PROCEEDINGS OF SPIE

[SPIDigitalLibrary.org/conference-proceedings-of-spie](https://spiedigitallibrary.org/conference-proceedings-of-spie)

Front Matter: Volume 6909

, "Front Matter: Volume 6909," Proc. SPIE 6909, Novel In-Plane
Semiconductor Lasers VII, 690901 (5 February 2008); doi: 10.1117/12.791663

SPIE.

Event: Integrated Optoelectronic Devices 2008, 2008, San Jose, California,
United States

PROCEEDINGS OF SPIE

Novel In-Plane Semiconductor Lasers VII

Alexey A. Belyanin
Peter M. Smowton
Editors

21–24 January 2007
San Jose, California, USA

Sponsored and Published by
SPIE

Volume 6909

Proceedings of SPIE, 0277-786X, v. 6909

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Novel In-Plane Semiconductor Lasers VII*, edited by Alexey A. Belyanin, Peter M. Smowton, Proceedings of SPIE Vol. 6909 (SPIE, Bellingham, WA, 2008) Article CID Number.

ISSN 0277-786X

ISBN 9780819470843

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2008, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/08/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

ix Conference Committee

SESSION 1 QUANTUM DOTS AND InGaAsN

- 6909 03 **High-performance 1300-nm InAs/GaAs quantum-dot lasers** [6909-02]
H. Y. Liu, Univ. College London (United Kingdom) and Univ. of Sheffield (United Kingdom);
M. Hopkinson, K. Groom, R. A. Hogg, D. J. Mowbray, Univ. of Sheffield (United Kingdom)
- 6909 04 **High performance quantum dot distributed feedback laser diodes around 1.15 μm**
[6909-03]
J. Koeth, M. Fischer, M. Legge, J. Seufert, R. Werner, Nanoplus Nanosystems and
Technologies GmbH (Germany)
- 6909 05 **High performance 1.3 μm GaInNAs quantum well lasers on GaAs (Invited Paper)** [6909-04]
S. M. Wang, G. Adolfsson, H. Zhao, Chalmers Univ. of Technology (Sweden); Y. Q. Wei, Univ.
of Cambridge (United Kingdom); J. S. Gustavsson, M. Sadeghi, A. Larsson, Chalmers Univ.
of Technology (Sweden)

SESSION 2 QUANTUM DOTS AND MODELOCKING

- 6909 08 **Reconfigurable monolithic quantum dot passively mode-locked lasers (Invited Paper)**
[6909-07]
Y.-C. Xin, Y. Li, Ctr. for High Technology Materials, Univ. of New Mexico (USA); V. Kovanis,
AFRL (USA); L. F. Lester, Ctr. for High Technology Materials, Univ. of New Mexico (USA)
- 6909 09 **Monolithic mode-locked quantum dot lasers (Invited Paper)** [6909-08]
R. V. Penty, M. G. Thompson, I. H. White, Univ. of Cambridge (United Kingdom)
- 6909 0A **Low-noise monolithic mode-locked semiconductor lasers through low-dimensional
structures (Invited Paper)** [6909-09]
K. Yvind, D. Larsson, J. Mørk, J. M. Hvam, Technical Univ. of Denmark (Denmark);
M. Thompson, R. Penty, I. White, Univ. of Cambridge (United Kingdom)

SESSION 3 INTEGRATION

- 6909 0B **High performance laser arrays for tunable and parallel link applications (Invited Paper)**
[6909-10]
B. Pezeshki, G. Yoffe, Santur Corp. (USA)

- 6909 0C **Reduction of RIE induced damage of GaInAsP/InP DQW lasers fabricated by 2-step growth** [6909-11]
D. Plumwongrot, M. Kurokawa, T. Okumura, Y. Nishimoto, Tokyo Institute of Technology (Japan); T. Maruyama, Tokyo Institute of Technology (Japan) and JST-CREST (Japan); N. Nishiyama, Tokyo Institute of Technology (Japan); S. Arai, Tokyo Institute of Technology (Japan) and JST-CREST (Japan)
- 6909 0D **Three-guide coupled rectangular ring lasers with total internal reflection mirrors** [6909-12]
D. G. Kim, W. K. Choi, I.-I. Jung, G.-Y. Oh, Y. W. Choi, Chung-Ang Univ. (South Korea); J. C. Yi, Hong-Ik Univ. (South Korea); N. Dagli, Univ. of California, Santa Barbara (USA)

SESSION 4 NITRIDES

- 6909 0F **A GaN-based surface-emitting laser with 45°-inclined mirror in horizontal cavity** [6909-14]
M. Kawaguchi, S. Tamura, M. Yuri, D. Ueda, Matsushita Electric Industrial Co., Ltd. (Japan)
- 6909 0G **Characterization of AlInGaN-based 405nm distributed feedback laser diodes (Invited Paper)** [6909-15]
S. Masui, K. Tsukayama, T. Yanamoto, T. Kozaki, S. Nagahama, T. Mukai, Nichia Corp. (Japan)

SESSION 5 THz LASERS

- 6909 0I **High-temperature and high-power operation of terahertz quantum-cascade lasers (Invited Paper)** [6909-17]
S. Kumar, A. W. M. Lee, Q. Qin, Massachusetts Institute of Technology (USA); B. S. Williams, Univ. of California, Los Angeles (USA); Q. Hu, Massachusetts Institute of Technology (USA); J. L. Reno, Sandia National Labs. (USA)

SESSION 6 SILICON PHOTONICS I: JOINT SESSION WITH CONFERENCE 6898

- 6909 0M **Monolithically integrated III-Sb based laser diodes grown on miscut Si substrates (Invited Paper)** [6909-21]
J. Tatebayashi, Univ. of California, Los Angeles (USA); A. Jallipalli, M. N. Kuttu, S. H. Huang, N. Nuntawong, Ctr. for High Technology Materials, Univ. of New Mexico (USA); G. Balakrishnan, Univ. of California, Los Angeles (USA); L. R. Dawson, Ctr. for High Technology Materials, Univ. of New Mexico (USA); D. L. Huffaker, Univ. of California, Los Angeles (USA) and Ctr. for High Technology Materials, Univ. of New Mexico (USA)
- 6909 0N **On-chip integration of InGaAs/GaAs quantum dot lasers with waveguides and modulators on silicon (Invited Paper)** [6909-22]
J. Yang, P. Bhattacharya, Univ. of Michigan (USA); G. Qin, Z. Ma, Univ. of Wisconsin, Madison (USA)

SESSION 7 SILICON PHOTONICS II: JOINT SESSION WITH CONFERENCE 6898

- 6909 0O **Recess integration of micro-cleaved laser diode platelets with dielectric waveguides on silicon (Invited Paper)** [6909-23]
C. G. Fonstad, Jr., J. J. Rumpler, E. R. Barkley, J. M. Perkins, S. Famenini, Massachusetts Institute of Technology (USA)

SESSION 8 HIGH BRIGHTNESS

- 6909 0P **High-brightness diode lasers with very narrow vertical divergence (Invited Paper)** [6909-24]
G. Erbert, F. Bugge, B. Eppich, J. Fricke, K.-H. Hasler, K. Paschke, A. Pietrzak, H. Wenzel, G. Tränkle, Ferdinand-Braun-Institut (Germany)
- 6909 0Q **Highly reliable, high-brightness 915nm laser diodes for fiber laser applications** [6909-25]
Z. Xu, W. Gao, L. Cheng, K. Luo, K. Shen, A. Mastrovito, Axcel Photonics, Inc. (USA)
- 6909 0R **Asymmetric Al-free active region laser structure for high-brightness tapered lasers at 975 nm** [6909-26]
N. Michel, M. Calligaro, M. Lecomte, O. Parillaud, M. Krakowski, Alcatel-Thales III-V Lab. (France); J. M. G. Garcia-Tijero, H. Odriozola, I. Esquivias, Univ. Politécnica de Madrid (Spain)
- 6909 0S **High reliability, high power arrays of 808 nm single mode diode lasers employing various quantum well structures** [6909-27]
B. C. Qiu, O. Kowalski, S. D. McDougall, X. F. Liu, J. H. Marsh, Intense, Ltd. (United Kingdom)
- 6909 0T **Grazing-incidence-slab semiconductor laser (GRISL)** [6909-28]
A. K. Goyal, R. K. Huang, L. Missaggia, MIT Lincoln Lab. (USA)

SESSION 9 MID-IR LASERS

- 6909 0U **InAs-based quantum-cascade lasers (Invited Paper)** [6909-29]
J. Devenson, R. Teissier, O. Cathabard, A. N. Baranov, Institut d'Électronique du Sud, CNRS, Univ. Montpellier II (France)
- 6909 0V **Short-wavelength quantum cascade lasers (Invited Paper)** [6909-30]
D. G. Revin, S. Zhang, M. J. Steer, R. J. Airey, A. B. Krysa, M. Hopkinson, L. R. Wilson, S. Menzel, J. W. Cockburn, Univ. of Sheffield (United Kingdom)
- 6909 0X **Interband cascade laser progress (Invited Paper)** [6909-32]
W. W. Bewley, C. L. Canedy, M. Kim, C. S. Kim, J. A. Nolde, D. C. Larrabee, J. R. Lindle, I. Vurgaftman, J. R. Meyer, Naval Research Lab. (USA)

SESSION 10 QUANTUM CASCADE LASERS I

- 6909 0Z **Bloch gain in quantum cascade lasers (Invited Paper)** [6909-34]
R. Terazzi, T. Gresch, ETH Zuerich (Switzerland); M. Giovannini, Univ. of Neuchâtel (Switzerland); N. Sekine, Univ. of Tokyo (Japan); J. Faist, ETH Zuerich (Switzerland)

- 6909 10 **Intracavity amplitude modulation of quantum-cascade lasers using intersubband absorption in the active region under reverse bias** [6909-35]
A. Lyakh, R. Maulini, A. Tsekoun, R. Go, Pranalytica, Inc. (USA); C. K. N. Patel, Pranalytica, Inc. (USA) and Univ. of California, Los Angeles (USA)

SESSION 11 QUANTUM CASCADE LASERS II

- 6909 12 **On the coherence/incoherence of electron transport in semiconductor heterostructure optoelectronic devices (Invited Paper)** [6909-37]
P. Harrison, D. Indjin, I. Savić, Z. Ikonić, C. A. Evans, N. Vukmirović, R. W. Kelsall, J. McTavish, V. D. Jovanović, Univ. of Leeds (United Kingdom); V. Milanović, School of Electrical Engineering (Serbia and Montenegro)
- 6909 14 **Multimode regimes and instabilities in quantum-cascade lasers (Invited Paper)** [6909-39]
F. X. Kärtner, A. Gordon, Massachusetts Institute of Technology (USA)
- 6909 16 **Coherent coupling of mid-infrared quantum cascade lasers** [6909-41]
L. K. Hoffmann, TU Vienna (Austria); C. A. Hurni, TU Vienna (Austria) and UCSB (USA); S. Schartner, M. Austerer, E. Mujagić, M. Nobile, W. Schrenk, A. M. Andrews, P. Klang, TU Vienna (Austria); M. P. Semtsiv, W. T. Masselink, Humboldt Univ. Berlin (Germany); G. Strasser, TU Vienna (Austria) and State Univ. of New York at Buffalo (USA)

SESSION 12 HIGH POWER

- 6909 18 **High brightness quantum well and quantum dot tapered lasers (Invited Paper)** [6909-53]
N. Michel, M. Krakowski, I. Hassiaoui, M. Calligaro, M. Lecomte, O. Parillaud, Alcatel-Thales III-V Lab. (France); P. Weinmann, C. Zimmermann, W. Kaiser, M. Kamp, A. Forchel, Univ. Wuerzburg (Germany); E.-M. Pavelescu, J.-P. Reithmaier, Univ. Kassel (Germany); B. Sumpf, G. Erbert, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); M. Kelemen, R. Ostendorf, Fraunhofer Institut für Angewandte Festkörperphysik (Germany); J.-M. García-Tijero, H. Odriozola, I. Esquivias, Univ. Politécnica de Madrid (Spain)
- 6909 19 **Master oscillator power amplifier 3D assemblies based on grating coupled laser diodes** [6909-44]
O. V. Smolski, Univ. of North Carolina at Charlotte (USA); J. K. O'Daniel, Photodigm, Inc. (USA); E. G. Johnson, Univ. of North Carolina at Charlotte (USA); P. Leisher, nLight Corp. (USA); P. Crump, Ferdinand-Braun-Institut (Germany)
- 6909 1A **External cavity phase-locked semiconductor tapered lasers** [6909-45]
I. Hassiaoui, N. Michel, M. Lecomte, O. Parillaud, M. Calligaro, M. Krakowski, Alcatel-Thales III-V Lab. (France); R. McBride, Power Photonic (United Kingdom); G. Bourdet, LULI, Ecole Polytechnique, CNRS, CEA (France); J.-P. Huignard, Thales Research and Technology (France)
- 6909 1B **High-power laser arrays with 100% fill factor emission facet** [6909-46]
D. A. Yanson, S. D. McDougall, B. Qiu, V. Loyo-Maldonado, G. Bacchin, S. Robertson, S. Bon, J. H. Marsh, Intense, Ltd. (United Kingdom)

SESSION 13 APPLICATIONS DRIVEN

- 6909 1C **700–730 nm InGaAsP quantum well ridge-waveguide lasers** [6909-47]
E. Nomoto, T. Taniguchi, T. Ohtoshi, Hitachi, Ltd. (Japan); S. Sasaki, K. Saito, H. Hamada, H. Hara, Opnext Japan, Inc. (Japan)
- 6909 1D **Chirped comb generation in frequency shifted feedback DFB lasers** [6909-48]
J. Paul, Y. Hong, P. S. Spencer, K. A. Shore, Bangor Univ. (United Kingdom)
- 6909 1E **High power DFB lasers for D1 and D2 caesium absorption spectroscopy and atomic clocks** [6909-49]
A. Klehr, H. Wenzel, O. Brox, F. Bugge, G. Erbert, T.-P. Nguyen, G. Tränkle, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany)
- 6909 1F **Narrow linewidth and demonstration of saturation spectra of the Cesium at 852 nm with high power Al-free DFB laser diodes** [6909-50]
V. Ligeret, Alcatel Thales III-V Lab. (France) and Observatoire de Paris, SYRTE (France); S. Bansropun, Thales Research and Technology (France); M. Lecomte, M. Calligaro, O. Parillaud, Alcatel Thales III-V Lab. (France); D. Holleville, N. Dimarcq, Observatoire de Paris, SYRTE (France); N. Michel, M. Krakowski, Alcatel Thales III-V Lab. (France)
- 6909 1G **Integrated 1060nm MOPA pump source for high-power green light emitters in display technology** [6909-52]
O. Brox, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); J. Wiedmann, F. Scholz, Eagleyard Photonics GmbH (Germany); F. Bugge, J. Fricke, A. Klehr, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); T. Laurent, Eagleyard Photonics GmbH (Germany); P. Ressel, H. Wenzel, G. Erbert, G. Tränkle, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany)

Author Index

Conference Committee

Symposium Chair

Ali Adibi, Georgia Institute of Technology (USA)

Symposium Cochair

James G. Grote, Air Force Research Laboratory (USA)

Program Track Chair

E. Fred Schubert, Rensselaer Polytechnic Institute (USA)

Conference Chairs

Alexey A. Belyanin, Texas A&M University (USA)

Peter M. Smowton, Cardiff University (United Kingdom)

Program Committee

Yasuhiko Arakawa, The University of Tokyo (Japan)

Dan Botez, University of Wisconsin, Madison (USA)

David P. Bour, BridgeLux Corporation (USA)

Federico Capasso, Harvard University (USA)

Gary A. Evans, Photodigm, Inc. (USA)

Claire Gmachl, Princeton University (USA)

Michael Kneissl, Technische Universität Berlin (Germany)

Hui Chun Liu, National Research Council Canada (Canada)

Luke J. Mawst, University of Wisconsin, Madison (USA)

Carmen Mermelstein, Reute (Germany)

Jerry R. Meyer, Naval Research Laboratory (USA)

Jesper Mørk, Danmarks Tekniske Universitet (Denmark)

Mario J. Paniccia, Intel Corporation (USA)

Johann P. Reithmaier, Universität Kassel (Germany)

Session Chairs

Quantum Dots and InGaAsN

Peter M. Smowton, Cardiff University (United Kingdom)

Quantum Dots and Modelocking

Shumin Wang, Chalmers Tekniska Högskola (Sweden)

Integration

Johann P. Reithmaier, Universität Kassel (Germany)

Nitrides

Peter M. Smowton, Cardiff University (United Kingdom)

THz Lasers

Dan Botez, University of Wisconsin, Madison (USA)

High Brightness

Gary A. Evans, Photodigm, Inc. (USA)

Mid-IR Lasers

Claire F. Gmachl, Princeton University (USA)

Quantum Cascade Lasers I

Jerry R. Meyer, Naval Research Laboratory (USA)

Quantum Cascade Lasers II

Mikhail A. Belkin, Harvard University (USA)

High Power

Luke J. Mawst, University of Wisconsin, Madison (USA)

Applications Driven

Martin Kamp, Universität Würzburg (Germany)