

**CURRICULUM VITAE – Anders Larsson**

**Full name:** Anders Gösta Larsson

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+46-703-088626 (mobile)

**Date of birth:** December 5, 1957

**Citizenship:** Swedish

**Marital status:** Married, two children

**Employer:** Chalmers University of Technology, SE-41296 Göteborg, Sweden

**Position:** Professor

**Education:** Docent degree in Optoelectronics,  
Chalmers University of Technology, Göteborg, Sweden, 1990

Ph.D. degree in Electrical Engineering,  
Chalmers University of Technology, Göteborg, Sweden, 1987

M.Sc. degree in Electrical Engineering,  
Chalmers University of Technology, Göteborg, Sweden, 1982

**Professional experience:**

Jan. 1994 – : Professor in Optoelectronics,  
Chalmers University of Technology, Göteborg, Sweden.

April 2006 – April 2009: Guest Professor, Institute of Semiconductors,  
Chinese Academy of Sciences, Beijing, China (part time).

Oct. – Nov. 1999: Visiting Professor, Optical Science Center,  
University of Arizona, Tucson, Arizona, USA.

June – July 1997: Visiting Professor, Ulm University, Ulm, Germany.

Nov. 1995: Visiting Professor, Osaka University, Osaka, Japan.

Sept. 1991 – Dec. 1993: Associate Professor, Chalmers University of Technology,  
Göteborg, Sweden

Oct. 1988 – Aug. 1991: Member of Technical Staff, Jet Propulsion Laboratory, Pasadena,  
California, USA.

Sept. 1987 – Sept. 1988: Research Associate, Chalmers University of Technology, Göteborg,  
Sweden.

Aug. 1984 – Dec. 1985: Research Engineer, California Institute of Technology, Pasadena,  
California, USA (on leave from Chalmers).

**Research experience and achievements:**

Professor Larsson's scientific background is in the areas of semiconductor materials and devices for optical communication, optical information processing, infrared detection, and optical measurements.

Materials and fabrication techniques:

- Seven years of epitaxial growth of III-V semiconductor structures by molecular beam epitaxy.
- Materials characterization, including Hall-measurements, photoluminescence, deep level transient spectroscopy, etc.
- Development of nanofabrication techniques (electron beam lithography and dry etching) for advanced device fabrication.
- Investigation of MBE growth conditions and optimization of InAs quantum dots and GaInNAs quantum wells for 1.3  $\mu\text{m}$  emission.
- Development of MBE growth techniques for metamorphic long wavelength materials on GaAs.

Photodetectors:

- Tunable photodetectors for monolithic wavelength demultiplexing and detection.
- Resonant cavity enhanced heterojunction phototransistors with high current gain (3000) and responsivity (200 A/W).

Spatial light modulators:

- Optically controlled spatial light modulators based on novel quantum well structures.

Quantum well lasers, edge emitters:

- High power quantum well lasers, including the first efficient high power 980 nm lasers (240 mW) for pumping Er-doped fiber amplifiers.

Grating based lasers and integrated optics:

- Pioneering work on grating coupled surface emitting semiconductor lasers for high power generation with tailored radiation fields. Development of unstable resonator lasers and MOPAs (master-oscillator power amplifiers) for integration with gratings couplers. Holographic waveguide grating couplers for beam engineering.
- Diffractive integrated optics using surface gratings for functional coupling between guided and free space waves.

Vertical cavity surface emitting lasers:

- Vertical cavity surface emitting lasers (VCSELs) in the wavelength range 670 – 1300 nm.
- Comprehensive numerical modelling of VCSELs with self-consistent treatment of optical, electrical, and thermal effects.
- Record high output power (6 mW) and polarization stable single mode VCSELs using surface nanostructures for transverse and polarization mode control.
- Integration of VCSELs and diffractive optics for beam control.
- Dynamics and high speed modulation of VCSELs. Effects of mode behaviour on the digital and analog modulation characteristics.
- Record high speed VCSELs (47 Gb/s @ 25°C, 40 Gb/s @ 85°C) for short reach links and optical interconnects.
- High speed VCSELs for longer distance transmission over multimode fiber (22 Gb/s over 1100 m, 25 Gb/s over 500 m).

- High speed (5 Gb/s) wavelength tunable (24 nm) VCSELs using surface micromachined MEMS mirror.
- VCSELs for radio-over-fiber links with a record high dynamic range (110 dB·Hz<sup>2/3</sup>). Studies of the distortion characteristics of VCSELs.
- Cascade VCSEL arrays with record high differential efficiency (160%, 2.3 W/A) for improved RF modulation efficiency.

Lasers for uncooled, high speed operation:

- Dilute nitride (GaInNAs) lasers at 1.3 μm with record low threshold currents (300 A/cm<sup>2</sup>) and record high modulation bandwidth (17 GHz). High temperature, high speed operation (10 Gb/s at 110°C).

Optically pumped semiconductor disk lasers:

- InP based optically pumped 1.55 μm disk lasers with record high output power (800 mW), high beam quality ( $M^2 < 1.2$ ) and single frequency operation using novel techniques for thermal management and spectral filtering.
- Mode-locked operation of InP based optically pumped 1.55 μm disk lasers using a GaInNAs based saturable absorber for short pulse generation (3 ps) at high average power (120 mW).
- GaAs based high power (7.5 W) and widely tunable (40 nm) 980 nm disk lasers using gain element optimized for tuning.

UV and deep UV emitters:

- Development of Al-rich AlGaN materials and structures for light emitting diodes.

#### **Educational achievements/experience:**

Initiator and coordinator of the graduate Photonics Program at Chalmers (now part of the master program Wireless, Photonics and Space Engineering).

Teaching in Fundamentals of Photonics, Optoelectronics and Fiber Optical Communication for graduate students.

Teaching in Photonic Devices and Circuits and Semiconductor Physics for postgraduate (PhD) students.

20 students have received the PhD degree under the supervision of Professor Larsson:

|                        |   |
|------------------------|---|
| Torgil Kjellberg       | 1993  |
| Mats Hagberg           | 1994  |
| Ola Sjölund            | 1997  |
| Niklas Eriksson        | 1997  |
| Sigurgeir Kristjansson | 2000  |
| Hans Martinsson        | 2001  |
| Johan Backlund         | 2001 (shared supervision with J. Bengtsson) |
| Peter Modh             | 2002  |
| Josip Vukusic          | 2003  |
| Johan Gustavsson       | 2003 (shared supervision with J. Bengtsson) |
| Christina Carlsson     | 2003  |
| Åsa Haglund            | 2005  |
| Hans Lindberg          | 2006  |
| Yongqiang Wei          | 2006 (shared supervision with S.M. Wang)    |
| Ivar Tångring          | 2008 (shared supervision with S.M. Wang)    |
| Huan Zhao              | 2009 (shared supervision with S.M. Wang)    |

|                  |   |
|------------------|---|
| Göran Adolfsson  | 2011 (shared supervision with J. Bengtsson and S.M. Wang)   |
| Petter Westbergh | 2011 (shared supervision with J. Gustavsson and Å. Haglund) |
| Carl Borgentun   | 2012 (shared supervision with J. Bengtsson)                 |
| Martin Stattin   | 2013 (shared supervision with Å. Haglund and T. Ive)        |

5 postdocs have been trained under the guidance of Professor Larsson:

|                      |           |
|----------------------|-----------|
| Dr. Marco Ghisoni    | 1995-1999 |
| Dr. Ming Li          | 1995-1997 |
| Dr. Xiadong Wang     | 2002-2004 |
| Dr. Benjamin Kögel   | 2009-2012 |
| Dr. Rashid Safaisini | 2011-     |

### **Leadership:**

Manager of the Photonics Laboratory at Chalmers since 1993. The laboratory has ~30 members and an annual turnover of ~ 4 MEuro.

Head of the Optoelectronics Group at the Photonics Laboratory with ~ 15 members.

Principal investigator for numerous national and European projects during the last 20 years. Recent European projects include the FP6 and FP7 projects FAST ACCESS, NATAL, NEMIS, SUBTUNE, VISIT, and MERLIN.

### **Conference organization/management:**

Conference chair:

- IEEE International Semiconductor Laser Conference (2008)
- European Semiconductor Laser Workshop (2004)

Program Chair/co-Chair:

- IEEE International Semiconductor Laser Conference (2006)
- European Conference on Optical Communication (2004)
- IEEE Semiconductor Laser Workshop (2004)

Member of the Technical Program Committee:

- European Conference on Optical Communication (2003)
- European Conference on Integrated Optics (1997, 1999, 2001)
- Conference on Lasers and Electro-Optics Europe (1996, 1998, 2000, 2005)
- IEEE International Semiconductor Laser Conference (1998, 2000, 2002, 2004)
- IEEE LEOS Annual Meeting (2005, 2006, 2007)
- Workshop on Compound Semiconductor Devices & Integrated Circuits in Europe (2006)
- SPIE Photonics Europe – Semiconductor Lasers and Laser Dynamics (2008, 2010, 2012)
- International Conference on Molecular Beam Epitaxy (2008)
- SPIE Photonics West – Vertical Cavity Surface Emitting Lasers (2013, 2014)
- IEEE Topical Meeting on Microwave Photonics (2013)

### **Commissions of trust:**

Member of IEEE Photonics Society Board of Governors, 2014 – 2016.

Associate Editor, IEEE Journal of Lightwave Technology, since 2011.

Member of the Editorial Board, IET Optoelectronics, 2007 – 2012.

Member of the Executive Group, Department of Microtechnology and Nanoscience, Chalmers University of Technology, since 2003.

Member of the Faculty Senate, Chalmers University of Technology, 1994 – 1996.

### **Memberships and awards:**

HP Labs Innovation Research Award, 2012.

Senior Member of IEEE, 2009.

Fellow of the European Optical Society, 2007.

### **Publications:**

Journal and conference papers: 492 (including 50 invited conference papers and 9 invited journal papers).

Book chapters: 2

Patents: 3

h-index: 32 (Google Scholar), 28 (Web of Science)

Number of citations: ~ 4500 (Google Scholar), ~ 3200 (Web of Science)

### **Invited conference presentations:**

1. J. Maserjian and A. Larsson, "Low power optically addressed spatial light modulators (O-SLM's) using MBE grown III-V structures", SPIE's 36th Annual International Symposium on Optical and Optoelectronic Applied Science and Engineering, San Diego, California, USA, July 1991.
2. A. Larsson, B. Jonsson, O. Sjölund, J. Cody, T.G. Andersson, S. Wang, U. Södervall, and J. Maserjian, "Carrier lifetime in periodically delta-doped multiple quantum well structures", International Symposium on Physical Concepts and Materials for Novel Optoelectronic Device Applications II, Trieste, Italy, May 1993.
3. A. Larsson, B. Jonsson, O. Sjölund, J. Cody, S. Wang, T. Andersson, U. Södervall, D.H. Rich, and J. Maserjian, "Delta-doped hetero nipi structures: Photo-optic effects, optical nonlinearities, and applications to all-optical devices", 9th Interdisciplinary Laser Science Conference, Toronto, Canada, October 1993.
4. D.H. Rich, H.T. Lin, K. Rammohan, and A. Larsson, "Optical studies of InGaAs/GaAs MQWs and GaAs/Si using novel SEM-based techniques", 13th Pfefferkorn Conference on Luminescence, Niagra Falls, Canada, May 1994.
5. A. Larsson, M. Hagberg, N. Eriksson, and T. Kjellberg, "Grating coupled surface emitters with enhanced surface emission efficiency", SPIE OE/LASE '95, Conference on Circular Grating Light Emitting Sources, San Jose, California, USA, February 1995.
6. A. Larsson, N. Eriksson, M. Li, M. Hagberg, and S. Kristjánsson, "Grating coupled surface emitters with built-in beam control", Optoelectronics'97, San Jose, California, USA, February 1997.

7. N. Eriksson, S. Kristjánsson, P. Modh, A. Larsson, M. Uemukai, A. Yoshimoto, N. Matsumoto, and T. Suhara, “Grating coupled surface emitters with built-in beam control”, 193rd Meeting of the Electrochemical Society, San Diego, California, USA, May 1998.
8. A. Larsson, H. Martinsson, M. Ghisoni, J. Bengtsson, and J. Vukusic, “VCSELs with diffractive optics”, EOS Topical Meeting on Semiconductor Microcavity Light Emitters, Ascona, Switzerland, September 1998.
9. A. Larsson, N. Eriksson, S. Kristjánsson, P. Modh, M. Uemukai, A. Yoshimoto, N. Masumoto, T. Suhara, and H. Nishihara, “Grating coupled surface emitters: integrated lasers, amplifiers, and beam shaping outcouplers”, Photonics West 99, San José, California, USA, January 1999.
10. J. Bengtsson, J. Backlund, N. Eriksson, P. Modh, H. Martinsson, J. Vukusic, and A. Larsson, “Diffractive solutions in integrated optics?”, International Conference on Diffractive Optics and Microoptics, Quebec, Canada, October 2000.
11. A. Larsson, N. Eriksson, J. Bengtsson, S. Kristjánsson, P. Modh, H. Martinsson, and J. Backlund, “Laser diodes with diffractive optics”, Northern Optics, Uppsala, Sweden, June 2000.
12. A. Larsson, N. Eriksson, J. Bengtsson, H. Martinsson, J. Vukusic, S. Kristjánsson, and P. Modh, “Surface emitting lasers with integrated elements for mode and beam control”, 19<sup>th</sup> Nordic Semiconductor Meeting, Copenhagen, Denmark, May 2001.
13. A. Larsson, N. Eriksson, J. Bengtsson, H. Martinsson, J. Vukusic, S. Kristjánsson, and P. Modh, “Monolithic integration of semiconductor lasers and diffractive optical elements”, CLEO/Pacific Rim, Chiba, Japan, July 2001.
14. A. Larsson, “Integrated surface emitting lasers”, Symposium on Current Trends in Semiconductor Physics and Optoelectronic Technologies”, Tampere, Finland, November 2001.
15. T. Suhara, M. Uemukai, N. Shimada, and A. Larsson, “Broad area and MOPA lasers with integrated grating components for beam shaping and novel functions”, SPIE Photonics West, San José, USA, January 2003.
16. A. Larsson, “High frequency VCSEL dynamics and microwave applications”, IEICE LQE/OPE Technical Meeting, Kobe, Japan, December 2003.
17. A. Larsson, C. Carlsson, J. Gustavsson, Å. Haglund, and P. Modh, “Broadband direct modulation of VCSELs and applications in fiber optic RF links”, IEEE Int. Conf. on Microwave Photonics, Ogunquit, Main, USA, October 2004.
18. J.S. Gustavsson, J. Bengtsson, and A. Larsson, “Modal dynamics and noise of vertical cavity surface emitting lasers”, Int. Conf. on Numerical Simulation of Optoelectronic Devices, Santa Barbara, California, USA, August 2004.
19. A. Larsson, J.S. Gustavsson, Å. Haglund, and P. Modh, “High power single mode VCSELs using surface microstructures”, LEOS Annual Meeting, Rio Grande, Puerto Rico, USA, November 2004.
20. A. Larsson, “VCSELs for radio-over-fiber applications”, Nefertiti Workshop on Photonics in Wireless Communication: Cost-effective Solutions and Future Technologies”, Särö, Sweden, June 2005.

21. M. Hammar, R. Marcks von Würtemberg, P. Sundgren, J. Berggren, A. Larsson, E. Söderberg, P. Modh, J. Gustavsson, M. Ghisoni, and N. Chitica, "1.3  $\mu\text{m}$  InGaAs vertical cavity surface emitting lasers", IEEE LEOS Annual Meeting, Sydney, Australia, October 2005.
22. A. Larsson, J.S. Gustavsson, P. Modh, Å. Haglund, and E. Söderberg, "VCSELs for microwave fiber optic links", International Microwave Symposium, Workshop on Low Cost Microwave Photonic Component Technologies to Address Emerging Applications", San Francisco, California, USA, June 2006.
23. A. Larsson, J.S. Gustavsson, Å. Haglund, and P. Modh, "High power single mode VCSELs for emerging applications", International Symposium on Semiconductor Nanostructures, Berlin, Germany, September 2006.
24. S. M. Wang, Y. Q. Wei, Q. X. Zhao, J. Gustavsson, X. D. Wang, M. Sadeghi and A. Larsson, "State-of-the-art GaInNAs quantum wells and 1.3  $\mu\text{m}$  lasers grown by molecular beam epitaxy", 14<sup>th</sup> European Molecular Beam Epitaxy Workshop, Sierra Nevada, Spain, March 2007.
25. A. Larsson, "High power single mode VCSELs for emerging applications", Japan Society for the Promotion of Science Forum on Laser and Nanotechnology, Kista, Sweden, June 2007.
26. M. Dumitrescu, A. Larsson, Y. Wei, E. Larkins, P. Uusimaa, K. Schultz, and M. Pessa, "High performance 1.3  $\mu\text{m}$  dilute nitride edge emitting lasers", International Semiconductor Conference, Romaina, October 2007.
27. S. M. Wang, Y. Q. Wei, I. Tangring, G. Adolfsson, J. S. Gustavsson, X. D. Wang, M. Sadeghi and A. Larsson, "GaAs based 1.3  $\mu\text{m}$  quantum well lasers grown by molecular beam epitaxy", MBE China 2007, Nanchang, China, October 2007.
28. A. Larsson, "Engineering the optical properties of VCSELs using surface structures", International Symposium on VCSELs and Integrated Photonics, Tokyo, Japan, December 2007.
29. S. M. Wang, G. Adolfsson, H. Zhao, Y. Q. Wei, J. S. Gustavsson, M. Sadeghi and A. Larsson, "High performance 1.3  $\mu\text{m}$  GaInNAs quantum well lasers on GaAs", Photonics West, San José, California, USA, January 2008.
30. S. M. Wang, G. Adolfsson, Y. Q. Wei, J. Gustavsson, M. Sadeghi, and A. Larsson, "Dilute nitrides and 1.3  $\mu\text{m}$  GaInNAs/GaAs quantum well lasers on GaAs", Workshop on Recent Advances in Low Dimensional Structures and Devices (WRA-LDSD), Nottingham, UK, April 2008.
31. M. Dumitrescu, M. Wolf, K. Schultz, S.M. Wang, A. Larsson, S. Sujecki, E. Larkins, P. Melanen, P. Uusimaa, A. Laakso, and M. Pessa, "Uncooled 10 Gb/s dilute nitride optical transmitters at 1300 nm", International Semiconductor Conference, Bucharest, Romania, October 2008.
32. I. Tangring, Y.X. Song, D.H. Wu, Z.C. Niu, S.M. Wang and A. Larsson, "Metamorphic InGaAs telecom lasers on GaAs", Photonics West, San José, California, USA, Jan. 2009.

33. A. Larsson, “High speed VCSELs for broadband access and interconnects”, International Symposium on Challenge to New Frontiers in Photonic Technology, Tokyo, Japan, March 2009.
34. S.M. Wang, Y.X. Song, I. Tångring, Z.H. Lai, M. Sedeghi, A. Larsson, D.H. Wu and Z.C. Niu, “Metamorphic InGaAs materials and telecom lasers”, International conference on Material and Advanced Technology (ICMAT), Singapore, June 2009.
35. A. Larsson, P. Westbergh, J.S. Gustavsson and Å. Haglund, “VCSELs for Broadband Access and Interconnects”, International Nano-Optoelectronics Workshop (iNOW), Stockholm-Berlin, Aug. 2009.
36. A. Larsson, J.S. Gustavsson, Å. Haglund and P. Westbergh, “High speed VCSELs for broadband interconnects”, ChinaNANO, Beijing, China, Sept. 2009.
37. P. Meissner, B. Kögel, K. Zogal, S. Jatta, C. Gierl, C. Grasse, T. Gründl, M.C. Amann, P. Westbergh, J. Gustavsson, Å. Haglund, A. Larsson, M. Ortsiefer, and P. Debernardi, “Widely tunable micromachined VCSELs – new results”, 10<sup>th</sup> Chitose International Forum on Photonics Science and Technology, Chitose, Hokkaido, Japan, Nov. 2009.
38. A. Larsson, P. Westbergh, J. Gustavsson, and Å. Haglund, “High speed low current density 850 nm VCSELs”, Photonics West, San Francisco, CA, USA, Jan. 2010.
39. J.S. Gustavsson, P. Westbergh, K. Szczerba, Å. Haglund, A. Larsson, M. Karlsson, P.A. Andrekson, F. Hopfer, G. Fiol, D. Bimberg, B.E. Olsson, A. Kristiansson, and A. Joel, “High speed 850 nm VCSELs for 40 Gb/s transmission”, Photonics Europe, Brussels, April 2010.
40. S.M. Wang, H. Zhao, G. Adolfsson, Y.Q. Wei, J.S. Gustavsson, M. Sadeghi and A. Larsson, “1.3  $\mu\text{m}$  dilute nitride edge emitting lasers on GaAs”, European Materials Research Society Spring Meeting, Strasbourg, France, June 2010.
41. A. Larsson, J. Gustavsson, Å. Haglund and P. Westbergh, “Advances in VCSELs for Communication and Sensing”, IEEE International Conference on Semiconductor Lasers, Kyoto, Japan, Sept. 2010.
42. C. Gierl, K. Zogal, S. Jatta, H.A. Davani, F. Küppers, P. Meissner, T. Gründl, C. Grasse, M.C. Amann, A. Daly, B. Corbett, B. Kögel, Å. Haglund, J. Gustavsson, P. Westbergh, A. Larsson, P. Debernardi, M. Ortsiefer, “Tuneable VCSEL aiming for the application in interconnects and short haul systems”, SPIE Photonics West, San Francisco, CA, USA, Jan. 2011.
43. A. Larsson, “High speed VCSELs for short reach communication”, International Nano-Optoelectronics Workshop (iNOW), St Petersburg (Russia)-Würzburg (Germany), Aug. 2011.
44. M. Hammar and A. Larsson, “VCSELs for high-speed datacom & interconnects”, Asia Communication and Photonics Conference (ACP’2011), Shanghai, China, Nov. 2011.
45. J.D. Ingham, Z. Qureshi, M.J. Crisp, R.V. Penty, I.H. White, P. Westbergh, J.S. Gustavsson, Å. Haglund, A. Larsson, N.N. Ledentsov, and J.A. Lott, “Novel modulation approaches for directly and electrooptically modulated vertical cavity surface emitting lasers”, SPIE Photonics West, San Francisco, CA, USA, Jan. 2012.



46. A. Larsson, J.S. Gustavsson, Å. Haglund, B. Kögel, P. Westbergh, and E. Haglund, “High speed tunable and fixed wavelength VCSELs for short reach optical links and interconnects”, SPIE Photonics West, San Francisco, CA, USA, Jan. 2012.
47. A. Larsson, J.S. Gustavsson, Å. Haglund, J. Bengtsson, B. Kögel, P. Westbergh, R. Safaisini, E. Haglund, K. Szczerba, M. Karlsson, and P.A. Andrekson, “High speed VCSELs for optical interconnects”, International Conference on Indium Phosphide and Related Materials”, Santa Barbara, CA, USA, Aug. 2012.
48. J.S. Gustavsson, A. Larsson, Å. Haglund, J. Bengtsson, P. Westbergh, R. Safaisini, and E. Haglund, “High speed 850 nm VCSELs for >40 Gb/s transmission”, Optical Fiber Communications Conference, Anaheim, CA, March 2013.
49. J.S. Gustavsson, A. Larsson, Å. Haglund, J. Bengtsson, P. Westbergh, R. Safaisini, and E. Haglund, “High speed, high temperature VCSELs for optical interconnects”, IEEE Summer Topical Meetings, Micro and Nanocavity Integrated Photonics, Waikoloa, HI, USA, July 2013.
50. A. Larsson, “VCSELs and Optical Interconnects”, Photonics Ireland, Belfast, UK, Sept. 2013.

## Publications – Anders Larsson

**Publications in scientific journals:**

1. A. Larsson, A. Yariv, R. Tell, J. Maserjian, and S.T. Eng, "Spectral and temporal characteristics of AlGaAs/GaAs superlattice pin-photodetectors", *Appl. Phys. Lett.* 47, 866, 1985.
2. A. Larsson, M. Mittelstein, Y. Arakawa, and A. Yariv, "High efficiency broad area single quantum well lasers with narrow single lobed far field patterns prepared by molecular beam epitaxy", *Electron. Lett.* 22, 79, 1986.
3. Y. Arakawa, A. Larsson, J. Paslaski, and A. Yariv, "Active Q-switching in a GaAs/AlGaAs multiquantum well laser with an intracavity loss modulator", *Appl. Phys. Lett.* 48, 561, 1986.
4. A. Larsson, J. Salzman, M. Mittelstein, and A. Yariv, "Lateral coherence properties of broad area semiconductor quantum well lasers", *J. Appl. Phys.* 60, 66, 1986.
5. J. Salzman, R. Lang, A. Larsson, and A. Yariv, "The confocal unstable resonator semiconductor laser", *Opt. Lett.* 11, 507, 1986.
6. A. Larsson, P.A. Andrekson, P. Andersson, S.T. Eng, J. Salzman, and A. Yariv, "High speed dual wavelength demultiplexing and detection in a monolithic superlattice pin waveguide detector array", *Appl. Phys. Lett.* 49, 233, 1986.
7. J. Salzman, A. Larsson, and A. Yariv, "Phase locked controlled filament laser", *Appl. Phys. Lett.* 49, 611, 1986.
8. M. Mittelstein, Y. Arakawa, A. Larsson, and A. Yariv, "Second quantized state lasing of a current pumped single quantum well laser", *Appl. Phys. Lett.* 49, 1689, 1986.
9. A. Larsson, P. Andersson, and A. Yariv, "Frequency chirping in pulse modulated gain and index guided single quantum well lasers", in *Picosecond Electronics and Optoelectronics II*, Springer Series in Electronics and Photonics 24, Springer Verlag, 1987.
10. A. Larsson, P.A. Andrekson, S.T. Eng, and A. Yariv, "Tunable superlattice pin photodetectors: Characteristics, theory, and applications", *IEEE J. Quantum Electron.* QE-24, 787, 1988.
11. A. Larsson and C. Lindström, "Modulation bandwidth of GaAs/AlGaAs single quantum well lasers operating at the second quantized state", *Appl. Phys. Lett.* 54, 884, 1989.
12. A. Larsson, P.A. Andrekson, B. Jonsson, and C. Lindström, "Highly coherent long cavity GaAs/AlGaAs single quantum well lasers", *IEEE J. Quantum Electron.* 25, 2013, 1989.
13. A. Larsson, J. Cody, and R.J. Lang, "Strained layer InGaAs/GaAs/AlGaAs single quantum well lasers with high internal quantum efficiency", *Appl. Phys. Lett.* 55, 2268, 1989.
14. A. Larsson, J. Cody, S. Forouhar, and R.J. Lang, "Highly efficient pseudomorphic InGaAs/GaAs/AlGaAs single quantum well lasers for monolithic integration", *Appl. Phys. Lett.* 56, 1731, 1990.
15. M. Hagberg, A. Larsson, and S.T. Eng, *Appl. Phys. Lett.* "Single ended output GaAs/AlGaAs single quantum well laser with a dry etched corner reflector", *Appl. Phys. Lett.* 56, 1934, 1990.
16. A. Larsson, S. Forouhar, J. Cody, and R.J. Lang, "High power operation of highly reliable narrow stripe pseudomorphic single quantum well lasers emitting at 980 nm", *IEEE Photonics Techn. Lett.* 2, 307, 1990.
17. A. Larsson, S. Forouhar, J. Cody, R.J. Lang, and P.A. Andrekson, "A 980 nm pseudomorphic single quantum well laser for pumping Er-doped optical fiber amplifiers", *IEEE Photonics Techn. Lett.* 2, 540, 1990.

18. R.C. Tiberio, G. Porkolab, J.E. Johnson, W.J. Grande, L.C. Rathbun, E.D. Wolf, H.G. Craighead, R.J. Lang, A. Larsson, S. Forouhar, and J. Cody, "Electron beam lithography and chemically assisted ion beam etching for the fabrication of grating surface emitting broad area AlGaAs lasers", *J. Vac. Sci. Techn. B* 8, 1408, 1990.
19. R.J. Lang, A. Larsson, and J. Cody, "Lateral modes of broad area semiconductor lasers: Theory and experiments", *IEEE J. Quantum Electron.* 27, 312, 1990.
20. J. H. Kim, R.J. Lang, A. Larsson, L.P. Lee, and A.A. Narayanan, "High power AlGaAs/GaAs single quantum well surface emitting lasers with integrated 45° beam deflectors", *Appl. Phys. Lett.* 57, 2048, 1990.
21. J.H. Kim, A. Larsson, and L.P. Lee, "Pseudomorphic InGaAs/GaAs/AlGaAs single quantum well surface emitting lasers with 45° beam deflectors", *Appl. Phys. Lett.* 58, 7, 1991.
22. A. Larsson, S.I. Borenstain, B. Jonsson, I. Andersson, J. Westin, and T.G. Andersson, "Photon-assisted resonant tunneling through variably spaced superlattice energy filters", *Appl. Phys. Lett.* 58, 1297, 1990.
23. S.I. Borenstain, I. Grave, A. Larsson, D.H. Rich, B. Jonsson, I. Andersson, J. Westin, and T. Andersson, "Long wavelength infrared spectroscopy of an asymmetrically structured Ga<sub>0.6</sub>Al<sub>0.4</sub>As/GaAs superlattice", *Phys. Rev. B* 43, 9320, 1991.
24. A. Larsson and J. Maserjian, "Optically induced absorption modulation in a periodically delta-doped InGaAs/GaAs multiple quantum well structure", *Appl. Phys. Lett.* 58, 1946, 1991.
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