

# Problems In Laser Physics 1st Edition

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## **Issues in Applied Physics: 2011 Edition** - 2012-01-09

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## **Semiconductor-Laser Fundamentals** - Weng W. Chow 2013-03-09

This in-depth title discusses the underlying physics and operational principles of semiconductor lasers. It analyzes the optical and electronic properties of the semiconductor medium in detail, including quantum confinement and gain-engineering effects. The text also includes recent developments in blue-emitting semiconductor lasers.

## **Semiconductor Disk Lasers** - Oleg G. Okhotnikov 2010-03-30

This timely publication presents a review of the

most recent developments in the field of Semiconductor Disk Lasers. Covering a wide range of key topics, such as operating principles, thermal management, nonlinear frequency conversion, semiconductor materials, short pulse generation, electrical pumping, and laser applications, the book provides readers with a comprehensive account of the fundamentals and latest advances in this rich and diverse field. In so doing, it brings together contributions from world experts at major collaborative research centers in Europe and the USA. Each chapter includes a tutorial style introduction to the selected topic suitable for postgraduate students and scientists with a basic background in optics - making it of interest to a wide range of scientists, researchers, engineers and physicists working and interested in this rapidly developing field. It will also serve as additional reading for students in the field.

## *Foundations of Laser Spectroscopy* - Stig Stenholm 2012-09-20

A simple presentation of the theoretical foundations of steady-state laser spectroscopy, this text helps students to apply theory to calculations with a systematic series of examples and exercises. 1984 edition.

## *Physics of Laser Materials Processing* - Gennady G. Gladush 2011-08-05

This book describes the basic mechanisms, theory, simulations and technological aspects of Laser processing techniques. It covers the principles of laser quenching, welding, cutting, alloying, selective sintering, ablation, etc. The main attention is paid to the quantitative description. The diversity and complexity of

technological and physical processes is discussed using a unitary approach. The book aims on understanding the cause-and-effect relations in physical processes in Laser technologies. It will help researchers and engineers to improve the existing and develop new Laser machining techniques. The book addresses readers with a certain background in general physics and mathematical analysis: graduate students, researchers and engineers practicing laser applications.

The Interaction of High-Power Lasers with Plasmas - Shalom Eliezer 2002-08-16

The Interaction of High-Power Lasers with Plasmas provides a thorough self-contained discussion of the physical processes occurring in laser-plasma interactions, including a detailed review of the relevant plasma and laser physics. The book analyzes laser absorption and propagation, electron transport, and the relevant plasma waves in detail. It al

Optics, Light and Lasers - Dieter Meschede 2007-02-27

Starting from the concepts of classical optics, Optics, Light and Lasers introduces in detail the phenomena of linear and nonlinear light matter interaction, the properties of modern laser sources, and the concepts of quantum optics. Several examples taken from the scope of modern research are provided to emphasize the relevance of optics in current developments within science and technology. The text has been written for newcomers to the topic and benefits from the author's ability to explain difficult sequences and effects in a straightforward and easily comprehensible way. To this second, completely updated and enlarged edition, new chapters on quantum optics, quantum information, matter waves, photonic fibres and materials have been added, as well as more than 100 problems on laser physics and applied optics.

Problems in Laser Physics - Giulio Cerullo 2012-12-06

There is hardly any book that aims at solving problems typically encountered in the laser field, and this book intends to fill the void. Following some initial exercises related to general aspects in laser physics (Chapt. 1), the subsequent problems are organized along the following topics: (i) Interaction of radiation with matter

either made of atoms or ions, weakly interacting with surrounding species, or made of more complicated elements such as molecules or semiconductors (Chapters 2 and 3). (ii) Wave propagation in optical media and optical resonators (Chapters 4 and 5). (iii) Optical and electrical pumping processes and systems (Chapter 6): (iv) Continuous wave and transient laser behaviors (Chapters 7 and 8). (v) Solid-state, dye, semiconductor, gas and X-ray lasers (Chapters 9 and 10). (vi) Proper ties of the output beam and beam transformation by amplification, frequency conversion and pulse compression or expansion (Chapters 11 and 12). Problems are proposed here and solved following the contents of Orazio Svelto's Principles of Lasers (fourth edition; Plenum Press, New York, 1998). Whenever needed, equations and figures of the book mentioned above are currently used with an appropriate reference [e. g. , Eq. (1. L1) of the book is referred to as Eq. (L1. 1) of PL]. One can observe, however, that the types of problems proposed and discussed are of general validity and many of these problems have actually been suggested by our own long-time experience in performing theoretical and experimental researches in the field.

**Laser Dynamics** - Thomas Erneux 2010-04-29  
Bridging the gap between laser physics and applied mathematics, this book offers a new perspective on laser dynamics. Combining fresh treatments of classic problems with up-to-date research, asymptotic techniques appropriate for nonlinear dynamical systems are shown to offer a powerful alternative to numerical simulations. The combined analytical and experimental description of dynamical instabilities provides a clear derivation of physical formulae and an evaluation of their significance. Starting with the observation of different time scales of an operating laser, the book develops approximation techniques to systematically explore their effects. Laser dynamical regimes are introduced at different levels of complexity, from standard turn-on experiments to stiff, chaotic, spontaneous or driven pulsations. Particular attention is given to quantitative comparisons between experiments and theory. The book broadens the range of analytical tools available to laser physicists and provides applied

mathematicians with problems of practical interest, making it invaluable for graduate students and researchers.

**Optics, Light and Lasers** - Dieter Meschede  
2017-06-06

This new, updated and enlarged edition of the successful and exceptionally well-structured textbook features new chapters on such hot topics as optical angular momentum, microscopy beyond the resolution limit, metamaterials, femtocombs, and quantum cascade lasers. It provides comprehensive and coherent coverage of fundamental optics, laser physics, and important modern applications, while equally including some traditional aspects for the first time, such as the Collins integral or solid immersion lenses. Written for newcomers to the topic who will benefit from the author's ability to explain difficult theories and effects in a straightforward and readily comprehensible way.

**Ultrafast Phenomena X** - Paul F. Barbara  
2012-12-06

This volume contains papers presented at the Tenth International Conference on Ultrafast Phenomena held at Del Coronado, California, from May 28 to June 1, 1996. The biannual Ultrafast Phenomena Conferences provide a forum for the discussion of the latest advances in ultrafast optics and their applications in science and engineering. The Ultrafast Phenomena Conference maintains a broad international representation with 391 participants from 18 countries, including 94 students attending the conference. The multidisciplinary character of this meeting provides a cross-fertilization of ultrafast concepts and techniques among various scientific and engineering disciplines. The enthusiasm of the participants, the originality and quality of the papers that they presented, and the beautiful conference site combined to produce a very successful and enjoyable meeting. Progress was reported in the technology of generating ultrashort pulses, including new techniques for improving laser-pulse duration, output power, wave length range, and compactness. Ultrafast spectroscopy continues to impact on and expand the knowledge base of fundamental processes in physics, chemistry, biology and engineering. In addition ultrafast phenomena now extends to

real-world applications in biology, high-speed communication, and material diagnostics. The Tenth Ultrafast Phenomena Conference was highlighted by a 'special event' in which the developments of the previous conferences were reviewed in a panel discussion by G. Mourou, E. Ippen, A. Migus, A. Laubereau and R. Hochstrasser.

*Essential Semiconductor Laser Physics* - A F J Levi  
2018-07-18

The invention of the semiconductor laser along with silica glass fiber has enabled an incredible revolution in global communication infrastructure of direct benefit to all.

Development of devices and system concepts that exploit the same fundamental light-matter interaction continues. Researchers and technologists are pursuing a broad range of emerging applications, everything from automobile collision avoidance to secure quantum key distribution. This book sets out to summarize key aspects of semiconductor laser device physics and principles of laser operation. It provides a convenient reference and essential knowledge to be understood before exploring more sophisticated device concepts. The contents serve as a foundation for scientists and engineers, without the need to invest in specialized detailed study. Supplementary material in the form of MATLAB is available for numerically generated figures.

Issues in Applied Physics: 2013 Edition -  
2013-05-01

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with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

The Quantum Mechanics Solver - Jean-Louis Basdevant 2019-05-22

Motivates students by challenging them with real-life applications of the sometimes esoteric aspects of quantum mechanics that they are learning. Offers completely original exercises developed at the Ecole Polytechnique in France, which is known for its innovative and original teaching methods. Problems from modern physics to help the student apply just-learned theory to fields such as molecular physics, condensed matter physics or laser physics.

*Laser Physics* - Simon Hooker 2010-08-05

An up-to-date perspective on laser technology for students at advanced undergraduate or introductory graduate level. The principles of operation and applications of modern laser systems are analysed in detail. The text has over 300 diagrams and each chapter is accompanied with questions (solutions available on application).

Basics of Laser Physics - Karl F. Renk 2017

*Laser Fundamentals* - William T. Silfvast 2008-07-21

Laser Fundamentals provides a clear and comprehensive introduction to the physical and engineering principles of laser operation and design. Simple explanations, based throughout on key underlying concepts, lead the reader logically from the basics of laser action to advanced topics in laser physics and engineering. Much new material has been added to this second edition, especially in the areas of solid-state lasers, semiconductor lasers, and laser cavities. This 2004 edition contains a new chapter on laser operation above threshold, including extensive discussion of laser amplifiers. The clear explanations, worked examples, and many homework problems will make this book invaluable to undergraduate and first-year graduate students in science and engineering taking courses on lasers. The summaries of key types of lasers, the use of many unique theoretical descriptions, and the extensive bibliography will also make this a valuable reference work for researchers.

Lasers - K. Thyagarajan 2010-09-27

Ever since their invention in 1960, lasers have assumed tremendous importance in the fields of science, engineering and technology because of their use both in basic research and in various technological applications. *Lasers: Theory and Applications 2nd Edition* will provide a coherent presentation of the basic physics behind the working of the laser along with some of their most important applications. Numerical examples are scattered throughout the book for helping the student gain a better appreciation of the concepts and problems at the end of each chapter and provides the student a better understanding of the basics and help in applying the concepts to practical situations. This book serves as a text in a course on lasers and their applications for students majoring in various disciplines such as Physics, Chemistry and Electrical Engineering.

Aesthetic Dermatology - Jaishree Sharad 2018-12-31

This book is a comprehensive guide to aesthetic dermatology for clinicians and trainees. Divided into four sections, the text begins with discussion on cosmeceuticals (moisturisers, sunscreens, anti-aging products etc). The next section covers Botulinum Toxin (Botox) treatments, and section three examines soft tissue augmentation such as facial fillers and hand rejuvenation. The final chapters discuss adjunctive treatments including basic peels, thread lift, laser hair removal, microneedling and body contouring. Each procedure is described in detail, along with its advantages and disadvantages. The book is highly illustrated with nearly 600 clinical photographs, diagrams and tables, and features access to videos demonstrating cosmetic procedures. Key points  
Comprehensive guide to aesthetic dermatology  
Each procedure explained in detail with advantages and disadvantages  
Highly illustrated with clinical photographs, diagrams and tables  
Includes access to videos demonstrating cosmetic procedures

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vast information databases of ScholarlyNews.™ You can expect the information about Medical Physics in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Applied Physics / 2013 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at <http://www.ScholarlyEditions.com/>.

**Lasers** - J. H. Eberly 1991

*Problems in Laser Physics* - Giulio Cerullo  
2001-10-31

This book presents the first comprehensive collection of solved problems in laser physics covering both fundamental and applied aspects of laser science and technology. The framework of the book, including structuring of topics and notations, closely follows that adopted in the Principles of Laser book by Professor O. Svelto. The collection of problems presented in this book appears therefore a natural complement to Svelto's textbook for testing and developing the skills acquired in the reading of the theory; however, it may also be a useful support to any general textbook on laser physics, wherein problems are usually not solved in detail. We remark that this is, to our knowledge, the first book to provide a complete and satisfactory set of solved problems in such a highly developing field of science and technology. The problems fall mainly into three distinct categories: (i) numerical/applied problems, which help the reader to become confident and familiar with the basic concepts and methods of laser physics, and to acquire a feeling for numerical parameters entering in real-world laser systems; (ii) complementary problems, that present in detail demonstrations of some analytical parts not given in the textbook; and (iii) advanced problems, aimed either to provide a deeper understanding of the subject or to cover more recent developments in the field. Audience: This book is primarily intended for undergraduate

and graduate students in physics, engineering, and chemistry. However, it may also be a useful tool for industrial professionals working in the field of laser technologies and laser applications, as well as for researchers interested in basic aspects of real-world lasers and related fields.

Basics of Laser Physics - Karl F. Renk  
2017-03-30

This textbook provides an introductory presentation of all types of lasers. It contains a general description of the laser, a theoretical treatment and a characterization of its operation as it deals with gas, solid state, free-electron and semiconductor lasers. This expanded and updated second edition of the book presents a description of the dynamics of free-electron laser oscillation using a model introduced in the first edition that allows a reader to understand basic properties of a free-electron laser and makes the difference to "conventional" lasers. The discussions and the treatment of equations are presented in a way that a reader can immediately follow. The book addresses graduate and undergraduate students in science and engineering, featuring problems with solutions and over 400 illustrations.

Laser Physics - Murray, Iii Sargent 1978-01-22

This book treats the interaction of radiation with matter, particular attention being paid to the laser. Knowledge is assumed of the usual half-year introduction of quantum mechanics found in undergraduate physics curricula. The material can be covered in two semesters, or, alternatively, the first part (Chaps 1-13) can be used as a one-semester course in which quantum mechanical aspects of the electromagnetic field are ignored. Each chapter is accompanied by problems that illustrate the text and give useful (occasionally new) results. Existing laser media are intrinsically quantum mechanical and are most easily studied with the quantum theory. Understanding the laser along these lines enlivens one's understanding of quantum mechanics itself. In fact, the material constitutes a viable, applied alternative for the usual second and third semesters of quantum mechanics.

Laser Physics - Murray, Iii Sargent 2018-03-05

This book treats the interaction of radiation with matter, particular attention being paid to the laser. Knowledge is assumed of the usual half-year introduction of quantum mechanics found

in undergraduate physics curricula. The material can be covered in two semesters, or, alternatively, the first part (Chaps 1-13) can be used as a one-semester course in which quantum mechanical aspects of the electromagnetic field are ignored. Each chapter is accompanied by problems that illustrate the text and give useful (occasionally new) results. Existing laser media are intrinsically quantum mechanical and are most easily studied with the quantum theory. Understanding the laser along these lines enlivens one's understanding of quantum mechanics itself. In fact, the material constitutes a viable, applied alternative for the usual second and third semesters of quantum mechanics.

*Introduction to Laser Physics* - K. Shimoda  
2013-11-11

To Laser Physics With 87 Figures Springer-Verlag Berlin Heidelberg GmbH 1984 Professor Koichi Shimoda Faculty of Science and Technology, Keio University, 3-14-1 Hiyoshi, Kohokuku, Yokohama 223, Japan ARTHUR L. SCHAWLOW, Ph. D. Editorial Board Department of Physics, Stanford University Stanford, CA 94305, USA JAY M. ENOCH, Ph. D. Professor KOICHI SHIMODA School of Optometry, Faculty of Science and Technology, University of California Keio University, 3-14-1 Hiyoshi, Kohoku-ku Berkeley, CA 94720, USA Yokohama 223, Japan DAVID L. MACADAM, Ph. D. THEODOR TAMIR, Ph. D. 68 Hamrnond Street, 981 East Lawn Drive, Rochester, NY 14615, USA Teaneck, NJ 07666, USA Revised translation of the original Japanese edition: Koichi Shimoda: Reza Butsuri Nyumon © Koichi Shimoda 1983 Originally published in Japanese by Iwanami Shoten, Publishers, Tokyo (1983) English translation by Munetada Yamamuro ISBN 978-3-662-13550-1 ISBN 978-3-662-13548-8 (eBook) DOI 10.1007/978-3-662-13548-8 Library of Congress Cataloging in Publication Data. Shimoda, Kōichi. Introduction to laser physics. (Springer series in optical sciences .; v. 44) Rev. translation of: Koichi Shimoda: Reza Butsuri Ny11mon. 1. Lasers. 1. Title. H. Series. QC688.S55 1984 535.5'8 84-5629 This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically those of translation, reprinting, reuse of illustrations, broadcasting, reproduction by photocopying machine or

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The VIII International Symposium "Modern Problems of Laser Physics" (MPLP-2018) - S. N. Bagayev 2019

*Principles of Lasers* - Orazio Svelto 2013-06-29  
This book is the result of more than ten years of research and teaching in the field of quantum electronics. The purpose of the book is to introduce the principles of lasers, starting from elementary notions of quantum mechanics and electromagnetism. Because it is an introductory book, an effort has been made to make it self-contained to minimize the need for reference to other works. For the same reason; the references have been limited (whenever possible) either to review papers or to papers of seminal importance. The organization of the book is based on the fact that a laser can be thought of as consisting of three elements: (i) an active material, (ii) a pumping system, and (iii) a suitable resonator. Accordingly, after an introductory chapter, the next three chapters deal, respectively, with the interaction of radiation with matter, pumping processes, and the theory of passive optical resonators.

**Laser Physics** - Peter W. Milonni 2010-04-07  
Although the basic principles of lasers have remained unchanged in the past 20 years, there has been a shift in the kinds of lasers generating interest. Providing a comprehensive introduction to the operating principles and applications of lasers, this second edition of the classic book on the subject reveals the latest developments and applications of lasers. Placing more emphasis on applications of lasers and on optical physics, the book's self-contained discussions will appeal to physicists, chemists, optical scientists, engineers, and advanced undergraduate students.

Crystalline Lasers - Alexander Kaminskii  
2020-09-10

By the end of the 1970s, crystalline lasers were widely used in science, engineering, medicine, and technology. The types of lasers used have continued to grow in number to include newly discovered crystalline hosts, previously known

compounds generating at other spectral wavelengths, and broadband tunable stimulated emission. This has led to the creation of an extremely promising new generation of crystalline lasers that are both highly efficient and more reliable. The major part of this book is devoted to describing multilevel operating laser schemes for stimulated emission excitation in insulating crystals doped with lanthanide ions. The first part of Crystalline Lasers deals with the history of the physics and spectroscopy of insulating laser crystals. The chapters in the second part of the book present results from the study of Stark-energy levels of generating ions in laser crystals and their radiative and nonradiative intermanifold transition characteristics. This section includes extensive tabular data and reference information. Popular and novel operating schemes of crystalline lasers are covered in Part 3. In the chapters in the fourth part of the book, the newest technologies in the physics and engineering of crystalline lasers are considered. The results of investigations into laser action under selective excitations, miniature crystalline lasers, and the properties of nonlinear activated laser crystals are presented and analyzed. Crystalline Lasers summarizes and reviews the results of many years of research and studies of activator ions and multilevel operating laser schemes, and discusses exciting prospects of using these systems to create new types of crystalline lasers. This book will be of use to laser scientists and engineers, physicists, and chemical engineers.

Basics of Laser Physics - Karl F. Renk  
2012-02-09

Basics of Laser Physics provides an introductory presentation of the field of all types of lasers. It contains a general description of the laser, a theoretical treatment and a characterization of its operation as it deals with gas, solid state, free-electron and semiconductor lasers and, furthermore, with a few laser related topics. The different subjects are connected to each other by the central principle of the laser, namely, that it is a self-oscillating system. Special emphasis is put on a uniform treatment of gas and solid-state lasers, on the one hand, and semiconductor lasers, on the other hand. The discussions and the treatment of equations are presented in a way that a reader can immediately follow. The

book addresses undergraduate and graduate students of science and engineering. Not only should it enable instructors to prepare their lectures, but it can be helpful to students for preparing for an examination.

**Laser Physics and Laser Instabilities** - Lorenzo M. Narducci 1988

This book is an edited version of lectures given by the authors at the 1985 Jilin University Summer School on Laser Physics. The School was held at Jilin University in Changchun, Peoples' Republic of China.

Advances In Laser Physics - V S Letokhov  
2000-07-06

The birth of quantum electronics in the middle of the 20th century and the subsequent discovery of the laser led to new trends in physics and a number of photonic technologies. This volume is dedicated to Peter Franken, a pioneer of nonlinear optics, and includes papers by the founders of quantum electronics, Aleksandr Prokhorov, Nicolaas Blombergen, and Norman Ramsey. The topics covered range from astronomy to nuclear and semiconductor physics, and from fundamental problems in quantum mechanics to applications in novel laser materials and nanoscience.

**Laser Physics and Spectroscopy** - Pradip Narayan Ghosh 2018-02-19

In this book emphasis is laid on laser including its operation, different types, properties like coherence and monochromaticity, beam propagation, theoretical treatment of atom-field interaction, semi-classical laser theory, non-linear effects, quantum properties, photon concept and coherent states etc. Please note: Taylor & Francis does not sell or distribute the Hardback in India, Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka.

**Laser Physics** - 2007

*Introduction to Laser Spectroscopy* - Halina Abramczyk 2005

"This book provides a solid grounding in the fundamentals of many aspects of laser physics, nonlinear optics, molecular spectroscopy and explicates a variety of problems that are key to understanding broad areas of physical, chemical and biological science. It is a useful stepping stone to more specialized topics in laser molecular spectroscopy."--BOOK JACKET.

*Introduction to Laser Physics* - Koichi Shimoda  
2013-04-17

Most of the texts available on lasers deal with laser engineering and laser applications, only a few of them treating theoretical aspects of the laser at an advanced level. *Introduction to Laser Physics* provides an introduction to the essential physics of quantum electronics and lasers. Fundamental topics in modern optics, the applicability of various theoretical approaches, and the physical meaning of laser-related phenomena are carefully described. Experimental results and properties of practical lasers are interwoven, thereby allowing an explicit demonstration of the rate equation approach and the semiclassical treatment. The basic concepts of nonlinear optical devices and laser spectroscopy are introduced. The second edition includes additional information on optical resonators, minor improvements of the text and several new problems, completed with solutions.

**Semiconductor Laser Engineering, Reliability and Diagnostics** - Peter W. Epperlein  
2013-03-18

This reference book provides a fully integrated novel approach to the development of high-power, single-transverse mode, edge-emitting diode lasers by addressing the complementary topics of device engineering, reliability engineering and device diagnostics in the same book, and thus closes the gap in the current book literature. Diode laser fundamentals are discussed, followed by an elaborate discussion of problem-oriented design guidelines and techniques, and by a systematic treatment of the origins of laser degradation and a thorough exploration of the engineering means to enhance the optical strength of the laser. Stability criteria of critical laser characteristics and key laser robustness factors are discussed along with clear design considerations in the context of reliability engineering approaches and models, and typical programs for reliability tests and laser product qualifications. Novel, advanced diagnostic methods are reviewed to discuss, for the first time in detail in book literature, performance- and reliability-impacting factors such as temperature, stress and material instabilities. Further key features include: practical design guidelines that consider also reliability related effects, key laser robustness

factors, basic laser fabrication and packaging issues; detailed discussion of diagnostic investigations of diode lasers, the fundamentals of the applied approaches and techniques, many of them pioneered by the author to be fit-for-purpose and novel in the application; systematic insight into laser degradation modes such as catastrophic optical damage, and a wide range of technologies to increase the optical strength of diode lasers; coverage of basic concepts and techniques of laser reliability engineering with details on a standard commercial high power laser reliability test program. *Semiconductor Laser Engineering, Reliability and Diagnostics* reflects the extensive expertise of the author in the diode laser field both as a top scientific researcher as well as a key developer of high-power highly reliable devices. With invaluable practical advice, this new reference book is suited to practising researchers in diode laser technologies, and to postgraduate engineering students. Dr. Peter W. Epperlein is Technology Consultant with his own semiconductor technology consulting business Pwe-PhotonicsElectronics-IssueResolution in the UK. He looks back at a thirty years career in cutting edge photonics and electronics industries with focus on emerging technologies, both in global and start-up companies, including IBM, Hewlett-Packard, Agilent Technologies, Philips/NXP, Essient Photonics and IBM/JDSU Laser Enterprise. He holds Pre-Dipl. (B.Sc.), Dipl. Phys. (M.Sc.) and Dr. rer. nat. (Ph.D.) degrees in physics, magna cum laude, from the University of Stuttgart, Germany. Dr. Epperlein is an internationally recognized expert in compound semiconductor and diode laser technologies. He has accomplished R&D in many device areas such as semiconductor lasers, LEDs, optical modulators, quantum well devices, resonant tunneling devices, FETs, and superconducting tunnel junctions and integrated circuits. His pioneering work on sophisticated diagnostic research has led to many world's first reports and has been adopted by other researchers in academia and industry. He authored more than seventy peer-reviewed journal papers, published more than ten invention disclosures in the IBM Technical Disclosure Bulletin, has served as reviewer of numerous proposals for publication in technical journals, and has won five IBM



Research Division Awards. His key achievements include the design and fabrication of high-power, highly reliable, single mode diode lasers. Book Reviews "Semiconductor Laser Engineering, Reliability and Diagnostics: A Practical Approach to High Power and Single Mode Devices". By Peter W. Epperlein Prof. em. Dr. Heinz Jäckel, High Speed Electronics and Photonics, Swiss Federal Institute of Technology ETH Zürich, Switzerland The book "Semiconductor Laser Engineering, Reliability and Diagnostics" by Dr. P.W. Epperlein is a landmark in the recent literature on semiconductor lasers because it fills a longstanding gap between many excellent books on laser theory and the complex and challenging endeavor to fabricate these devices reproducibly and reliably in an industrial, real world environment. Having worked myself in the early research and development of high power semiconductor lasers, I appreciate the competent, complete and skillful presentation of these three highly interrelated topics, where small effects have dramatic consequences on the success of a final product, on the ultimate performance and on the stringent reliability requirements, which are the name of the game. As the title suggests the author addresses three tightly interwoven and critical topics of state-of-the-art power laser research. The three parts are: device and mode stability engineering (chapter 1, 2), reliability mechanisms and reliability assessment strategies (chapter 3, 4, 5, 6) and finally material and device diagnostics (chapter 7, 8, 9) all treated with a strong focus on the implementation. This emphasis on the complex practical aspects for a large-scale power laser fabrication is a true highlight of the book. The subtle interplay between laser design, reliability strategies, advanced failure analysis and characterization techniques are elaborated in a very rigorous and scientific way using a very clear and easy to read representation of the complex interrelation of the three major topics. I will abstain from trying to provide a complete account of all the topics but mainly concentrate on the numerous highlights. The first part 1 "Laser Engineering" is divided in two chapters on basic electronic-optical, structural, material and resonator laser engineering on the one side, and on single mode control and stability at very

high, still reliable power-levels with the trade-off between mirror damage, single mode stability on the other side. To round up the picture less well-known concepts and the state-of-the-art of large-area lasers, which can be forced into single-mode operation, are reviewed carefully. The subtle and complex interplay, which is challenging to optimize for a design for reliability and low stress as a major boundary condition is crucial for the design. The section gives a rather complete and well-referenced account of all relevant aspects, relations and trade-offs for understanding the rest of the book. The completeness of the presentation on power laser diode design based on basic physical and plausible arguments is mainly based on analytic mathematical relations as well as experiments providing a new and well-balanced addition for the power diode laser literature in particular. Modern 2D self-consistent electro-optical laser modeling including carrier hole burning and thermal effects - this is important because the weak optical guiding and gain-discrimination depend critically on rather small quantities and effects, which are difficult to optimize experimentally - is used in the book for simulation results, but is not treated separately. The novel and really original, "gap-filling" bulk of the book is elaborated by the author in a very clear way in the following four chapters in the part 2 "Laser Reliability" on laser degradation physics and mirror design and passivation at high power, followed then by two very application oriented chapters on reliability design engineering and practical reliability strategies and implementation procedures. This original combination of integral design and reliability aspects - which are mostly neglected in standard literature - is certainly a major plus of this book. I liked this second section as a whole, because it provides excellent insights in degradation physics on a high level and combines it in an interesting and skillful way with the less "glamorous" (unfortunately) but highly relevant reliability science and testing strategies, which is particularly important for devices operating at extreme optical stresses with challenging lifetime requirements in a real word environment. Finally, the last part 3 "Laser Diagnostics" comprising three chapters, is devoted mainly to advanced experimental

diagnostics techniques for material integrity, mechanical stress, deep level defects, various dynamic laser degradation effects, surface- and interface quality, and most importantly heating and disordering of mirrors and mirror coatings. The topics of characterization techniques comprising micro-Raman- and micro-thermoreflectance-probing, 2K photoluminescence spectroscopy, micro-electroluminescence and photoluminescence scanning, and deep-level-transient spectroscopy have been pioneered by the author for the specific applications over many years guaranteeing many competent and well represented insights. These techniques are brilliantly discussed and the information distributed in many articles by the author has been successfully unified in a book form. In my personal judgment and liking, I consider the parts 2 and 3 on reliability and diagnostics as the most valuable and true novel contribution of the book, which in combination with the extremely well-covered laser design of part 1 clearly fill the gap in the current diode laser literature, which in this detail has certainly been neglected in the past. In summary, I can highly recommend this excellent, well-organized and clearly written book to readers who are already familiar with basic diode laser theory and who are active in the academic and industrial fabrication and characterization of semiconductor lasers. Due to its completeness, it also serves as an excellent reference of the current state-of-the-art in reliability engineering and device and material diagnostics. Needless to mention that the quality of the book, its representations and methodical structure meet the highest expectation and are certainly a tribute from the long and broad experience of the author in academic laser science and the industrial commercialization of high power diode lasers. In my opinion, this book was a pleasure to read and due to its quality and relevance deserves a large audience in the power diode laser community! Prof. em. Dr. Heinz Jäckel, High Speed Electronics and Photonics, Swiss Federal Institute of Technology ETH Zürich, Switzerland June 16, 2013

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===== "Semiconductor Laser Engineering, Reliability and Diagnostics: A

Practical Approach to High Power and Single Mode Devices". By Peter W. Epperlein Dr. Chung-en Zah, Research Director, Semiconductor Technologies Research, S&T Division, Corning Incorporated, Corning NY, USA This book covers for the first time the three closely interrelated key laser areas of engineering (design), reliability and diagnostics in one book, written by the well-known practitioner in cutting-edge optoelectronics industries, Dr. Peter W. Epperlein. The book closes the gap in the current book literature and is thus a unique and excellent example of how to merge design, reliability and diagnostics aspects in a very professional, profound and complete manner. All physical and technological principles, concepts and practical aspects required for developing and fabricating highly-reliable high-power single-mode laser products are precisely specified and skilfully formulated along with all the necessary equations, figures, tables and worked-out examples making it easy to follow through the nine chapters. Hence, this unique book is a milestone in the diode laser literature and is an excellent reference book not only for diode laser researchers and engineers, but also diode laser users. The engineering part starts with a very informative and clear, well-presented account of all necessary basic diode laser types, principles, parameters and characteristics for an easy and quick understanding of laser functionality within the context of the book. Along with an elaborate and broad discussion of relevant laser material systems, applications, typical output powers, power-limiting factors and reliability tradeoffs, basic fabrication and packaging technologies, this excellent introductory section is well suited to become quickly and easily familiar with practical aspects and issues of diode laser technologies. Of special importance and high usefulness is the first analytic and quantitative discussion in a book on issues of coupling laser power into optical single mode fibers. The second section discusses in a well-balanced, competent and skilful way waveguide topics such as basic high-power design approaches, transverse vertical and lateral waveguide concepts, stability of the fundamental transverse lateral mode and fundamental mode waveguide optimization techniques by considering

detrimental effects such as heating, carrier injection, spatial hole burning, lateral current spreading and gain profile variations. Less well-known approaches to force large-area lasers into a single mode operation are well-identified and carefully discussed in depth and breadth. All these topics are elaborated in a very complete, rigorous and scientific way and are clearly articulated and easy to read. In particular, the book works out the complex interaction between the many different effects to optimize high-power single-mode performance at ultimate reliability and thus is of great benefit to every researcher and engineer engaged in this diode laser field. Another novelty and highlight is, for the first time ever in book form, a comprehensive yet concise discussion of diode laser reliability related issues. These are elaborated in four distinct chapters comprising laser degradation physics and modes, optical strength enhancement approaches including mirror passivation/coating and non-absorbing mirror technologies, followed by two highly relevant product-oriented chapters on reliability design engineering concepts and techniques and an elaborate reliability test plan for laser chip and module product qualification. This original and novel approach to link laser design to reliability aspects and requirements provides both, most useful insight into degradation processes such as catastrophic optical mirror damage on a microscopic scale, and a wide selection of effective remedial actions. These accounts, which are of highest significance for lasers operating at the optical stress limit due to extremely high output power densities and most demanding lifetime requirements are very professionally prepared and discussed in an interesting, coherent and skilful manner. The diagnostics part, consisting of three very elaborate chapters, is most unique and novel with respect to other diode laser books. It discusses for the first time ever on a very high level and in a competent way studies on material integrity, impurity trapping effects, mirror and cavity temperatures, surface- and interface quality, mirror facet disorder effects, mechanical stress and facet coating instability, and diverse laser temperature effects, dynamic laser degradation effects and mirror temperature maps. Of highest significance to design,

performance and reliability are the various correlations established between laser device and material parameters. The most different and sophisticated experiments, carried out by the author at micrometer spatial resolutions and at temperatures as low as 2K, provide highly valuable insights into laser and material quality parameters, and reveal for the first time the origins of high power limitations on an atomic scale due to local heating effects and deep level defects. It is of great benefit, that the experimental techniques such as Raman spectroscopy, various luminescence techniques, thermorelectance and deep-level transient spectroscopy, pioneered by the author for the specific experiments on lasers, are discussed with great expertise in depth and breadth, and the numerous paper articles published by the author are now represented in this book. The book has an elaborate table of contents and index, which are very useful, over 200 illustrative figures and tables, and extensive lists of references to all technical topics at the end of each of the nine chapters, which make it easy to follow from cover to cover or by jumping in at random areas of special interest. Moreover, experimental and theoretical concepts are always illustrated by practical examples and data. I can highly recommend this extremely relevant, well-structured and well-formulated book to all practising researchers in industrial and academic diode laser R&D environments and to post-graduate engineering students interested in the actual problems of designing, manufacturing, testing, characterising and qualifying diode lasers. Due to its completeness and novel approach to combine design, reliability and diagnostics in the same book, it can serve as an ideal reference book as well, and it deserves to be welcomed worldwide by the addressed audience. Dr. Chung-en Zah, Research Director, Semiconductor Technologies Research, S&T Division, Corning Incorporated, Corning NY, USA

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 ===== "Semiconductor Laser Engineering, Reliability and Diagnostics: A Practical Approach to High Power and Single Mode Devices". By Peter W. Epperlein  
 Cordinatore Prof. Lorenzo Pavesi, UNIVERSITÀ DEGLI STUDI DI TRENTO, Dipartimento di

Fisica / Laboratorio di Nanoscienze This book represents a well thought description of three fundamental aspects of laser technology: the functioning principles, the reliability and the diagnostics. From this point of view, and, as far as I know, this is a unique example of a book where all these aspects are merged together resulting in a well-balanced presentation. This helps the reader to move with ease between different concepts since they are presented in a coherent manner and with the same terminology, symbols and definitions. The book reads well. Despite the subtitle indicates that it is a practical approach, the book is also correct from a formal point of view and presents the necessary equations and derivations to understand both the physical mechanisms and the practicalities via a set of useful formulas. In addition, there is the more important aspect of many real-life examples of how a laser is actually manufactured and which the relevant parameters that determine its behaviour are. It impresses the amounts of information that are given in the book: this would be more typical of a thick handbook on semiconductor laser than of an agile book. Dr. Epperlein was able to identify the most important concepts and to present them in a clear though concise way. I am teaching a course on Optoelectronics and I'm going to advise students to refer to this book, because it has all the necessary concepts and derivations for a systematic understanding of semiconductor lasers with many worked-out examples, which will help the student to grasp the actual problems of designing, manufacturing, testing and using semiconductor lasers. All the various concepts are joined to very useful figures, which, if provided to instructors as files, can be a useful add-on for the use of the book as text for teaching. Concepts are always detailed with numbers to give a feeling of their practical use. In conclusion, I do find the book suitable for my teaching duties and will refer it to my students.

Prof. Dr. Lorenzo Pavesi, Head of the Department of Physics, Head of the Nanoscience Laboratory, University of Trento, Italy 31 May 2013

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 ===== "Semiconductor Laser Engineering, Reliability and Diagnostics: A

Practical Approach to High Power and Single Mode Devices". By Peter W. Epperlein Robert W. Herrick, Ph.D., Senior Component Reliability Engineer, Intel Corp., Santa Clara, California, USA Dr. Epperlein has done the semiconductor laser community a great service, by releasing the most complete book on the market on the practical issues of how to make reliable semiconductor lasers. While dozens of books have been written over the past couple of decades on semiconductor laser design, only a handful have been written on semiconductor laser reliability. Prior to the release of this book, perhaps 40% of the material could be obtained elsewhere by combining five books: one on laser design, one on laser reliability, one on reliability calculations, and a couple of laser review books. Another 40% could be pieced together by collecting 50 -100 papers on the subjects of laser design, laser fabrication, characterization, and reliability. The remaining 20% have not previously been covered in any comprehensive way. Only the introductory material in the first half of the first chapter has good coverage elsewhere. The large majority of the knowledge in this book is generally held as "trade secret" by those with the expertise in the field, and most of those in the know are not free to discuss. The author was fortunate enough to work for the first half of his career in the IBM research labs, with access to unparalleled resources, and the ability to publish his work without trade secret restrictions. The results are still at the cutting edge of our understanding of semiconductor laser reliability today, and go well beyond the empirical "black box" approach many use of "try everything, and see what works." The author did a fine job of pulling together material from many disparate fields. Dr. Epperlein has particular expertise in high power single mode semiconductor lasers, and those working on those type of lasers will be especially interested in this book, as there has never been a book published on the fabrication and qualification of such lasers before. But those in almost any field of semiconductor lasers will learn items of interest about device design, fabrication, reliability, and characterization. Unlike most other books, which intend to convey the scientific findings or past work of the author, this one is written more as a "how to" manual,

which should make it more accessible and useful to development engineers and researchers in the field. It also has over 200 figures, which make it easier to follow. As with many books of this type, it is not necessary to read it from cover-to-cover; it is best skimmed, with deep diving into any areas of special interest to the reader. The book is remarkable also for how comprehensive it is - even experts will discover something new and useful. Dr. Epperlein's book is an essential read for anyone looking to develop semiconductor lasers for anything other than pure research use, and I give it my highest recommendation. Robert W. Herrick, Ph.D., Senior Component Reliability Engineer, Intel Corp., Santa Clara, California, USA

Principles of Lasers - Orazio Svelto 2010-03-16  
This fifth edition of Principles of Lasers includes corrections to the previous edition as well as being the first available as an ebook. Its mission remains to provide a broad, unified description of laser behavior, physics, technology, and applications.

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