewers for the books listed in the "Books Received" section. In exchange for a publication-worthy critique, reviewers will receive a complimentary copy of the book they review. Interested individuals should contact Dr. Bradley D. Duncan, Book Reviews Editor, The University of Dayton, Center for Electro-Optics, 300 College Park, Dayton, OH 45469-0245. E-mail: bduncan@engr.udayton.edu. Phone: 513/229-2796.*