

BIOGRAPHICAL AND BIBLIOGRAPHICAL INFORMATION

BIOGRAPHICAL INFORMATION

Academic History:

Ph.D.	Electrical Engineering, Stanford University	1992
M. S.	Electrical Engineering, Stanford University	1987
B. S.	Electrical Engineering, Norwegian Institute of Technology, Norway	1981

Employment Record:

2008-Present	Director of Edward L. Ginzton Laboratory, Stanford University
2006-2008	Deputy Director of Edward L. Ginzton Laboratory, Stanford University
09/01/2003-Present	Associate Professor, Department of Electrical Engineering, Stanford University
07/01/1999- 08/31/2003	Assistant Professor, Department of Electrical Engineering, Stanford University
1995-1999	Assistant Professor, Department of Electrical and Computer Engineering, University of CA, Davis
1994-2001	Co-founder, consultant and member of Technology Advisory Board, Silicon Light Machines, Sunnyvale, CA
1992-1995	Post Doctoral Research Engineer, University of CA, Berkeley
1983-1986	Development Engineer, SensoNor a.s., Horten, Norway
1982-1983	Noncommissioned officer, Royal Norwegian Naval Academy, Norway
1981-1982	Teaching Assistant, Norwegian Institute of Technology, Norway

Scholarships and Honors:

- Royal Norwegian Councils for Scientific and Industrial Research Fellowship for Advanced Studies, 1986
- Andrew E. Wigeland and G. Norman Wigeland Fund Grant for Graduate Study, 1986

Post Degree Awards and Honors/Professional Affiliations

Awards and Honors:

- Fellow of the Optical Society of America, 2008
- Member of Det Kongelige Norske Videnskapers Selskab (The Royal Norwegian Society of Sciences and Letters), 2008
- Terman Fellow, 1999-2002
- National Science Foundation - Faculty Early Career Development Program, 1998

Professional Activities:

- Guest editor of Special Issue on Nano Photonics and Optical MEMS of the *IEEE Journal on Selected Topics in Quantum Electronics*, Sept/Oct 2009.
- Chairman of standing committee for IEEE/LEOS Conference on Optical MEMS 2006-2009
- Topical editor of IEEE Journal of MicroelectroMechanicalSystems (JMEMS) since 2004.
- Member of standing committee for IEEE/LEOS Conference on Optical MEMS 2002-2009.
- Guest editor of Special Issue on Optical Microsystems of the *IEEE Journal on Selected Topics in Quantum Electronics*, March/April 2007, May/June 2004, and January/February 2002.
- General Chair of IEEE/LEOS Conference on Optical MEMS 2003.
- Program Committee Chair, IEEE/LEOS Conference on Optical MEMS 2000.

Invited Talks and Invited Papers:

- O. Solgaard, "Scaling of Optical Systems with Photonic Crystals and Optical MEMS", International Symposium on Nano-Micro Multi Functional Devices, Kawasaki City, March 18-19, 2010 (invited talk).
- S. Hadzialic, **I.-W. Jung**, **O. Kilic**, **S. Kim**, J. Provine, R.T. Howe, O. Solgaard, "Photonic Crystal Mirrors for Free-Space Communication and Fiber-Optic Sensors," Technical Digest of the OSA Optics and Photonic Congress on Advanced Solid-State Photonics/Applications of Lasers for Sensing and Free Space Communications (LS&C) on CD-ROM (The Optical Society, Washington, DC, 2010), presentation no. LSWD2, San Diego, CA, January 31-February 3, 2010 (invited talk).
- O. Solgaard, **F. Sarioglu**, "Nanoscale Material Characterization using AFM cantilevers with Differential Interferometric Force Sensors," Seeing at the Nanoscale Conference, pp. 51, University of California, Santa Barbara, July 28-31, 2009.
- O. Solgaard, "Optical MEMS Based on High-Reflectivity Photonic Crystals," 2007 IEEE/LEOS Annual Meeting Conference Proceedings, pp. 765-766, Lake Buena Vista, FL, October 21-25, 2007.
- O. Solgaard, "Diffractive Optical Modulators Based on MEMS Technology," 2007 SPIE Photonic West Conference, MOEMS and MEMS 2007, San Jose, CA, January 22, 2007 (Invited plenary presentation).
- **H. Ra**, W. Piyawattanametha, Y. Taguchi, **D. Lee**, O. Solgaard, "Dual-axes confocal microscopy with a MEMS scanner for reflectance and fluorescence imaging," 2007 SPIE Photonic West Conference, MOEMS and Miniaturized Systems VI, San Jose, CA, January 24, 2007 (Invited talk that I elected to let a student present).
- M. Wu, O. Solgaard, J. Ford, "Optical MEMS for Light Wave Communication), *Journal of Lightwave Technology*, Vol. 24, No. 12, pp. 4433-4454, December 2006.
- O. Solgaard, "Wavelength Control with MEMS and Photonic Crystals," Presented at the 2006 Northern Light Conference, Bergen, Norway June 14-16, 2006.

- **X. Li, R. Belikov, K. Yu**, O. Solgaard, “Micromachined Tunable Blazed Gratings,” Proc. 2004 IEEE/LEOS International Conf. on Optical MEMS, pp. 6-7, Takamatsu, Kagawa, Japan, August 22-26, 2004 (Invited talk presented by student due to medical emergency).
- O. Solgaard, “OPTICAL MICROSISTEMS: MEMS in Optical Communication and Sensing”, Norwegian Electro-Optics Meeting 2004, Tønsberg, Norway, May 2-4, 2004.
- O. Solgaard, **R. Belikov, K. Yu**, “Interference-Based Optical MEMS Filters,” Technical Digest of the 2004 Optical Fiber Communication Conference (OFC 04), paper No. TuD3, Los Angeles, CA, February 22-27, 2004.
- O.Solgaard, “Optical MEMS - Fabrication, Scaling and Design of Microoptical Devices and Systems,” Conference on Lasers and Electro-Optics (CLEO), Technical Digest, Baltimore, MD, June 1-6, 2003 (Invited tutorial presentation).
- O. Solgaard, “Dynamic Diffractive Optical Elements based on MEMS Technology,” Technical Digest of the 3rd International Conference on Optics-Photonics Design and Fabrication “ODF2002, Tokyo,” pp. 25-26, Tokyo, Japan, October 30-November 1, 2002.
- O. Solgaard, “Optical Communication with Coherent MEMS Arrays,” 40th Annual Allerton Conference on Communication, Control, and Computing, Allerton House, Monticello, IL, October 2-4, 2002.
- O. Solgaard, **K. Yu, U. Krishnamoorthy**, K. Li, J.P. Heritage, “Microoptical phased arrays for spatial and spectral switching,” Design, Test, and Packaging of MEMS/MOEMS 2002, Proceedings of the SPIE, Vol. 4755, pp. 1-9, Cannes, France, May 6-8, 2002.
- O. Solgaard, “High-Resolution Silicon Surface Micromachined Displays” Technical Digest of the IEEE/LEOS IEEJ/SAMS 1997 International Conference on Optical MEMS and their Applications (MOEMS97), pp. 9-14, Nara, Japan, November 18-21, 1997.
- O. Solgaard, M. Daneman, N.C. Tien, R.S. Muller, K.Y. Lau, "Surface-micromachined active optical bench for optoelectronic integration and packaging," Proceeding of the Microelectronics and Sensor Technology Meeting, Lillehammer, Norway, January 17, 1995.

BIBLIOGRAPHICAL INFORMATION

(The following lists of publications adhere to the customary practice that the student or non-faculty researcher who is primary responsible for the publication is named first and the faculty are named last. Student authors are shown in boldface. Patents: the inventors are mostly listed alphabetically).

Refereed Journal Publications:

1. **J.-W. Jeung, I.W. Jung**, H.J. Hung, D.M. Baney, O. Solgaard, “Multifunctional Tunable Optical Filter Using MEMS Spatial Light Modulator,” *Journal of Microelectromechanical Systems*, Vol. 19, No. 3, pp. 610-618, June 2010.
2. **H. Ra**, E. Gonzalez-Gonzalez, B.R. Smith, S.S. Gambhir, G.S. Kino, O. Solgaard, R.L. Kaspar, C.H. Contag, “Assessing delivery and quantifying efficacy of small interfering ribonucleic acid therapeutics in the skin using a dual-axis confocal microscope,” *J Biomed Opt.*, vol. 15, No. 3, p. 036027, May-June, 2010.

3. J.T.C. Liu, M.J. Mandella, N.O. Loewke, H. Haeberle, **H. Ra**, W. Piyawattanametha, O. Solgaard, G.S. Kino, C.H. Contag, "Micromirror-scanned dual-Axis confocal microscope utilizing a gradient-index relay lens for image guidance during brain surgery," *Journal of Biomedical Optics*, vol. 15, no. 2, pp. 026029-1-5, March/April, 2010.
4. S. Hadzialic, **S. Kim**, A.S. Sudbo, O. Solgaard, "Two-dimensional photonic crystals fabricated in monolithic single-crystal silicon", *IEEE Photonics Technology Letters*, vol. 22, no. 2, pp. 67-69, January 15, 2010.
5. **O. Kilic**, M.J.F. Digonnet, G.S. Kino, O. Solgaard, "Asymmetrical Spectral Response in Fiber Fabry-Pérot Interferometers", *Journal of Lightwave Technology*, vol. 27, no. 24, pp. 5648-5656, December 15, 2009.
6. W. Piyawattanametha, **H. Ra**, M.J. Mandella, K. Loewke, T.D. Wang, G.S. Kino, O. Solgaard, C.H. Contag, "3-D Near-Infrared Imaging Using a MEMS-Based Miniature Dual-Axis Confocal Microscope," *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 15, No. 5, pp. 1344-1350, September/October, 2009.
7. E. Gonzalez-Gonzalez, **H. Ra**, R. Hickerson, Q. Wang, W. Piyawattanametha, M. Mandella, G.S. Kino, D. Leake, A. Avilion, O. Solgaard, T. Doyle, C.H. Contag, R. Kaspar, "siRNA silencing of keratinocyte-specific GFP expression in a transgenic mouse skin model," *Gene Therapy*, vol. 16, no. 8, pp. 963-972, August 1, 2009.
8. **I.W. Jung**, **S.B. Mallick**, O. Solgaard, "A Large-Area High-Reflectivity Broadband Monolithic Single-Crystal-Silicon Photonic Crystal MEMS Scanner With Low Dependence on Incident Angle and Polarization," *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 15, No. 5, pp. 1447-1454, September/October, 2009.
9. **I.W. Jung**, **S. Kim**, O. Solgaard, "High-Reflectivity Broadband Photonic Crystal Mirror MEMS Scanner With Low Dependence on Incident Angle and Polarization," *Journal of Microelectromechanical Systems*, Vol. 18, No. 4, pp. 924-932, August 2009.
10. W. Piyawattanametha, E.D. Cocker, L.D. Burns, R.P.J. Barretto, J.C. Jung, **H. Ra**, O. Solgaard, M.J. Schnitzer, "In vivo brain imaging using a portable 2.9 g two-photon microscope based on a microelectromechanical systems scanning mirror", *Optics Letter*, vol. 34, no. 15, pp. 2309-2311, August 1, 2009. (Also selected for publication in the *Virtual Journal for Biomedical Optics (VJBO)*, Vol. 4, Issue 10, Oct. 2, 2009. http://vjbo.osa.org/virtual_issue.cfm)
11. **D. Lee**, **K. Yu**, **U. Krishnamoorthy**, O. Solgaard, "Vertical Mirrors Fabrication Combining KOH Etch and DRIE of (110) Silicon", *IEEE Journal of MicroElectroMechanical Systems (JMEMS)*, Vol. 18, No. 1, pp. 217-227, February 2009.
12. **D. Lee**, O. Solgaard, "Pull-In Analysis of Torsional Scanners Actuated by Electrostatic Vertical Combdrives," *IEEE Journal of MicroElectroMechanical Systems (JMEMS)*, Vol. 17, No. 5, pp. 1228-1238, October 2008.
13. **O. Kilic**, S. Fan, O. Solgaard, "Analysis of guided-resonance based polarization beam splitting in photonic crystal slabs," *Journal of the Optical Society of America A*, Vol. 25, No. 11, pp. 2680-2692, November 2008.
14. **O. Kilic**, M. Digonnet, G. Kino, O. Solgaard, "Controlling uncoupled resonances in photonic crystals through breaking the mirror symmetry," *Optics Express*, Vol. 16, No. 17, pp. 13090-13103, August 2008.
15. **A.F. Sarioglu**, O. Solgaard, "Cantilevers with integrated sensor for time-resolved force measurement in tapping-mode atomic force microscopy," *Applied Physics Letters*, Vol. 93,

manuscript 023114, 3 pages, (Selected for the July 28, 2008 issue of *Virtual Journal of Nanoscale Science & Technology*, a compilation of links to articles from participating publishers at <http://www.vjnano.org>.), July 2008.

16. C.L. Hoy, N.J. Durr, P. Chen, W. Piyawattanametha, **H. Ra**, O. Solgaard, A. Ben-Yakar, "Miniaturized probe for femtosecond laser microsurgery and two-photon imaging," *Optics Express*, Vol. 16, Issue 13, pp. 9996-10005, June 20, 2008.
17. **H. Ra**, W. Piyawattanametha, M.J. Mandella, P.-L. Hsiung, J. Hardy, T. D. Wang, C. H. Contag, G. S. Kino, O. Solgaard, "Three-dimensional in vivo imaging by a handheld dual-axes confocal microscope," *Optics Express*, Vol. 16, No. 10, pp. 7224-7232, May 12, 2008.
18. **I.-S. Joe**, O. Solgaard, "Scalable Optical Switches With Large Port Count Based on a Waveguide Grating Router and Passive Couplers," *IEEE Photonics Technology Letters*, Vol. 20, No. 7, pp. 508-510, April 1, 2008.
19. **C. Antoine**, **X. Li**, **J.-S. Wang**, O. Solgaard, "Reconfigurable Optical Wavelength Multiplexer Using a MEMS Tunable Blazed Grating," *Journal of Lightwave Technology*, Vol. 25, No. 10, pp. 3100-3107, October 2007.
20. **O. Kilic**, M. Dignonnet, G. Kino O. Solgaard, "External fibre Fabry-Perot acoustic sensor based on a photonic-crystal mirror," *IOP Publishing Measurement Science and Technology*, Vol. 18, No. 12, pp. 3049-3054, September 2007.
21. **H. Ra**, W. Piyawattanametha, Y. Taguchi, **D. Lee**, M.J. Mandella, O. Solgaard, "Two-Dimensional MEMS Scanner for Dual-Axes Confocal Microscopy," *Journal of Microelectromechanical Systems*, Vol. 16, No. 4, pp. 969-976, August 2007.
22. **O. Sahin**, S. Magonov, C. Su, C.F. Quate, O. Solgaard, "An atomic force microscope tip designed to measure time-varying nanomechanical forces," *Nature Nanotechnology* 2, pp. 507-514, published online: doi:10.1038/nnano.2007.226, July 29, 2007.
23. H.-J. Shin, M.C. Pierce, **D. Lee**, **H. Ra**, O. Solgaard, R. Richards-Kortum, "Fiber-optic confocal microscope using a MEMS scanner and miniature objective lens," *Optics Express*, Vol. 15, No. 15, pp. 9113-9122, July 23, 2007.
24. **I.W. Jung**, **J.-S. Wang**, O. Solgaard, "Optical Pattern Generation Using a Spatial Light Modulator for Maskless Lithography," *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 13, No. 2, pp. 147-154, March/April, 2007.
25. **I.W. Jung**, Y.-A. Peter, **E. Carr**, **J.-S. Wang**, O. Solgaard, "Single-Crystal-Silicon Continuous Membrane Deformable Mirror Array for Adaptive Optics in Space-Based Telescopes," *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 13, No. 2, pp. 162-167, March/April, 2007.
26. **K. Yu**, N. Park, D. Lee, O. Solgaard, "Superresolution Digital Image Enhancement by Subpixel Image Translation with a Scanning Micromirror," *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 13, No. 2, pp. 304-311, March/April, 2007.
27. J.T.C. Liu, M.J. Mandella, **H. Ra**, L.K. Wong, O. Solgaard, G.S. Kino, W. Piyawattanametha, C.H. Contag, T.D. Wang, "Miniature near-infrared dual-axes confocal microscope utilizing a two-dimensional microelectromechanical systems scanner," *Optics Letters*, Vol. 32, No. 3, pp. 256-258, February 1, 2007.
28. M. Lacolle, **R. Belikov**, H. Sagberg, O. Solgaard, A. Sudbø, "Algorithms for the synthesis of complex-value filters with an array of micromechanical mirrors," *Optics Express*, Vol. 14, No. 26, pp. 12590-12612, ISSN 1094-4087, December 2006.

29. M. Wu, O. Solgaard, J. Ford, "Optical MEMS for Light Wave Communication" (Invited Paper), *Journal of Lightwave Technology*, Vol. 24, No. 12, December 2006, pp. 4433-4454.
30. **K. Yu, D. Lee**, N. Park, O. Solgaard, "Tunable Optical Bandpass Filter with Variable-Aperture MEMS Reflector," *Journal of Lightwave Technology*, Vol. 24, No. 12, pp. 5095-5102, December 2006.
31. C-C. Chen, **J-S. Wang**, O. Solgaard, "Micromachined bubble-jet cell sorter with multiple operation modes," *Sensors and Actuators B: Chemical*, Vol. 117, No. 2, pp. 523-529, October 12, 2006.
32. K. Carlson Maitland, H.J. Shin, **H. Ra, D. Lee**, O. Solgaard, R. Richards-Kortum: "Single fiber confocal microscope with a two-axis gimbaled MEMS scanner for cellular imaging," *Optics Express*, Vol. 14, No. 19, pp. 8604-8612, September 18, 2006.
33. S. Zappe, M. Fish, M.P. Scott, O. Solgaard, "Automated MEMS-based Drosophila embryo injection system for high-throughput RNAi screens," *Lab on a Chip*, Vol. 6, No. 8, pp.1012-1019, August 2006.
34. **K. Yu, D. Lee, U. Krishnamoorthy**, N. Park, O. Solgaard, "Micromachined Fourier transform spectrometer on silicon optical bench platform," *Sensors and Actuators, A-Phys.*, Vol. 130-131, pp. 523-530, August 2006.
35. W. Piyawattanametha, R.P.J. Barretto, T.H. Ko, B.A. Flusberg, E.D. Cocker, **H. Ra, D. Lee**, O. Solgaard. M.J. Schnitzer, "Fast-scanning Two-photon Fluorescence Imaging Based on a Microelectromechanical Systems Two-dimensional Scanning Mirror," *Optics Letters*, Vol. 31, No. 13, pp. 2018-2020, July 1, 2006.
36. **X. Li, C. Antoine, D. Lee, J-S. Wang**, O. Solgaard, "Tunable Blazed Gratings," *Journal of Microelectromechanical Systems*, Vol. 15, No. 3, pp. 597-604, June 2006.
37. **I.W. Jung, U. Krishnamoorthy**, O. Solgaard, "High Fill-Factor Two-Axis Gimbaled Tip-Tilt-Piston Micromirror Array Actuated by Self-Aligned Vertical Combedrives," *Journal of Microelectromechanical Systems*, Vol. 15, No. 3, pp. 563-571, June 2006.
38. P. Ebrahimi, **K. Yu**, M.C. Hauer, A.E. Willner, O. Solgaard, "Tunable Wavelength Demultiplexer and OCDMA Code Hopping Using a 10-us-Tuning MEMS-Actuated Gires-Tournois Filter," *IEEE Photonics Technology Letters*, Vol. 18, No. 12, pp.1398-1400, June 15, 2006.
39. **X. Zhang**, M.P. Scott, C.F. Quate, O. Solgaard, "Microoptical Characterization of Piezoelectric Vibratory Microinjections in Drosophila Embryos for Genome-Wide RNAi Screen," *Journal of Microelectromechanical Systems (JMEMS)*, Vol. 15, No. 2, pp. 277-286, April 2006.
40. K.B. Crozier, V. Lousse, **O. Kilic, S. Kim**, W. Suh, S. Fan, O. Solgaard, "Air-bridged photonic crystal slabs at visible and near-infrared wavelengths," *Physical Review B (Condensed Matter and Materials Physics)*, Vol. 73, No. 11, p.115126-1-14, March 15, 2006.
41. **J-S. Wang**, S. Hafeman, A. R. Neureuther, and O. Solgaard, "Effects of Through-Focus Symmetry in Maskless Lithography Using Micromirror Arrays," *Journal of Vacuum Science and Technology B*, Vol. 23, No. 6, pp.2738-2742, November/December 2005.
42. M. Lacolle, H. Sagberg, I.-R. Johansen, O. Løvhaugen, O. Solgaard, A. Sudbo, "Reconfigurable Near-Infrared Optical Filter with Micromechanical Diffractive Fresnel

- Lens,” *IEEE Photonics Technology Letters*, Vol. 17, No. 12, pp. 2622-2624, December 2005.
43. **X. Zhang**, C.-C. Chen, R.W. Bernstein, S. Zappe, M.P. Scott, O. Solgaard, “Microoptical Characterization and Modeling of Positioning Forces on Drosophila Embryos Self-Assembled in Two-Dimensional Arrays,” *Journal of Microelectromechanical Systems*, Vol. 14, No. 5, pp. 1187-1197, October 2005.
 44. W. Suh, O. Solgaard, S. Fan, “Displacement sensing using evanescent tunneling between guided resonances in photonic crystal slabs,” *Journal of Applied Physics*, Vol. 98, issue 3, article 033102, (4 pages), August 1, 2005. (Selected for the August 22, 2005 issue of *Virtual Journal of Nanoscale Science & Technology*, a compilation of links to articles from participating publishers at <http://www.vjnano.org>).
 45. **X. Zhang, C.-C. Chen**, M.P. Scott, O. Solgaard, “Micro-optical characterization of fluidic self-assembly of Drosophila embryos through surface tension: principle, simulation and experiments,” *Optical Review*, Vol. 12, No. 4, pp. 352-7, July/August 2005.
 46. **O. Kilic, S. Kim**, W. Suh, Y.-A. Peter, A. S. Sudbø, M.F. Yanik, S. Fan, O. Solgaard, “Photonic crystal slabs demonstrating strong broadband suppression of transmission in the presence of disorders,” *Optics Letters*, Vol. 29, No. 23, pp. 2782-2784, December 1, 2004.
 47. H. Wada, **D. Lee**, S. Zappe, O. Solgaard, “Analysis of resonant frequency of fast scanning micromirror with vertical combdrives,” *IEICE Transactions on Electronics*, Vol. E87-C, No. 11, pp. 2006-2008, November, 2004.
 48. **J.-S. Wang, I.-W. Jung**, O. Solgaard, “Fabrication method for elastomer spatial light modulators for short wavelength maskless lithography,” *Sensors and Actuators: A Physical*, Vol. 114, issue 2-3, pp. 528-535, September 1, 2004.
 49. **D. Lee, U. Krishnamoorthy, K. Yu**, O. Solgaard, “Single-crystalline silicon micromirrors actuated by self-aligned vertical electrostatic combdrives with piston-motion and rotation capability,” *Sensors and Actuators: A Physical*, Vol. 114, issue 2-3, pp. 423-428, September 1, 2004.
 50. **O. Sahin**, G. Yaralioglu, R. Grow, S. F. Zappe, A. Atalar, C. Quate, O. Solgaard, “High-resolution imaging of elastic properties using harmonic cantilevers,” *Sensors and Actuators: A Physical*, Vol. 114, issue 2-3, pp. 183-190, September 1, 2004.
 51. **X.J. Zhang**, S. Zappe, R.W. Bernstein, C.C. Chen, O. Sahin, M. Fish, M.P. Scott, O. Solgaard, “Micromachined Silicon Force Sensor Based on Diffractive Optical Encoders for Characterization of Microinjection,” *Sensors and Actuators: A Physical*, Vol. 114, issue 2-3, pp. 197-203, September 1, 2004.
 52. R.W. Bernstein, **X.J. Zhang**, S. Zappe, M. Fish, M.P. Scott, O. Solgaard, “Characterization of Fluidic Microassembly for Immobilization and Positioning of Drosophila Embryos,” *Sensors and Actuators: A Physical*, Vol. 114, issue 2-3, pp. 191-196, September 1, 2004.
 53. C.C. Chen, S. Zappe, **O. Sahin, X.J. Zhang**, E. Furlong, M. Fish, M.P. Scott, O. Solgaard, “Design and Operation of a Microfluidic Sorter for Drosophila Embryo,” *Sensors and Actuators: B Chemical*, Vol. 102, issue 1, pp. 59-66, September, 2004.
 54. H. Wada, **D. Lee**, S. Zappe, **U. Krishnamoorthy**, O. Solgaard, “Lithography process for trench pattern above large cavity to fabricate fast scanning micromirror,” *IEICE Transactions on Electronics*, Vol. E87-C, No. 8, pp.1395-1398, August 2004.

55. **K. Yu**, O. Solgaard, "Tunable Optical Transversal Filters Based on a Gires-Tournois Interferometer with MEMS Phase Shifters," *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 10, No. 3, pp. 588-597, May/June 2004.
56. H. Sagberg, M. Lacolle, I-R. Johansen, O. Løvhaugen, **R. Belikov**, O. Solgaard, A. Sudbø, "Micromechanical Gratings for Visible and Near-Infrared Spectroscopy," *IEEE Journal of Selected Topics in Quantum Electronics*, Vol. 10, No. 3, pp. 604-613, May/June 2004.
57. **O. Sahin**, C.F. Quate, O. Solgaard, A. Atalar, "Resonant harmonic response in tapping-mode atomic force microscopy," *Phys. Rev. B*, Vol. 69, No. 16, article 165416, (9 pages), April 2004.
58. V. Lousse, W. Suh, O. Kilic, **S. Kim**, O. Solgaard, S. Fan, "Angular and polarization properties of a photonic crystal slab mirror," *Optics Express*, Vol. 12, No. 8, pp. 1575-1582, April 19, 2004.
59. H. Wada, **D. Lee**, S. Zappe, **U. Krishnamoorthy**, O Solgaard, "Snap Down Voltage of a Fast-Scanning Micromirror with Vertical Electrostatic Combdriives," *Japanese Journal of Applied Physics*, Vol. 43, No. 2B, pp. L284-L286, February 2004.
60. H. Wada, **D. Lee**, S. Zappe, **U. Krishnamoorthy**, O Solgaard, "Bonding of Two Silicon Layers above a Gap to Fabricate a Fast Scanning Micromirror," *Japanese Journal of Applied Physics*, Vol. 43, No. 1A/B, 2004, pp. L50-L52, January 15, 2004.
61. H. Wada, **D. Lee**, S. Zappe, O Solgaard, "The Torque of High Speed Scanning Micromirrors with Vertical Combdriives," *Japanese Journal of Applied Physics*, Vol. 42, part 2, No. 12A, pp. L1449-L1451, December 1, 2003.
62. I. Keslassy, S.-T. Chuang, **K. Yu**, D. Miller, M. Horowitz, O. Solgaard, N. McKeown, "Scaling Internet Routers Using Optics," Proceedings of SIGCOMM'03, Karlsruhe, Germany, pp. 189-200, August 25-29, 2003, *Computer Communication Review*; Vol. 33, No. 4, p.189-200, October 2003.
63. H. Sagberg, A. Sudbo, O. Solgaard, K.A. Hestnes Bakke, I-R. Johansen, "Optical Microphone Based on a Modulated Diffractive Lens," *IEEE Photonics Technology Letters*, Vol. 15, No. 10, pp. 1431-1433, October 2003.
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65. **K. Yu**, O. Solgaard, "MEMS optical wavelength deinterleaver with continuously variable channel spacing and center wavelength," *IEEE Photonics Technology Letters*, Vol. 15, No. 3, pp. 425-427, March, 2003.
66. W. Suh, M. F. Yanik, O. Solgaard, and S.-H. Fan, "Displacement-Sensitive Photonic Crystal Structures Based on Guided Resonance in Photonic Crystal Slabs," *Appl. Phys. Lett.*, Vol. 82 (13), pp. 1999-2001, March 31, 2003.
67. **R. Belikov**, O. Solgaard, "Optical Wavelength Filtering by Diffraction from a Surface Relief," *Optics Letters*, Vol. 28, No. 6, pp.447-449, March 15, 2003. Erratum in *Optics Letters* Vol. 28, No. 12, pp.1055, June 15, 2003.
68. H. Wada, **D. Lee**, **K. Yu**, **U. Krishnamoorthy**, O. Solgaard, "Optical Characterization of High Speed Scanning Micromirrors with Vertical Combdriives," *Japanese Journal of Applied Physics*, Vol. 41, part 2, No. 10B, pp. L1169-L1171, October 15, 2002.
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- Japanese Journal of Applied Physics*, Vol. 41, part 2, No. 8A, pp. L899-L901, August 1, 2002.
70. **U. Krishnamoorthy, K. Li, K. Yu, D. Lee**, J.P. Heritage, O. Solgaard, 'Dual mode micromirrors for optical phased array applications,' *Sensors and Actuators: A. Physical*, Vol. A97-98, pp 21-26, April 1, 2002.
 71. **K. Li, U. Krishnamoorthy**, J.P. Heritage, O. Solgaard, "Coherent micromirror arrays," *Optics Letters*, Vol. 27, No. 5, p.366-368, March 1, 2002.
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Refereed Conference/Symposia Proceedings:

1. **B. Park, I-W. Jung**, J. Provine, R.T. Howe, O. Solgaard, "Monolithic Silicon Photonic Crystal Fiber Tip Sensor for Refractive Index and Temperature Sensing", Conference on Lasers and Electro-Optics (CLEO) 2010, Paper CThB1, San Jose, CA, May 16-21, 2010.
2. S. Hadzialic, **I-W. Jung, O. Kilic, S. Kim**, J. Provine, R.T. Howe, O. Solgaard, "Photonic Crystal Mirrors for Free-Space Communication and Fiber-Optic Sensors," Technical Digest of the OSA Optics and Photonic Congress on Advanced Solid-State Photonics/Applications of Lasers for Sensing and Free Space Communications (LS&C) on CD-ROM (The Optical Society, Washington, DC, 2010), presentation no. LSWD2, San Diego, CA, January 31-February 3, 2010 (invited talk).
3. W. Piyawattanametha, **H. Ra**, M.J. Mandella, C.H. Contag, O. Solgaard, "From Bench to Bedside with Advanced Dual-Axes Confocal Microendoscope", proceedings of the IEEE 23rd International Conference on Micro Electro Mechanical Systems (MEMS 2010), pp. 27-30, Hong Kong S.A.R., China, January 24-28, 2010.
4. J.T.C. Lui, M.J. Mandella, **H. Ra**, W. Piyawattanametha, O. Solgaard, G.S. Kino, C.H. Contag, "Surgical Dual-Axis Confocal Microscope for Brain Tumor Resection", proceedings of the IEEE Photonics Society Winter Topical Meeting, pp. 76-77, Majorca, Spain, January 11-13, 2010.
5. W. Piyawattanametha, M.J. Mandella, **H. Ra**, J.T.C. Lui, S. Friedland, Z. Qui, G.S. Kino, T.D. Wang, C.H. Contag, O. Solgaard, "From Bench to Bedside with Advanced Dual-Axes Confocal Microendoscope", proceedings of the IEEE Photonics Society Winter Topical Meeting, pp. 83-84, Majorca, Spain, January 11-13, 2010.
6. **O. Kilic, O.C. Akkaya**, M. Digonnet, G. Kino, O. Solgaard, "Optomechanical fiber gyroscope," 20th International Conference on Optical Fibre Sensors, Edinburgh, United Kingdom, October 5-9, 2009, Proceedings of SPIE Vol. 7503, pp. 750345-1-4.
7. **I-W. Jung, B. Park**, J. Provine, R.T. Howe, O. Solgaard, "Photonic Crystal Fiber Tip Sensor for Precision Temperature Sensing," IEEE Lasers and Electro-Optics Society (LEOS) Annual Meeting, pp. 761-762, Belek-Antalya, Turkey, 4-8 October, 2009.
8. K. Takahashi, **I.W. Jung**, A. Higo, Y. Mita, H. Fujita, H. Toshiyoshi, O. Solgaard, "A CMOS Compatible Low Temperature Process for Photonic Crystal MEMS Scanner", 2009 IEEE/LEOS International Conference on Optical MEMS and Nanophotonics, pp. 77-78, Clearwater Beach, Florida, August 17-20, 2009.
9. **I-W. Jung, B. Park**, J. Provine, R.T. Howe, O. Solgaard, "Monolithic Silicon Photonic Crystal Slab Fiber Tip Sensor", 2009 IEEE/LEOS International Conference on Optical MEMS and Nanophotonics, pp. 19-20, Clearwater Beach, Florida, August 17-20, 2009.
10. W. Piyawattanametha¹, **H. Ra**, M.J. Mandella¹, E. Gonzalez, R. Kaspar, G.S. Kino, C.H. Contag, O. Solgaard, "Dual-Axes Confocal Microscopy for Clinical Skin Imaging (invited talk)", 2009 IEEE/LEOS International Conference on Optical MEMS and Nanophotonics, pp. 3-4, Clearwater Beach, Florida, August 17-20, 2009.
11. **H. Ra**, E. Gonzalez, W. Piyawattanametha, M.J. Mandella, R. Kaspar, C.H. Contag, G.S. Kino, O. Solgaard, "Sequential *in vivo* Molecular Imaging with a Dual-Axes Confocal Microscope," Conference on Lasers and Electro-Optics (CLEO) 2009, Paper CFA1, Baltimore, MD, May 31 – June 5, 2009.

12. W. Piyawattanametha, **H. Ra**, M.J. Mandella, J.T Liu, E. Gonzalez, R. Kaspar, G.S. Kino, O. Solgaard, C.H. Contag, "In vivo Clinical and Intravital Imaging with MEMS Based Dual-Axes Confocal Microscopes," 2009 OSA Spring Optics & Photonics Congress, paper NWC1, Vancouver, Canada, April 26-30, 2009, Novel Techniques in Microscopy (NTM) 2009, OSA Technical Digest (CD).
13. **J.-W. Jeung, I.-W. Jung**, D.M. Baney, O. Solgaard, "Tunable Optical Bandpass Filter with High-Quality Vertical Mirrors Microassembled on Movable MEMS Platforms," Transducers 09, The 15th International Conference on Solid-State Sensors, Actuators and Microsystems, pp. 2318-2321, Denver, Colorado, June 21-25, 2009.
14. **O. Kilic**, M.J.F. Digonnet, G.S. Kino, O. Solgaard, "Fiber-Optical Acoustic Sensor Based on a Photonic-Crystal Diaphragm," Transducers 09, The 15th International Conference on Solid-State Sensors, Actuators and Microsystems, pp. 1142-1145, Denver, Colorado, June 21-25, 2009.
15. **F. Sarioglu**, M. Liu, O. Solgaard, "Interferometric Force Sensing AFM Probes For Nanomechanical Mapping of Material Properties," Transducers 09, The 15th International Conference on Solid-State Sensors, Actuators and Microsystems, pp. 1634-1637, Denver, Colorado, June 21-25, 2009.
16. **H. Ra**, W. Piyawattanametha, E. Gonzalez, R. Kaspar, M.J. Mandella, C.H. Contag, G.S. Kino, O. Solgaard, "In vivo Intravital Imaging with a Dual-Axes Confocal Microscope in Skin," IEEE Lasers and Electro-Optics Society (LEOS) Annual Meeting, pp. 35-36, Newport Beach, CA, November 2008 (1st place in 2008 Best Student Paper Award).
17. **I.-W. Jung, S.B. Mallick**, O. Solgaard, "Large-Area High-Reflectivity Broadband Monolithic Silicon Photonic Crystal Mirror MEMS Scanner," 2008 IEEE/LEOS International Conference on Optical MEMS and Nanophotonics, pp. 76-77, Freiburg, Germany, August 11-14, 2008.
18. **I.-W. Jung, S.B. Mallick**, O. Solgaard, "Large-Area Monolithic Photonic Crystal Mirrors with High Reflectivity in the 1250-1650nm Band Patterned by Optical Lithography," 2008 IEEE/LEOS International Conference on Optical MEMS and Nanophotonics, pp. 86-87, Freiburg, Germany, August 11-14, 2008.
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20. **S. Kim**, R. Kant, S. Hadzialic, R.T. Howe, O. Solgaard, "Interface Quality Control of Monolithic Photonic Crystals by Hydrogen Annealing," Conference on Lasers and Electro-Optics (CLEO) 2008, Paper CFY5, San Jose, CA, May 4-9, 2008.
21. C. Hoy, N. Durr, P. Chen, D.K. Smith, T. Larson, W. Piyawattanametha, **H. Ra**, B. Korgel, K. Sokolov, O. Solgaard, A. Ben-Yakar, "Two-Photon Luminescence Imaging Using a MEMS-Based Miniaturized Probe," Conference on Lasers and Electro-Optics (CLEO) 2008, Paper CThG5, San Jose, CA, May 4-9, 2008.
22. **S. Basu Mallick, S. Kim**, S. Hadzialic, A. Sudbø, O. Solgaard, "Double-layered Monolithic Silicon Photonic Crystals," Conference on Lasers and Electro-Optics (CLEO) 2008, Paper CThCC7, San Jose, CA, May 4-9, 2008.
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- Sensors, Perth, Australia, April 14-18, 2008, Proceedings of SPIE Vol. 7004, pp. 700405-1-4 (Won first place "award in excellence - best student presentation").
24. S. Hadzialic, **S. Kim**, **S. Basu Mallick**, A. Sudbø, O. Solgaard, "Monolithic photonic crystals," Technical Digest of the Norwegian Electro-Optics Meeting 2008, Hurtigruta, Norway, March 27-28, 2008.
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 26. W. Piyawattanametha, M.J. Mandella, **H. Ra**, C. Du, C.H. Contag, G.S. Kino, O. Solgaard, "Three-dimensional in-vivo imaging with a miniature dual-axes confocal fluorescence microscope," 2008 SPIE Photonic West Conference, Endoscopic Microscopy III, San Jose, CA, January 20, 2008.
 27. O. Solgaard, "Optical MEMS Based on High-Reflectivity Photonic Crystals," 2007 IEEE/LEOS Annual Meeting Conference Proceedings, pp. 765-766, Lake Buena Vista, FL, October 21-25, 2007 (Invited).
 28. S. Hadzialic, **S. Kim**, A. Sudbø, O. Solgaard, "Displacement Sensing with a Mechanically Tunable Photonic Crystal," 2007 IEEE/LEOS Annual Meeting Conference Proceedings, pp. 345-346, Lake Buena Vista, FL, October 21-25, 2007.
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 33. W. Piyawattanametha, E.D Crocker, R.P.J. Barretto, J.C. Jung, B.A. Flusberg, **H. Ra**, O. Solgaard, M. Schnitzer, "A Portable Two-photon Fluorescence Microendoscope Based on a Two-dimensional Scanning Mirror," 2007 IEEE/LEOS International Conference on Optical MEMS and Nanophotonics, pp. 6-7, Hualien, Taiwan, August 12-16, 2007.
 34. **I.-W. Jung**, **S. Kim**, O. Solgaard, "High Reflectivity Broadband Photonic Crystal Mirror MEMS Scanner," Transducers & Euroensors'07, The 14th International Conference on Solid-State Sensors, Actuators and Microsystems, pp. 1513-1516, Lyon, France, June 10-14, 2007.
 35. W. Piyawattanametha, **H. Ra**, M. J. Mandella, J.T.C. Liu, L.K. Wong, C.B. Du, T.D. Wang, C.H. Contag, G.S. Kino, O. Solgaard, "Three-Dimensional In Vivo Real Time Imaging By A Miniature Dual-Axes Confocal Microscope Based on a Two-Dimensional MEMS Scanner," Transducers & Euroensors'07, The 14th International Conference on Solid-State Sensors, Actuators and Microsystems, pp. 439-442, Lyon, France, June 10-14, 2007.

36. **H. Ra**, W. Piyawattanametha, M. J. Mandella, J.T.C. Liu, L.K. Wong, T.D. Wang, C.H. Contag, G.S. Kino, O. Solgaard, "Three-Dimensional in vivo Reflectance and Fluorescence Imaging by a Handheld Dual-Axes Confocal Microscope, Conference on Lasers and Electro-Optics (CLEO) 2007, Paper CTuEE1, Baltimore, MD, May 6-11, 2007.
37. **S. Kim**, S. Hadzialic, A. Sudbo, O. Solgaard, "Single-film Broadband Photonic Crystal Micro-mirror with Large Angular Range and Low Polarization Dependence," Conference on Lasers and Electro-Optics (CLEO) 2007, Paper CThP7, Baltimore, MD, May 6-11, 2007.
38. **H. Ra**, W. Piyawattanametha, Y. Taguchi, D. Lee, O. Solgaard, "Reflectance and fluorescence imaging with a MEMS dual-axes confocal microscope (invited talk)," 2007 SPIE Photonic West Conference, MOEMS and Miniaturized Systems VI, *Proceedings of SPIE 6466*, pp. 64660G-1 - 64660G-8, San Jose, CA, January 22, 2007.
39. W. Piyawattanametha, **H. Ra**, M.J. Mandella, J.T.C. Liu, L.K. Wong, P. Hsiung, C.H. Contag, G.S. Kino, T.D. Wang, O. Solgaard, "MEMS Based Dual-axes Confocal Microscope for in-vivo Imaging," 2007 SPIE Photonic West Conference, Endoscopic Microscopy II, San Jose, CA, January 21, 2007.
40. W. Piyawattanametha, B.A. Flusberg, R.P.J. Baretto, J.C. Jung, T.H. Ko, E.D. Cocker, **H. Ra**, D. Lee, O. Solgaard, M.J. Schnitzer, "Toward portable two-photon fluorescence micro-endoscopy using a two-dimensional microelectromechanical (MEMS) scanning mirror," 2007 SPIE Photonic West Conference, Multiphoton Microscopy in the Biological Sciences VII, San Jose, CA, January 22, 2007.
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43. **K. Yu**, H. Lee, N. Park, **D. Lee**, O. Solgaard, "Optical Bandpass Filter with Tunable Chromatic Dispersion and Optical Bandwidth Using a Variable MEMS Reflector," Technical Digest of the 2007 Optical Fiber Communication Conference (OFC 07), paper no. OWO3, Anaheim, CA, March 25-29, 2007.
44. **O. Kilic**, M. Digonnet, G. Kino, O. Solgaard, "External Fiber Fabry-Perot Acoustic Sensor Based on Photonic Crystal Mirror," Technical Digest of the 2006 18th International Conference on Optical Fiber Sensors Topical Meeting (OFS-18), paper no. ThB2 (4 pages), Gran Meliá Cancún Convention Center, Cancun, Mexico, October 23-27, 2006. (Won first place for best student presentation).
45. **K. Yu**, N. Park, **D. Lee**, O. Solgaard, "Micromirror-based scan range enhancement in Fourier-domain optical coherence tomography," 2006 IEEE/LEOS International Conference on Optical MEMS and Their Applications, pp. 42-43, Big Sky, MO, August 21-24, 2006.
46. **I.W. Jung**, **J-S. Wang**, O. Solgaard, "Spatial Light Modulators for Maskless Lithography," 2006 IEEE/LEOS International Conference on Optical MEMS and Their Applications, pp. 150-151, Big Sky, MO, August 21-24, 2006.

47. **I.W. Jung**, Yves-Alain Peter, **Emily Carr**, **J-S. Wang**, O. Solgaard, "Single-Crystal-Silicon Continuous Membrane Deformable Mirror Array for Adaptive Optics," 2006 IEEE/LEOS International Conference on Optical MEMS and Their Applications, pp. 152-153, Big Sky, MO, August 21-24, 2006.
48. W. Piyawattanametha, J.T.C. Liu, M.J. Mandella, **H. Ra**, L.K. Wong, P. Hsiung, T.D. Wang, G.S. Kino, O. Solgaard, "MEMS Based Dual-axes Confocal Reflectance Handheld Microscope for in vivo Imaging," 2006 IEEE/LEOS International Conference on Optical MEMS and Their Applications, pp. 164-165, Big Sky, MO, August 21-24, 2006.
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51. M. Lacolle, H. Sagberg, I.-R. Johansen, O. Løvhaugen, A. Sudbø, O. Solgaard, "Micromechanical Diffractive Optical Filters for Spectroscopy," Technical Digest of the 2006 Northern Light Conference, p. 55, Bergen, Norway June 14-16, 2006.
52. J. Blad, A. Sudbø, O. Solgaard, "Photonic Crystals as Angle-Insensitive Broadband Mirrors," Technical Digest of the 2006 Northern Light Conference, p. 123, Bergen, Norway, June 14-16, 2006.
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54. **O. Sahin**, H.H.J. Person, C.F. Quate, O. Solgaard "Coupled Torsional Cantilevers for label-free single-molecule bio-detection and nanomaterials characterization," Proceedings of the Solid-State Sensor and Actuator Workshop, pp. 82-85, Hilton Head, SC, June 4-8, 2006.
55. K. Carlson, H.J. Shin, **H. Ra**, **D. Lee**, O. Solgaard, R. Richards-Kortum, "Single Fiber Confocal Microscope Using a Two-Axis Microscanner for Cellular Imaging, Conference on Lasers and Electro-Optics (CLEO), Technical Digest, paper CMR4, Long Beach, CA, May 21-26, 2006.
56. W. Piyawattanametha, R.P.J. Barretto, T.H. Ko, B.A. Flusberg, E.D. Cocker, H. Ra, D. Lee, O. Solgaard. M.J. Schnitzer, "Fast-scanning Two-photon Fluorescence Imaging Using a Microelectromechanical Systems (MEMS) Two-dimensional Scanning Mirror," Conference on Lasers and Electro-Optics (CLEO), Technical Digest, paper CMMM5, Long Beach, CA, May 21-26, 2006.
57. **K. Yu**, N. Park, **D. Lee**, O. Solgaard, "Compact Laser Scanning Distance Sensor with a Two-axis Gimbaled Microscanner for Volumetric Imaging," Conference on Lasers and Electro-Optics (CLEO), Technical Digest, paper CWL5, Long Beach, CA, May 21-26, 2006.
58. **K. Yu**, N. Park, **D. Lee**, O. Solgaard, "Superresolution Image Enhancement in Digital Photomicrography by Subpixel Translation using a Scanning Micromirror," Conference on Lasers and Electro-Optics (CLEO), Technical Digest, paper JTuD54, Long Beach, CA, May 21-26, 2006.

59. **I.-S. Joe**, O. Solgaard, "High Capacity Optical Packet Switch Based on a Waveguide Grating Router Operated over Multiple FSRs," Conference on Lasers and Electro-Optics (CLEO), Technical Digest, paper CThHH2, Long Beach, CA, May 21-26, 2006.
60. **E. Carr**, S. Olivier, O. Solgaard, "Large-Stroke Self-Aligned Vertical Comb Drive Actuators for Adaptive Optics Applications," MEMS/MOEMS Components and Their Applications III, Proceedings of SPIE Vol. 6113, pp. 61130T-1 to 61130T-9 (2006), San Jose, CA, January 21-25, 2006.
61. **J.-S. Wang**, O. Solgaard, A. R. Neureuther, "High-sensitivity interferometric schemes for ML2 micromirror calibrations," presented at the Emerging Lithographic Technologies X conference, SPIE Proc. 6151, pp. 615112/1-615112/8, San Jose, CA, February 19-24, 2006.
62. **I.-S. Joe**, O. Solgaard, "Scalable optical switch fabric for avionic networks," Proceedings of Avionics Fiber-Optics and Photonics, Institute of Electrical and Electronics Engineers, pp. 19-20, Minneapolis, MN, September 12-14, 2005.
63. **D. Lee**, O. Solgaard, "Silicon Masking Layers for Fabrication of High Aspect Ratio MEMS," Proc. 2005 IEEE/LEOS International Conf. on Optical MEMS and Their Applications, pp. 85-86, Oulu, Finland, August 1-4, 2005.
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