

Third Edition

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HANDBOOK OF OPTICS

Volume V

*Atmospheric Optics, Modulators, Fiber Optics,
X-Ray and Neutron Optics*



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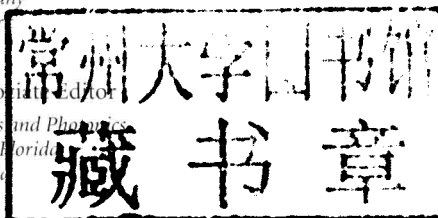
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HANDBOOK OF OPTICS

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COVER ILLUSTRATIONS

Boadband supercontinuum. Generated in a photonic crystal fiber using a mode-locked Ti:Sapphire laser as pump source. The spectrum is much broader than seen in the photograph, extending from 400 nm to beyond 2 μm . (*Photo courtesy of the Optoelectronics Group, University of Bath.*)

Supernova remnant. A Chandra X-Ray Space Telescope image of the supernova remnant G292.0+1.8. The colors in the image encode the X-ray energies emitted by the supernova remnant; the center of G292.0+1.8 contains a region of high energy X-ray emission from the magnetized bubble of high-energy particles that surrounds the pulsar, a rapidly rotating neutron star that remained behind after the original, massive star exploded. (*This image is from NASA/CXC/Penn State/S.Park et al. and more detailed information can be found on the Chandra website: <http://chandra.harvard.edu/photo/2007/g292/>.*)

Crab Nebula. A Chandra X-Ray Space Telescope image of the Crab Nebula—the remains of a nearby supernova explosion first seen on Earth in 1054 AD. At the center of the bright nebula is a rapidly spinning neutron star, or pulsar, that emits pulses of radiation 30 times a second. (*This image is from NASA/CXC/ASU/J.Hester et al. and more detailed information can be found on the Chandra website: <http://chandra.harvard.edu/photo/2002/0052/>.*)

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EDITORS' PREFACE

The third edition of the *Handbook of Optics* is designed to pull together the dramatic developments in both the basic and applied aspects of the field while retaining the archival, reference book value of a handbook. This means that it is much more extensive than either the first edition, published in 1978, or the second edition, with Volumes I and II appearing in 1995 and Volumes III and IV in 2001. To cover the greatly expanded field of optics, the *Handbook* now appears in five volumes. Over 100 authors or author teams have contributed to this work.

Volume I is devoted to the fundamentals, components, and instruments that make optics possible. Volume II contains chapters on design, fabrication, testing, sources of light, detection, and a new section devoted to radiometry and photometry. Volume III concerns vision optics only and is printed entirely in color. In Volume IV there are chapters on the optical properties of materials, nonlinear, quantum and molecular optics. Volume V has extensive sections on fiber optics and x ray and neutron optics, along with shorter sections on measurements, modulators, and atmospheric optical properties and turbulence. Several pages of color inserts are provided where appropriate to aid the reader. A purchaser of the print version of any volume of the *Handbook* will be able to download a digital version containing all of the material in that volume in PDF format to one computer (see download instructions on bound-in card). The combined index for all five volumes can be downloaded from www.HandbookofOpticsOnline.com.

It is possible by careful selection of what and how to present that the third edition of the *Handbook* could serve as a text for a comprehensive course in optics. In addition, students who take such a course would have the *Handbook* as a career-long reference.

Topics were selected by the editors so that the *Handbook* could be a desktop (bookshelf) general reference for the parts of optics that had matured enough to warrant archival presentation. New chapters were included on topics that had reached this stage since the second edition, and existing chapters from the second edition were updated where necessary to provide this compendium. In selecting subjects to include, we also had to select which subjects to leave out. The criteria we applied were: (1) was it a specific application of optics rather than a core science or technology and (2) was it a subject in which the role of optics was peripheral to the central issue addressed. Thus, such topics as medical optics, laser surgery, and laser materials processing were not included. While applications of optics are mentioned in the chapters there is no space in the *Handbook* to include separate chapters devoted to all of the myriad uses of optics in today's world. If we had, the third edition would be much longer than it is and much of it would soon be outdated. We designed the third edition of the *Handbook of Optics* so that it concentrates on the principles of optics that make applications possible.

Authors were asked to try to achieve the dual purpose of preparing a chapter that was a worthwhile reference for someone working in the field and that could be used as a starting point to become acquainted with that aspect of optics. They did that and we thank them for the outstanding results seen throughout the *Handbook*. We also thank Mr. Taisuke Soda of McGraw-Hill for his help in putting this complex project together and Mr. Alan Tourtlotte and Ms. Susannah Lehman of the Optical Society of America for logistical help that made this effort possible.

We dedicate the third edition of the *Handbook of Optics* to all of the OSA volunteers who, since OSA's founding in 1916, give their time and energy to promoting the generation, application, archiving, and worldwide dissemination of knowledge in optics and photonics.

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