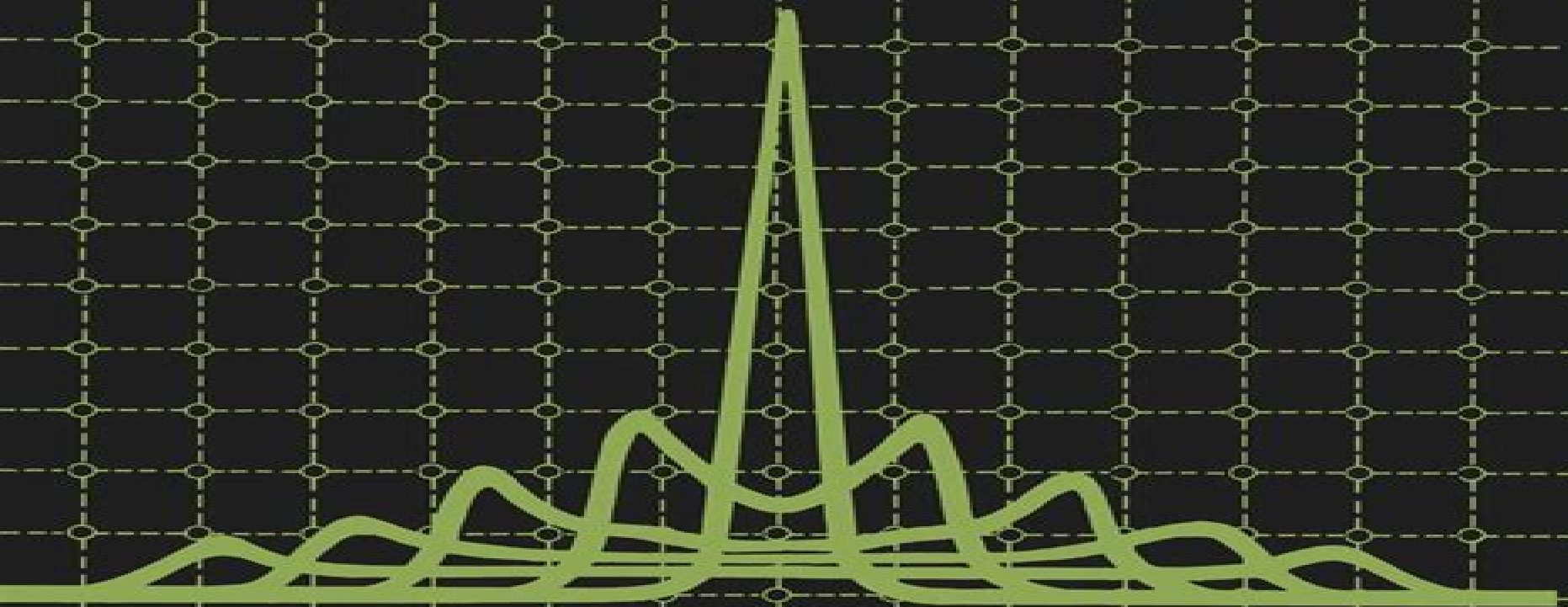


LONG-WAVELENGTH SEMICONDUCTOR LASERS

G.P. AGRAWAL
N.K. DUTTA



Long Wavelength Semiconductor Lasers

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Long-Wavelength Semiconductor Lasers Govind Agrawal, 2014-09-12 Since its invention in 1962 the semiconductor laser has come a long way Advances in material purity and epitaxial growth techniques have led to a variety of semiconductor lasers covering a wide wavelength range of 0.3-100 μm The development during the 1970s of GaAs semiconductor lasers emitting in the near infrared region of 0.8-0.9 μm resulted in their use for the first generation of optical fiber communication systems However to take advantage of low losses in silica fibers occurring around 1.3 and 1.55 μm the emphasis soon shifted toward long wavelength semiconductor lasers The material system of choice in this wavelength range has been the quaternary alloy InGaAsP During the last five years or so the intense development effort devoted to InGaAsP lasers has resulted in a technology mature enough that lightwave transmission systems using InGaAsP lasers are currently being deployed throughout the world This book is intended to provide a comprehensive account of long wave length semiconductor lasers Particular attention is paid to InGaAsP lasers although we also consider semiconductor lasers operating at longer wave lengths The objective is to provide an up to date understanding of semicon ductor lasers while incorporating recent research results that are not yet available in the book form Although InGaAsP lasers are often used as an example the basic concepts discussed in this text apply to all semiconductor lasers irrespective of their wavelengths

Long-Wavelength Infrared Semiconductor Lasers Hong K. Choi, 2004-03-18 Long wavelength Infrared Semiconductor Lasers provides a comprehensive review of the current status of semiconductor coherent sources emitting in the mid to far infrared spectrum and their applications It includes three topics not covered in any previous book far infrared

emission from photo mixers as well as from hot hole lasers and InP based lasers emitting beyond two micrometers. Semiconductor lasers emitting at more than two micrometers have many applications such as in trace gas analysis, environmental monitoring and industrial process control. Because of very rapid progress in recent years, until this book, no comprehensive information beyond scattered journal articles is available at present.

Semiconductor Lasers Govind P. Agrawal, Niloy K. Dutta, 2013-11-27. Since its invention in 1962, the semiconductor laser has come a long way. Advances in material purity and epitaxial growth techniques have led to a variety of semiconductor lasers covering a wide wavelength range of 0.3 to 100 μm . The development during the 1970s of GaAs semiconductor lasers emitting in the near infrared region of 0.8 to 0.9 μm resulted in their use for the first generation of optical fiber communication systems. However, to take advantage of low losses in silica fibers occurring around 1.3 and 1.55 μm , the emphasis soon shifted toward long wavelength semiconductor lasers. The material system of choice in this wavelength range has been the quaternary alloy InGaAsP. During the last five years or so, the intense development effort devoted to InGaAsP lasers has resulted in a technology mature enough that lightwave transmission systems using InGaAsP lasers are currently being deployed throughout the world. This book is intended to provide a comprehensive account of long wavelength semiconductor lasers. Particular attention is paid to InGaAsP lasers, although we also consider semiconductor lasers operating at longer wavelengths. The objective is to provide an up to date understanding of semiconductor lasers while incorporating recent research results that are not yet available in the book form. Although InGaAsP lasers are often used as an example, the basic concepts discussed in this text apply to all semiconductor lasers irrespective of their wavelengths.

Design and Fabrication of High Speed, Long Wavelength, Semiconductor Lasers John Gilmary Wasserbauer, 1994. Semiconductor Lasers for Long-wavelength Optical-fibre Communications Systems M. J. Adams, 1987. Using Band-filling to Understand Long-wavelength Semiconductor Lasers and Q-switching of Solid-state Lasers Yi-jen Tsou, 1993. *InGaAsNSb* Xiaoping Yang, 2002. *Long Wavelength Infrared Emitters Based on Quantum Wells and Superlattices* Manfred Helm, 2000-10-31. This book offers a thorough survey of long wavelength infrared semiconductor emitters based primarily on quantum wells and superlattices. Featuring contributions from the most prominent researchers in the field, this volume allows readers to compare different types of lasers as well as examine investigations of potential far infrared terahertz sources. This is an essential reference for researchers, engineers and graduate students who wish to obtain comprehensive knowledge about infrared semiconductor sources and recent developments in this field.

Long-Wavelength Infrared Semiconductor Lasers Hong K Choi, 2004. *Semiconductor Lasers II* Eli Kapon, 1999-01-14. Judging from the impact it has on our everyday lives, the semiconductor laser has emerged as perhaps the most important laser device currently in use. This volume presents information on recent advances in materials and structures.

Long Wavelength Semiconductor Lasers Development for Infrared Heterodyne Applications National Aeronautics and Space Administration, 2018-12-29. PbSnTe single crystals were grown in a new 3 zone furnace. Molecular beam

epitaxy MBE growth parameters have been established including beam flux vs temperature and growth rates and dopant vs PbTe flux ratios for the various effusion sources involved Lattice matching studies were conducted and doping studies were completed Broad area Pb 1 x Sn x Te double heterostructure lasers were fabricated with active layer compositions up to x equals 0.04 at percent Sn in the active layers Electrical and optical test data are presented Feit Zeev and Kostyk Douglas NASA CR 189243 NAS 1.26 189243 NAS5 30445

Fundamentals of Semiconductor Lasers Takahiro Numai, 2006-05-10 Fundamentals of Semiconductor Lasers explains the physics and fundamental characteristics of semiconductor lasers with regard to systems applications The detailed and comprehensive presentation is unique in that it encourages the reader to consider different semiconductor lasers from different angles Emphasis is placed on recognizing common concepts such as operating principles and structure and solving problems based on individual situations The treatment is enhanced by an historical account of advances in semiconductor lasers over the years discussing both those ideas that have persisted over the years and those that have faded out The first four chapters cover the basics of semiconductors including band structures optical transitions optical waveguides and optical resonators The remaining chapters discuss operating principles and basic characteristics of semiconductor lasers and advanced topics including dynamic single mode lasers quantum well lasers and control of spontaneous emission The reader need only be familiar with undergraduate level electromagnetism and quantum mechanics After reading this book the student will be able to think critically about semiconductor lasers and be able to read and understand journal papers in the field This book will be essential to any advanced undergraduate or graduate student of semiconductor lasers and any professional physicist or engineer looking for a good overview of the subject

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

Semiconductor Laser Theory Prasanta Kumar Basu, Bratati Mukhopadhyay, Rikmantra Basu, 2015-06-17 Developed from the authors classroom tested material Semiconductor Laser Theory takes a semiclassical approach to teaching the principles structure and applications of semiconductor lasers Designed for graduate students in physics electrical engineering and materials science the text covers many recent developments including diode lasers u

Process Technology for Semiconductor Lasers Kenichi Iga, Susumu Kinoshita, 2013-03-07 Process Technology for Semiconductor Lasers describes the design principles of semiconductor lasers mainly from the fabrication point of view A review is given of the history of semiconductor laser development and applications and of the materials used in lasing at short to long wavelengths The basic design principles for semiconductor laser devices and the epitaxy for laser production are discussed An entire chapter is devoted to the technology of liquid phase epitaxy and another one to vapor phase and beam epitaxies The characterizations of laser materials and the fabrication and characteristics of semiconductor lasers are treated Mode control techniques are presented and surface emitting lasers are introduced in the final chapter

History Of

Modern Optics And Optoelectronics Development In China Shouyun Tan, 2014-06-11 This book presents a collection of memoir papers on the development of modern and contemporary optics and optoelectronics in China from the 18th to 20th centuries The papers were written by famous scientists in China including members of the Chinese Academy of Sciences and the Chinese Academy of Engineering sharing their experience in different fields of optics and optoelectronics development This is a unique book in understanding the natural science history of optics and optoelectronics It gives you the general idea about how the western optical science spread to China in the 17th to 18th century the cradle of the contemporary optics in China Birth development and application of lasers in China high energy and high power lasers for laser antiballistic missile and laser nuclear fusion development of Chinese optical communication and optical information storage laser and infrared optics research for space science development of Chinese optical instruments etc

Distributed Feedback Laser Diodes and Optical Tunable Filters Dr. H. Ghafouri-Shiraz, 2004-02-06 Advances in optical fibre based communications systems have played a crucial role in the development of the information highway By offering a single mode oscillation and narrow spectral output distributed feedback DFB semiconductor laser diodes offer excellent optical light sources as well as optical filters for fibre based communications and dense wavelength division multiplexing DWDM systems This comprehensive text focuses on the basic working principles of DFB laser diodes and optical filters and details the development of a new technique for enhanced system performance Considers the optical waveguiding characteristics and properties of semiconductor materials and the physics of DFB semiconductor lasers Presents a powerful modelling technique based on the transfer matrix method which can be used to improve the design of laser diodes optical fibres and amplifiers Examines the effect of the various corrugation shapes on the coupling coefficients and lasing characteristics of DFB laser diodes Technical advice to improve immunity against the spatial hole burning effect Extensive referencing throughout and a comprehensive glossary of symbols and abbreviations Suitable for both introductory and advanced levels This is an indispensable textbook for undergraduate and postgraduate students of electrical and electronic engineering and physics as it consolidates their knowledge in this rapidly growing field As a technical guide for the structural design of DFB laser diodes and optical filters the book will serve as an invaluable reference for researchers in opto electronics and semi conductor device physics

Optical and Microwave Technologies for Telecommunication Networks Otto Strobel, 2016-03-23 This is a self contained book on the foundations and applications of optical and microwave technologies to telecommunication networks application with an emphasis on access local road cars trains vessels and airplanes indoor and in car data transmission as well as for long distance fiber systems and application in outer space and automation technology The book provides a systematic discussion of physics optics electromagnetic wave theory optical fibre technology and the potential and limitations of optical and microwave transmission

Vertical External Cavity Surface Emitting Lasers Michael Jetter, Peter Michler, 2021-09-16 Vertical External Cavity Surface Emitting Lasers Provides comprehensive coverage of the advancement

of vertical external cavity surface emitting lasers Vertical external cavity surface emitting lasers VECSELs emit coherent light from the infrared to the visible spectral range with high power output Recent years have seen new device developments such as the mode locked integrated MIXSEL and the membrane external cavity surface emitting laser MECSEL expand the application of VECSELs to include laser cooling spectroscopy telecommunications biophotonics and laser based displays and projectors In Vertical External Cavity Surface Emitting Lasers VECSEL Technology and Applications leading international research groups provide a comprehensive fully up to date account of all fundamental and technological aspects of vertical external cavity surface emitting lasers This unique book reviews the physics and technology of optically pumped disk lasers and discusses the latest developments of VECSEL devices in different wavelength ranges Topics include OP VECSEL physics continuous wave CW lasers frequency doubling carrier dynamics in SESAMs and characterization of nonlinear lensing in VECSEL gain samples This authoritative volume Summarizes new concepts of DBR free and MECSEL lasers for the first time Covers the mode locking concept and its application Provides an overview of the emerging concept of self mode locking Describes the development of next generation OPS laser products Vertical External Cavity Surface Emitting Lasers VECSEL Technology and Applications is an invaluable resource for laser specialists semiconductor physicists optical industry professionals spectroscopists telecommunications engineers and industrial physicists

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Table of Contents Long Wavelength Semiconductor Lasers

1. Understanding the eBook Long Wavelength Semiconductor Lasers
 - The Rise of Digital Reading Long Wavelength Semiconductor Lasers
 - Advantages of eBooks Over Traditional Books
2. Identifying Long Wavelength Semiconductor Lasers
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Long Wavelength Semiconductor Lasers
 - User-Friendly Interface
4. Exploring eBook Recommendations from Long Wavelength Semiconductor Lasers

- Personalized Recommendations
- Long Wavelength Semiconductor Lasers User Reviews and Ratings
- Long Wavelength Semiconductor Lasers and Bestseller Lists
- 5. Accessing Long Wavelength Semiconductor Lasers Free and Paid eBooks
 - Long Wavelength Semiconductor Lasers Public Domain eBooks
 - Long Wavelength Semiconductor Lasers eBook Subscription Services
 - Long Wavelength Semiconductor Lasers Budget-Friendly Options
- 6. Navigating Long Wavelength Semiconductor Lasers eBook Formats
 - ePub, PDF, MOBI, and More
 - Long Wavelength Semiconductor Lasers Compatibility with Devices
 - Long Wavelength Semiconductor Lasers Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Long Wavelength Semiconductor Lasers
 - Highlighting and Note-Taking Long Wavelength Semiconductor Lasers
 - Interactive Elements Long Wavelength Semiconductor Lasers
- 8. Staying Engaged with Long Wavelength Semiconductor Lasers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Long Wavelength Semiconductor Lasers
- 9. Balancing eBooks and Physical Books Long Wavelength Semiconductor Lasers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Long Wavelength Semiconductor Lasers
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Long Wavelength Semiconductor Lasers
 - Setting Reading Goals Long Wavelength Semiconductor Lasers
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Long Wavelength Semiconductor Lasers

- Fact-Checking eBook Content of Long Wavelength Semiconductor Lasers
- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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