Andrew Sarangan

Dept. of Electro-Optics and Photonics
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OVERVIEW

Professor, Dept. of Electro-Optics and Photonics
Optoelectronics, Thin Films, Nanofabrication & Integrated Optics
Licensed Professional Engineer (Ohio)
Commercial Pilot & Flight Instructor
Citizenship: USA & Canada
Security Clearance: Available upon request

ACADEMIC APPOINTMENTS

University of Dayton, OH, USA

Department of Electro-Optics and Photonics	2000 -
Full Professor	2011 -
Associate Professor	2006 - 2011
Assistant Professor	2000 - 2006

- Nanofabrication, Optical Thin Films, Integrated Photonics, Photodetectors, Computational Electromagnetics
- Joint Appointment with Electrical and Computer Engineering
- **Key Accomplishments**: I established a nanofabrication laboratory as a single-PI effort *entirely from externally sponsored research funds*. I personally maintain its daily operations, and receive no subsidies or course-release from the university. The laboratory has all of the fab capabilities - thin films, photolithography, deep-UV interference lithography, thermal processes and plasma etching.
  Laboratory website: http://nano-fab.com

  I also developed remote-executing photonic simulation software, long before cloud computing. This software is used by many researchers around the world.
  Photonics simulation: http://maxwellsequations.org

University of New Mexico, Albuquerque, NM, USA

Center for High Technology Materials (CHTM)	1997 - 2000
Research Assistant Professor	

- High power, high brightness semiconductor lasers
- Taught courses in Introductory Photonics

- **Key Accomplishments**: Completed the first theoretical and experimental study of the α-DFB semiconductor laser.

EDUCATION

PhD Electrical Engineering 1993-1997
University of Waterloo, Canada
"Multi-wavelength distributed feedback lasers"
Dissertation advisor: W. -P. Huang (currently at Shandong University, China)

MASc Electrical Engineering 1991-1993
University of Waterloo, Canada
"An electronic switch based on quantum interference"
Thesis advisor: W. -P. Huang

BASc Electrical Engineering 1986-1991
University of Waterloo, Canada
Physics Option

AWARDS & HONORS

- 2018 Vision Award for Excellence - University of Dayton
- 2013 Faculty Excellence in Teaching Awards – Southwestern Ohio Council for Higher Education
- 2013 Affiliate Societies Council Outstanding Scientists & Engineers Award – Research category, Dayton, OH
- 2008 Sigma Xi Noland Award for Excellence in Research, University of Dayton
- AFOSR Summer Faculty Fellowship (2001, 2002, 2017 & 2018) for research at Air Force Research Laboratory, Wright-Patterson AFB.
- Post-Doctoral Fellowship for Research in Optoelectronics (1997 &1998) - Natural Sciences and Engineering Research Council (NSERC) of Canada. This is a prestigious two-year award. Only 14 were awarded in all of Canada in Electrical Engineering, and I was the only Engineering recipient at Waterloo.
- Post-Graduate Scholarship, NSERC of Canada (1991-1995). Full scholarships for MS & PhD.
- Telecommunications Research Institute of Ontario Internship award (1995-1997).

PROFESSIONAL SOCIETIES

- Senior Member, IEEE, Photonics Society, Electron Devices Society
- Senior Lifetime Member, SPIE
- Associate Editor of IEEE Journal of Quantum Electronics
- Chair of the Technical program committee of IEEE Photonics Society on Photodetectors, Sensors, Systems and Imaging (2017 & 2018)
- Chair of the IEEE/Photonics Society chapter of Dayton, OH (2002 - 2018)

ENGINEERING EXPERIENCE

- Consultant for Silfex (Lam Research) on semiconductor etch process development
- Consultant for Gentex (automotive displays)
- Founder, Dayton Photonics, LLC
- Worked in various capacities at Nortel Networks, IBM & Air Force Research Laboratory.

AERONAUTICAL EXPERIENCE

- $\sim$ 1500 hours as pilot-in-command
- 20 years of flight experience
- FAA Certificates:
  - CP-ASEL (IA)/CFI-I
  - Commercial Pilot
  - Flight Instructor
  - Advanced Ground Instructor

PATENTS

- Agus Widjaja, Andrew Sarangan, "*Thin film structures with negative inductance and methods for fabricating inductors comprising the same*", U.S. Patent No. 20090261936, 2011
- Gregory M. Peake, Stephen D. Hersee and Andrew M. Sarangan, "*Non-Planar Micro-Optical Structures*", U.S. Patent No. 6,728,289, 2004
- Gregory M. Peake, Stephen D. Hersee and Andrew M. Sarangan, "*Method of Making Non-Planar Micro-Optical Structures*", U.S. Patent No. 6365237, 2002
- G.P. Li, T. Makino, A. Sarangan and W.P. Huang, "*Multi-Wavelength Gain-Coupled Distributed Feedback Laser Arrays with Fine Tunability*", U.S. Patent No. 5536085, 1996

FUNDING [$\approx$$4.2M as PI, $\approx$$2.5M as Co-PI]

- Lam Research Corp., "Laser-assisted chemical etching for deep silicon micromachining", $25,000 (Research Donation) (PI, 08/2018).
- Gentex Corp., "Wiregrid polarizers for automotive applications", $39,220 (PI, 06/2017 - 12/2018).
- National Science Foundation (NSF), "Collaborative Research: Nanopatterning and temporal control of phase-change materials for reconfigurable photonics", $197,768 (Co-PI, 08/2017 - 07/2020).
- Silfex Inc., "Process development for wet-chemical etching of silicon", $20,000 (PI, 07/2016 - 10/2017).
- Silanna Semiconductor, "UVC Material evaluation", $9000 (PI, 03/2017 - 08/2017).

- Dayton Area Graduate Studies Institute, "An Integrated Photonics CMOS Compatible Platform for Chemical and Biological Sensors", $212,976 (PI, 07/2016 - 06/2019).
- Air Force Research Laboratory, "Transition Metal Nitrides for Opto-Electronic Applications & New Ferroelectrics & Composite Multiferroic Materials for RF", $98,734 (PI, 07/2017 - 08/2019).
- Air Force Research Laboratory/UES, "Infrared Anti-Reflection Coatings", $53,271 (PI, 01/2015 - 12/2017).
- Missile Defense Agency Phase 1 SBIR/Rnet, "ID Compromised Electronic Components", $40,000 (PI, 01/2015 - 07/2015).
- Air Force Research Laboratory, "Thermal Diffusion Tube Furnace System", $13,352 (PI, 10/2014 - 10/2014).
- Air Force Research Laboratory, "Ion Assisted Deposition System", $19,514 (PI, 07/2014 - 07/2014).
- Air Force Research Laboratory, "Interferometric Lithography and Substrate Patterning/Epitaxy for Nonlinear Quasi-Phase-Matched Device Development", $368,505 (PI, 01/2014 - 07/2016).
- Air Force Research Laboratory/UES, "Anti-reflection coatings", $25,000 (PI, 01/2014 - 12/2015).
- National Science Foundation (NSF), "CC-NIE Network Infrastructure: Network 10Gb Upgrade and Science DMZ Implementation to Support Science and Engineering Research and Enhance Outreach for High School STEM Education", $232,788 (Co-PI, 12/2013 - 05/2016).
- National Science Foundation (NSF), "CCSS: Spectral Filter Array for Multispectral Imaging", $319,952 (Co-PI, 09/2013 - 08/2016).
- National Science Foundation (NSF), "Collaborative Research: Cross-institutional Nanotechnology Education and Workforce Training Project", $100,000 (PI, 01/2012 - 12/2014).
- China Southern Glass Holding Co. Ltd, "Electrochromic glass research and development", $175,000 (Co-PI, 10/2012 - 09/2013).
- FMI Imaging, "Development of metal vapor coating & blue-enhanced detectors for medical imaging", $30,800 (PI, 09/2012 - 04/2013).
- FMI Imaging, "Rapid thermal annealer for blue enhanced detector development", $44,300 (PI, 06/2011 - 01/2012).
- Air Force Research Laboratory/UES, "Infrared Coatings for Laser Effects on Materials, Structures and Sensors", $39,000 (PI, 04/2011 - 10/2013).
- Navy SBIR Phase 1/Forza Silicon, "Dual Well Focal Plane Array", $19,536 (PI, 08/2010 - 12/2010).
- Air Force Research Laboratory, "Interdisciplinary Technology Development for Future MAV Systems", $1,506,500 (Co-PI, 10/2008 - 09/2011).
- Air Force Research Laboratory, "Project Biosense", $175,000 (PI, 08/2010 - 07/2013).

- Air Force Research Laboratory, "Mid-Wave Infrared Sensing Technology Advancement (MISTA)", $99,989 (PI, 08/2010 - 12/2012).
- DARPA/University of Rochester, "Development of Mini-Cluster Computational Facility For Modeling Large Mode Area Fibers", $45,200 (PI, 04/2009 - 08/2010).
- Missile Defense Agency SBIR Phase 2/Aegis, "Beam Steering", $33,121 (PI, 04/2009 - 03/2011).
- L3 Cincinnati Electronics, "Development of Spectral and Polarimetric Devices for Lenslet Imaging", $34,158 (PI, 07/2009 - 06/2010).
- Air Force Research Laboratory/GDIT, "Anti-reflection coatings", $44,600 (PI, 04/2008 - 10/2010).
- Air Force Research Laboratory, "Development of Advanced Infrared Detectors", $78,016 (PI, 01/2009 - 10/2009).
- Institute for the Development and Commercialization of Advanced Sensors Technology, "Polarimetric Imaging Technology", $200,000 (PI, 02/2007 - 01/2010).
- Institute for the Development and Commercialization of Advanced Sensors Technology - OSCAR Project, "Fabrication of MWIR Micro-lenslet imaging arrays", $24,530 (PI, 07/2009 - 06/2010).
- Air Force Research Laboratory/L3CE, "Multispectral/Polarimetric Imaging Camera Program", $202,000 (PI, 04/2006 - 12/2007).
- Office of Naval Research/L3CE, "Multi Color IR FPA Utilizing Low Cost 2D Pixel Architecture", $37,000 (PI, 04/2006 - 12/2006).
- Mantech/L3CE, "Large Area Micro-Optics", $25,000 (PI, 10/2005 - 04/2006).
- Air Force Research Laboratory, "Quantum Cascade Lasers", $18,000 (PI, 05/2005 - 12/2005).
- Missile Defense Agency/L3CE, "C-QWIP Based IR Detectors", $45,598 (PI, 05/2005 - 04/2006).
- Ohio Third Frontier Wright Project, "Development and Commercialization of Long-wavelength Infrared Focal Plane Arrays", $1,092,800 (PI, 1/05 - 3/09).
- L3 Cincinnati Electronics, "Micro-optic IR FPA Project", $126,727 (PI, 09/2004 - 12/2008).
- Wright Capital Project Fund, "Development of Arrayed micro-optic elements for enhanced infrared image detection", $773,589 (PI, 09/2003 - 08/2006).
- Navy Research Laboratory STTR Phase 1/Defense Research Associates, "Silicon-Based Visible/Near-Infrared Affordable Missile Warning", $17,644 (PI, 07/2003 - 01/2004).
- National Science Foundation (NSF) SBIR Phase 1/Srico Inc, "Photonic Band Gap Waveguide Structures in Lithium Niobate", $19,714 (Co-PI, 07/2002 - 12/2002).
- Dayton Area Graduate Studies Institute, "Measurement and Modeling of Aero-Optical Aberrations in Coherent Laser Radiation", $66,660 (Co-PI, 07/2001 - 06/2004).

BOOKS

- Andrew Sarangan. *Nanofabrication: Principles to Laboratory Practice (Optical Sciences and Applications of Light)*. CRC Press, 2016. ISBN:1498725570

BOOK CHAPTERS

- A. Sarangan. "Quantum mechanics and computation in nanophotonics". *Fundamentals and Applications of Nanophotonics*, pages 45–87. Elsevier, 2016. doi:10.1016/B978-1-78242-464-2.00003-8
- A. Sarangan. "Nanofabrication". *Fundamentals and Applications of Nanophotonics*, pages 149–184. Elsevier, 2016. doi:10.1016/B978-1-78242-464-2.00005-1

PUBLICATIONS AND CONFERENCE PROCEEDINGS [statistics]

2019

117. Pengfei Guo, Andrew Sarangan, and Imad Agha. "A review of germanium-antimony-telluride phase change materials for non-volatile memories and optical modulators". *Applied Sciences - Special Issue on Advanced Applications of Phase Change Materials*, Accepted

116. Joshua Duran and Andrew M. Sarangan. "Schottky-Barrier Photodiode Internal Quantum Efficiency Dependence on Nickel Silicide Film Thickness". *IEEE Photonics Journal*, pages 1–1, 2019. doi:10.1109/JPHOT.2018.2886556

2018

115. Pengfei Guo, Joshua A. Burrow, Gary A. Sevison, Aditya Sood, Mehdi Asheghi, Joshua R. Hendrickson, Kenneth E. Goodson, Imad Agha, and Andrew Sarangan. "Improving the performance of $Ge_2Sb_2Te_5$ materials via nickel doping: Towards RF-compatible phase-change devices". *Applied Physics Letters*, 113(17):171903, 2018. doi:10.1063/1.5053713

114. Andrew Sarangan, Josh Duran, Vladimir Vasilyev, Nicholaos Limberopoulos, Ilya Vitebskiy, and Igor Anisimov. "Broadband Reflective Optical Limiter Using GST Phase Change Material". *IEEE Photonics Journal*, 10(2):1–9, 2018. doi:10.1109/JPHOT.2018.2796448

113. Chuan Ni, Jie Jia, Matthew Howard, Keigo Hirakawa, and Andrew Sarangan. "Single-shot multispectral imager using spatially multiplexed fourier spectral filters". *J. Opt. Soc. Am. B*, 35(5):1072–1079, 2018. doi:10.1364/JOSAB.35.001072

112. Andrew Sarangan. "Design of metal-dielectric resonant-cavity thin-film structures using the effective reflectance index method". *Journal of the Optical Society of America B*, 35(9):2294, 2018. doi:10.1364/JOSAB.35.002294

111. R. Yahiaoui, J. A. Burrow, S. M. Mekonen, A. Sarangan, J. Mathews, I. Agha, and T. A. Searles. "Electromagnetically induced transparency control in terahertz metasurfaces based on bright-bright mode coupling". *Physical Review B*, 97(15):155403, 2018. doi:10.1103/PhysRevB.97.155403

110. Riad Yahiaoui, Joshua A. Burrow, Jay Matthews, Andrew Sarangan, Imad Agha, and Thomas A. Searles. "Tunable Electromagnetically Induced Transparency in $Ge_2Sb_2Te_5$-Based Infrared Metasurfaces". *Frontiers in Optics / Laser Science*, page JTu2A.96, Washington, D.C., 2018. OSA. doi:10.1364/FIO.2018.JTu2A.96

109. Sirak M. Mekonen, Riad Yahiaoui, Joshua A. Burrow, Andrew Sarangan, Imad Agha, Jay Matthews, and Thomas A. Searles. "Modulation of Electromagnetically Induced Transparency in Toriodal Resonance Terahertz Metasurfaces". *Frontiers in Optics / Laser Science*, page JTu3A.103, Washington, D.C., 2018. OSA. doi:10.1364/FIO.2018.JTu3A.103

108. Joshua Duran and Andrew Sarangan. "Internal Quantum Efficiency Dependence on Thickness of NiSi Schottky Barrier Photodetectors". *2018 IEEE Photonics Conference (IPC)*, pages 1–2. IEEE, 2018. doi:10.1109/IPCon.2018.8527106

107. Pengfei Guo, Gary Sevison, Imad Agha, Andrew Sarangan, and Joshua Burrow. "Electrical and optical properties of nickel-doped $Ge_2Sb_2Te_5$ films produced by magnetron co-sputtering". *Nanoengineering: Fabrication, Properties, Optics, and Devices XV*, page 19. SPIE, 2018. doi:10.1117/12.2320843

106. Riad Yahiaoui, Sirak M. Mekonen, Joshua A. Burrow, Pheona O. Williams, Andrew Sarangan, Imad Agha, Jay Mathews, and Thomas A. Searles. "Toroidal Response of Asymmetric Metasurfaces with Multiple High Q-Factor Resonances". *Conference on Lasers and Electro-Optics*, page JW2A.112, Washington, D.C., 2018. OSA. doi:10.1364/CLEO_AT.2018.JW2A.112

105. Joshua A. Burrow, Riad Yahiaoui, Andrew Sarangan, Jay Mathews, Imad Agha, and Thomas A. Searles. "Mode hybridization in lattice induced transparency for polarization-insensitive THz metasurfaces". *Conference on Lasers and Electro-Optics*, page JW2A.106, Washington, D.C., 2018. OSA. doi:10.1364/CLEO_AT.2018.JW2A.106

104. Andrea Aboujaoude, Joshua Burrow, Joshua Hendrickson, Imad Agha, Andrew Sarangan, and Joseph W. Haus. "Influence of geometry on speed of phase-change in GST-based nanorods". *Conference on Lasers and Electro-Optics*, page JW2A.105, Washington, D.C., 2018. OSA. doi:10.1364/CLEO_AT.2018.JW2A.105

103. Riad Yahiaoui, Jay Mathews, Joshua A. Burrow, Imad Agha, Gary Sevison, Augustine M. Urbas, Andrew Sarangan, and Thomas A. Searles. "Thermally tunable far-infrared metasurfaces enabled by $Ge_2Sb_2Te_5$ phase-change material". *2018 IEEE Research and Applications of Photonics In Defense Conference (RAPID)*, pages 1–4. IEEE, 2018. doi:10.1109/RAPID.2018.8508956

102. Gary A. Sevison, Joshua A. Burrow, Andrea Aboujaoude, Matthew Mircovich, Andrew Sarangan, Joshua Hendrickson, and Imad Agha. "Free-Space optical switching of GST phase-change thin films via 1550 nm light". *Conference on Lasers and Electro-Optics*, page JTu2A.6, Washington, D.C., 2018. OSA. doi:10.1364/CLEO_AT.2018.JTu2A.6

101. Mallik M. R. Hussain, Zhengning Gao, Domenico de Ceglia, Maria A. Vincenti, Andrew Sarangan, Imad Agha, Michael Scalora, Parag Banerjee, and Joseph W. Haus. "Enhanced Harmonic Generation in Metal-Insulator-Metal Nanostructures". *Conference on Lasers and Electro-Optics*, page JTh2A.71, Washington, D.C., 2018. OSA. doi:10.1364/CLEO_AT.2018.JTh2A.71

2017

100. Joshua A. Burrow, Riad Yahiaoui, Andrew Sarangan, Imad Agha, Jay Mathews, and Thomas A. Searles. "Polarization-dependent electromagnetic responses of ultrathin and highly flexible asymmetric terahertz metasurfaces". *Optics Express*, 25(26):32540, 2017. doi:10.1364/OE.25.032540

99. Zhengning Gao, Mallik M. R. Hussain, Domenico de Ceglia, Maria A. Vincenti, Andrew Sarangan, Imad Agha, Michael Scalora, Joseph W. Haus, and Parag Banerjee. "Unraveling delocalized electrons in metal induced gap states from second harmonics". *Applied Physics Letters*, 111(16):161601, 2017. doi:10.1063/1.4996893

98. Mallik Mohd Raihan Hussain, Zhengning Gao, Domenico de Ceglia, Maria Vinceti, Andrew Sarangan, Imad Agha, Michael Scalora, Parag Banergee, and Joseph W. Haus. "Observation of Third Harmonic Enhancement Due to Tunneling at a Metal-Insulator-Metal Junction". *Frontiers in Optics 2017*, volume Part F66-F, page JTu3A.29, Washington, D.C., 2017. OSA. doi:10.1364/FIO.2017.JTu3A.29

97. Pengfei Guo, David Lombardo, and Andrew M. Sarangan. "Vanadium dioxide switchable components based on wiregrids for mid-infrared applications". *Nanoengineering: Fabrication, Properties, Optics, and Devices XIV*, page 43. SPIE, 2017. doi:10.1117/12.2272758

96. Joshua M. Duran and Andrew Sarangan. "Fabrication of ultrahigh aspect ratio silicon nanostructures using self-assembled gold metal-assisted chemical etching". *Journal of Micro/Nanolithography, MEMS, and MOEMS*, 16(1):014502, 2017. doi:10.1117/1.JMM.16.1.014502

95. Chenhao Wan, David Lombardo, Andrew Sarangan, and Qiwen Zhan. "High efficiency geometric-phase polarization fan-out grating on silicon". *Optics Express*, 25(20):24559, 2017. doi:10.1364/OE.25.024559

94. Chenhao Wan, David Lombardo, Andrew Sarangan, and Qiwen Zhan. "Geometric-Phase Polarization Fan-out Grating Fabricated with Deep-UV Interference Lithography". *Journal of Physics: Conference Series*, 844(1):012028, 2017. doi:10.1088/1742-6596/844/1/012028

93. Diego Garcia Mina, Joseph W. Haus, Andy Chong, Ankita Khanolkar, Andrew Sarangan, and Karolyn Hansen. "Bi-tapered fiber sensor using visible to near infrared light". *Sensors and Actuators A: Physical*, 263:285–290, 2017. doi:10.1016/j.sna.2017.06.017

92. J. Duran and A. Sarangan. "Infrared absorption in MacEtch fabricated silicon quantum walls". *2016 IEEE Photonics Conference, IPC 2016*, 2017. doi:10.1109/IPCon.2016.7831057

91. C. Ni, J. Jia, K. Hirakawa, and A. Sarangan. "A Fourier multispectral imaging camera with pixel-level sinusoidal filter arrays". *2016 IEEE Photonics Conference, IPC 2016*, 2017. doi:10.1109/IPCon.2016.7831060

2016

90. David Lombardo, Piyush Shah, Pengfei Guo, and Andrew Sarangan. "Deep-UV interference lithography combined with masked contact lithography for pixel wiregrid patterns". *Proc. SPIE - The International Society for Optical Engineering*, volume 9777, page 97771N, 2016. doi:10.1117/12.2219484

89. Mengyang Zou, Chuan Ni, and Andrew Sarangan. "Ion-assisted evaporation of vanadium dioxide thin films". *Proc. SPIE Nanoengineering: Fabrication, Properties, Optics, and Devices XIII*, page 99271Q, 2016. doi:10.1117/12.2238491

88. A. Belardini, G. Leahu, M. Centini, R. Li Voti, E. Fazio, C. Sibilia, Joseph W. Haus, Andrew Sarangan, D. Hooper, and V. K. Valev. "Effective chiral behavior on self-assembled tilted gold nanowires metasurface by means of linear and nonlinear optical techniques". *Proceedings of SPIE - The International Society for Optical Engineering*, volume 9894, page 98941V, 2016. doi:10.1117/12.2230382

87. Alessandro Belardini, Marco Centini, Grigore Leahu, David C. Hooper, Roberto Li Voti, Eugenio Fazio, Joseph W. Haus, Andrew Sarangan, Ventsislav K. Valev, and Concita Sibilia. "Chiral light intrinsically couples to extrinsic/pseudo-chiral metasurfaces made of tilted gold nanowires". *Scientific Reports*, 6(1):31796, 2016. doi:10.1038/srep31796

2015

86. A. Belardini, A. Benedetti, M. Centini, E. Fazio, M. Bertolotti, C. Sibilia, Joseph W. Haus, and Andrew Sarangan. "Symmetry breaking in the second harmonic field of self-assembled metallic nanostructures". *Proc. SPIE - The International Society for Optical Engineering*, volume 9502, page 950206. SPIE, 2015. doi:10.1117/12.2182759

85. Alessandro Belardini, Marco Centini, Grigore Leahu, Eugenio Fazio, Concita Sibilia, Joseph W. Haus, and Andrew Sarangan. "Second harmonic generation on self-assembled tilted gold nanowires". *Faraday Discussions*, 178:357–362, 2015. doi:10.1039/C4FD00200H

84. Jie Jia, Chuan Ni, Andrew Sarangan, and Keigo Hirakawa. "Fourier multispectral imaging". *Optics Express*, 23(17):22649, 2015. doi:10.1364/OE.23.022649

83. Junxin Wang, Yun Zhao, Imad Agha, and Andrew M. Sarangan. "SU-8 nanoimprint fabrication of wire-grid polarizers using deep-UV interference lithography". *Optics Letters*, 40(19):4396, 2015. doi:10.1364/OL.40.004396

82. Chuan Ni, Jie Jia, Keigo Hirakawa, and Andrew Sarangan. "Design and fabrication of sinusoidal spectral filters for multispectral imaging". *Proc. SPIE - The International Society for Optical Engineering*, volume 9556, page 95560I, 2015. doi:10.1117/12.2188830

81. Yun Zhao, Andrew Sarangan, and Imad Agha. "Frequency conversion via asymmetrically pumped four-wave-mixing Bragg scattering in silicon waveguides". *Frontiers in Optics 2015*, page FTh2B.5, Washington, D.C., 2015. OSA. doi:10.1364/FIO.2015.FTh2B.5

2014

80. Michael Benson, Piyush Shah, Michael Marciniak, Andrew Sarangan, and Augustine Urbas. "Optical Characterization of Silver Nanorod Thin Films Grown Using Oblique Angle Deposition". *Journal of Nanomaterials*, 2014:1–8, 2014. doi:10.1155/2014/694982

79. Long Wang, Peter E. Powers, Andrew Sarangan, and Joseph W. Haus. "Image revivals in multi-mode optical fibers with periodic multiple sub-apertures". *Optics Communications*, 326:57–63, 2014. doi:10.1016/j.optcom.2014.04.022

78. Junxin Wang and Andrew M. Sarangan. "Nanoimprint fabrication of wiregrids micro-polarizers in near infrared spectra using SU-8 as an intermediate film". *Proceedings of SPIE - The International Society for Optical Engineering*, volume 9170, page 917010, 2014. doi:10.1117/12.2061230

2013

77. Branden J. King, Ighodalo Idehenre, Peter E. Powers, Andrew M. Sarangan, Joseph W. Haus, and Karolyn M. Hansen. "Tapered optical fibers for aqueous and gaseous phase biosensing applications". *Progress in Biomedical Optics and Imaging - Proceedings of SPIE*, volume 8570, page 85700G, 2013. doi:10.1117/12.2004799

76. Emily M. Fehrman Cory, Roberto S. Aga, Jack P. Lombardi, Carrie M. Bartsch, Andrew Sarangan, and Emily M. Heckman. "Nanoimprint lithography of deoxyribonucleic acid biopolymer films". *Journal of Micro/Nanolithography, MEMS, and MOEMS*, 12(4):040501, 2013. doi:10.1117/1.JMM.12.4.040501

75. Susan Derenko, René Kullock, Zhi Wu, Andrew Sarangan, Christiane Schuster, Lukas M. Eng, and Thomas Härtling. "Local photochemical plasmon mode tuning in metal nanoparticle arrays". *Optical Materials Express*, 3(6):794, 2013. doi:10.1364/OME.3.000794

74. Susan Derenko, Roland Wuchrer, Andrew Sarangan, Christiane Schuster, and Thomas Härtling. "Plasmonic gradient structures of nanoparticle arrays for optical sensing applications". *Proceedings of SPIE - The International Society for Optical Engineering*, volume 8693, page 869305, 2013. doi:10.1117/12.2008954

73. A. Sarangan, J.W. Haus, S.M. Jain, J. Moradmand, and N. Reeder. "Collaborative classroom tools for nanotechnology process education". *ASEE Annual Conference and Exposition, Conference Proceedings*, 2013

72. Piyush Shah, Dongquan Ju, Xiaoxu Niu, and Andrew M. Sarangan. "Vapor Phase Sensing Using Metal Nanorod Thin Films Grown by Cryogenic Oblique Angle Deposition". *Journal of Sensors*, 2013:1–6, 2013. doi:10.1155/2013/823041

71. Joseph W. Haus, Long Wang, Peter E. Powers, and Andrew M. Sarangan. "Coherent superposition of multiple beams in a large mode area fiber". *Proceedings of SPIE - The International Society for Optical Engineering*, volume 8775, page 87750G, 2013. doi:10.1117/12.2018765

70. Piyush J. Shah, Zhi Wu, and Andrew M. Sarangan. "Effects of CO2 critical point drying on nanostructured SiO2 thin films after liquid exposure". *Thin Solid Films*, 527:344–348, 2013. doi:10.1016/j.tsf.2012.10.057

2012

69. Piyush J Shah, Xiaoxu Niu, and Andrew M Sarangan. "Journal of Nanoscience Letters High aspect ratio silver nanorod thin films grown at cryogenic substrate temperature". 2012

68. G. Nehmetallah, R. Aylo, P. Powers, A. Sarangan, J. Gao, H. Li, A. Achari, and P. P. Banerjee. "Co-sputtered SiC + Ag nanomixtures as visible wavelength negative index metamaterials". *Optics Express*, 20(7):7095, 2012. doi:10.1364/OE.20.007095

67. P. P. Banerjee, R. Aylo, G. Nehmetallah, H. Li, A. Sarangan, and P. Powers. "Binary nanoparticle dispersed metamaterial implementation and characterization". *Proceedings of SPIE - The International Society for Optical Engineering*, volume 8268, page 826805, 2012. doi:10.1117/12.915689

66. Piyush Shah, Xiaoxu Niu, and Andrew Sarangan. "Effect of Cryogenic Substrate Temperature on the Growth of Ag and Cu Nanostructured Optical Metamaterials". *2012 Symposium on Photonics and Optoelectronics*, pages 1–2. IEEE, 2012. doi:10.1109/SOPO.2012.6270908

65. Jian Gao, Andrew M. Sarangan, and Qiwen Zhan. "Polarization multiplexed fluorescence enhancer using a pixelated one-dimensional photonic band gap structure". *Optics Letters*, 37(13):2640, 2012. doi:10.1364/OL.37.002640

64. Xiaoxu Niu, Paul T. Murray, and Andrew Sarangan. "Synthesis of Fe–Ni bimetallic nanoparticles from pixel target ablation: plume dynamics and surface characterization". *Journal of Nanoparticle Research*, 14(8):1017, 2012. doi:10.1007/s11051-012-1017-z

63. R. C. G. Smith, A. M. Sarangan, Z. Jiang, and J. R. Marciante. "Direct measurement of bend-induced mode deformation in large-mode-area fibers". *Optics Express*, 20(4):4436, 2012. doi:10.1364/OE.20.004436

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- Quantum Electronics EOP-626/ECE-676

Undergraduate Courses

- Electrical and Electronic Circuits EGR-203