

Rajeev J. Ram

Professor of Electrical Engineering and Computer Science
Massachusetts Institute of Technology

Rajeev Ram is Professor of Electrical Engineering at MIT. His research focuses on the development of novel photonics & electronics for communications, energy, and sensing.

2017 Milestones:

- First single-mode, planar waveguide for ultraviolet light. Demonstrated integrated photonics platform covering the entire visible spectrum.
- First nanofluidic devices within CMOS. Architecture for high-resolution genome mapping using integrated photonics and nanofluidics.

Key Research Milestones

- Demonstrated integrated photonic architecture for trapped-ion based quantum information processing. Reported in *Nature Nanotechnology* (2016).
- Demonstrated on-demand, switchable production of full-doses of therapeutic protein using a microbioreactor exercising precise control over synthetic biological networks. Reported in *Nature Communications* (2016).
- Demonstrated the first microprocessor with embedded optical networking. This was in collaboration with researchers at UC Berkeley and CU Colorado. Reported in *Nature* (2015).
- Demonstrated trapped ion qubits with long-lifetime and long-coherence in a CMOS integrated circuit (2014).
- On the team that demonstrated <5 fJ/bit resonant Silicon photonic modulator and <20 fJ/bit integrated transmitter (2013).
- Demonstration of a thermally pumped light-emitting diode – first light-source to achieve greater than 100% electrical-to-optical conversion efficiency (2012)
- CMOS photonics in a deep-submicron technology (2008).
- Demonstration of a lab-on-a-chip microbioreactor for scale-down bioprocessing (2006)
- Measurement of thermoelectric parameters at p-n junction. Reported in *Science*. (2004)
- Room temperature, continuous-wave lasers on Si using graded SiGe/Si interlayers (2002)
- Proposed telecom switch based on electromagnetically induced transparency (2000)
- First room temperature, continuous-wave bipolar cascade laser (1999)
- Proposed semiconductor polariton laser (1996)
- Proposed semiconductor laser without population inversion (1994)
- On the team that produced the first electrically pumped, telecom VCSEL (1993)
- Developed III-V wafer bonding process (eg. high brightness LEDs) (1992)

Research Training

More than two dozen graduate and post-doctoral researchers have worked with Ram in the Physical Optics and Electronics Laboratory. These students have gone onto leading semiconductor companies such as Intel, Sun, Samsung and Freescale as well as to tenured professorships at Cornell, the University of California, the University of Michigan, ETH Zurich and MIT.

He has received the Ruth & Joel Spira Award and Jamieson Award for teaching. He is a MacVicar Faculty Fellow – MIT's highest honor for teaching.

Government Service

Until June 2012, he served as a Program Director at the Advanced Research Projects Agency within the Department of Energy. Joined ARPAe in its first year. Primary focus was in advanced electrical components and systems ranging from transportation to the generation and transmission of electric power. Created three programs at ARPAe: Agile Delivery of Electrical Power Technology (ADEPT), Solar ADEPT (part of the President’s Sunshot Initiative), and Green Electricity Network Integration (GENI). Portfolio of projects exceeded \$100M and included the demonstration of the highest voltage transistor and supported the breakthrough development of GaN-on-Si power electronics technology. Worked closely with path-breaking start-ups (Transphorm, Autogrid, Varentec, Foro Energy, FastCap, APEI), supported cutting-edge research at companies including IR, Cree, GE, GM, Toyota, and consulted with the Office of Science and Technology Policy and the White House

Education:

California Institute of Technology Applied Physics	BSc	1991
University of California, Santa Barbara Electrical Engineering	PhD	1997

Research Employment

Hewlett-Packard Laboratories	1992	1994
Assistant Professor, MIT	Jan. 1997	June 2000
Associate Professor (without tenure), MIT	July 2000	July 2003
Associate Professor (with tenure), MIT	July 2003	July 2007
Full Professor, MIT	July 2007	present
Director, Center for Integrated Photonics, MIT	May 2004	March 2012
Associate Director, Research Lab of Electronics, MIT	July 2005	March 2012
Scientific Advisory Board, Breakthrough Energy Ventures	July 2017	present

Professional service:

Program Director, ARPA-E, Department of Energy	April 2010	May 2012
DARPA Defense Science Research Council	August 2005	January 2007

Program Committees

Conference on Lasers & Electro-Optics (Optical Society of Am.)	2000, 2001, 2004
Advanced Semiconductor Lasers (OSA/IEEE)	2000, 2001
Semiconductor Amplifiers and Lasers (SPIE)	2002
Fluctuations and Noise (SPIE)	2003
International Electronic Devices Meeting (IEEE)	2003, 2004
Photonics in Switching (IEEE)	2007, 2008
Electronic Materials Conference (TMS)	2007
Chair, Optics for Advanced Energy Technology (CIPS/OSA)	2009

Awards and Honors

John and Fannie Hertz Foundation Fellowship	1995
NSF Early Career Award	1998
ONR Young Investigator Award	1999
NAE Frontiers in Engineering Symposium	1999
ITT Career Development Chair	2001-2003
Ruth and Joel Spira Distinguished Teaching Award	2002
Global Indus Technovator Award	2006
Jamieson Teaching Award	2009
MacVicar Faculty Fellow	2010-2020
Fellow, Optical Society of America	2014
Bose Research Fellow	2015
Fellow, IEEE	2016
Advisor, Student Paper Award, International Conference on Advanced Vibrational Spectroscopy	2003
Advisor, Student Paper Award, Materials Research Society Symposium	2005, 2009
Advisor, Widmer Award, μ TAS Symposium	2007
Co-author, Top Picks, Hot Interconnects 16	2008
Co-author, Top Scored, Optical Fiber Conference	2014
R&D 100 Award, ARPAe work on SiC Charger for Electric Vehicles	2014

Entrepreneurship Experience

Founder, Board of Directors, Pharyx Incorporated	2007-present
Scientific Advisory Board (founding), Joule Unlimited	2007-2010
ARPAe Start-ups	
Autogrid ARPAe (Jan 2012) Venture 10/12 (\$9M), Series C 1/14 (\$12.8M)	
Transphorm ARPAe (Sept 2010) Series C 2/11 (\$20M), Total to 2/14 (\$133M)	
Varentec ARPAe (Jan 2012) Series A 1/12 (\$7.7M), Total to 9/13 (\$21.8M)	
Founder, Advisory Board, AyarLabs Incorporated	2015-present

Patents Issued

1. Yang L. and R.J. Ram , “Semiconductor laser that generates second harmonic light by means of a nonlinear crystal in the laser cavity,” US Patent #5,363,390, November 1994; European Patent # 94,308,586, January 1995.
2. H. Schmidt, R.J. Ram, “All-optical Wavelength Conversion using Electromagnetically Induced Transparency.” US Patent #6,426,831, July 30, 2002.
3. S. G. Patterson, R. J. Ram, ”Bipolar Cascade ARROW Laser,” US Patent # 6,587,492, July 1, 2003.
4. Brennan, III; James F Chou; Patrick C. Lee; Harry L. T. Ram; Rajeev J. Haus; Hermann A. Ippen; Erich P “Method and apparatus for generating frequency modulated pulses” US Patent #6,834,134, December 21, 2004
5. K. P. Pipe and R. J. Ram, “Method and apparatus for characterization of photonic devices and circuits,” US Patent # 6,921,195, July 26, 2005.

6. R. J. Ram, T. Zaman, and X. Guo, "Magnetically active semiconductor waveguides for optoelectronic integration," US Patent #7,130,494, October 31, 2006
7. J. Hudgings, D. Lueerssen, P. Mayer, R. J. Ram "High Performance CCD-Based Thermoreflectance Imaging Using Stochastic Resonance," US 7,429,735 , issued 2009
8. Charles W Holzwarth, Judy L Hoyt, Jason Orcutt, Milos Popovic and Rajeev J Ram, "Reduction of Substrate Optical Leakage in Integrated Photonic Circuits Through Localized Substrate Removal" US 7,920,770 issued 2011
9. J. Montoya, M.G. Allen, J. M. Hensley, K. Parameswaran, and R. J. Ram, "Surface Plasmon Enhanced Optical Devices for Integrated Photonics" US 8849072, issued 2014.
10. Scot G. Frank, Catlin Powers, Amy Qian, Orian Z. Welling, Brad Simpson, Reja Amatya, Rajeev Ram, "Solar concentrator assembly and methods of using same" US 9291365, issued 2016.
11. Harry Lee, Rajeev Ram, Klavs Jensen, "Parallel integrated bioreactor device and method" US 9248421, issued 2016.
12. Jason Scott Orcutt, Karan Kartik Mehta, Rajeev Jagga Ram, Amir Hossein Atabaki, "Waveguide formation using CMOS fabrication techniques," US 9529150, issued 2016.
13. S Kevin Lee, Harry Lee, J Rajeev Ram, "Method of hydrolytically stable bonding of elastomers to substrates, US 9422409, issued 2016.
14. Solar concentrator assembly and methods of using same, SG Frank, C Powers, A Qian, OZ Welling, B Simpson, R Amatya, R Ram, US Patent 9,647,192
15. Method and optoelectronic structure providing polysilicon photonic devices with different optical properties in different regions R Meade, K Mehta, E Megged, J Orcutt, M Popovic, R Ram, J Shainline, US Patent 9,768,330
16. Systems and Methods for Modular DC Microgrids with Control of Loads W Inam, DJ Perreault, RJ Ram, DD Strawser US Patent 20,170,346,283

Papers in Refereed Journals

1. R. J. Ram, L. Yang, K. Nauka, M. Ludowise, Y. M. Houng, D. E. Mars, J. J. Dudley, and S. Y. Wang, "Analysis of Wafer Fusing for 1.3 μ m Vertical Cavity Surface Emitting Lasers", Applied Physics Letters vol. 62, pp. 2474-2476, May 17,1993.
2. R. J. Ram and R. A. York, "Parametric Oscillation in Nonlinear Dipole Arrays" IEEE Trans. on Antennas and Propagation, vol. 42, pp. 406-411, March 1994.
3. J. J. Dudley, D. I. Babic, R. Mirin, L. Yang, B. I. Miller, R. J. Ram, T. Reynolds, E. L. Hu, and J. E. Bowers, "Low Threshold, Wafer Fused Long Wavelength Vertical Cavity Lasers" Applied Physics Letters, vol. 64, pp. 1463-1593, March 21,1994.
4. D. I. Babic, R. J. Ram, J. E. Bowers, M. Tan, L. Yang."Scaling Laws in Gain Guided Vertical Cavity Lasers" Applied Physics Letters, vol. 64, pp. 1762-1764, April 4, 1994.
5. Imamoglu, A and R. J. Ram, "Semiconductor Lasers Without Population Inversion," Optics Letters., vol. 19, pp. 1744-1746 , November 1, 1994.
6. R. J. Ram, D. I. Babic, R. A. York and J. E. Bowers, "Spontaneous Emission in Microcavities with Distributed Mirrors," IEEE Journal of Quantum Electronics., vol. 31, pp. 399-410, February 1995.
7. E. F. Goobar, R. J. Ram, R. Nagarajan, J. E. Bowers, L. A. Coldren,"Intensity Noise and Facet Correlation in Fabry-Perot Laser Diodes with Low Facet Reflectivities," Applied Physics Letters vol. 66, pp. 3419-3421, June 19, 1995.

8. R. J. Ram, J. J. Dudley, J. E. Bowers, L. Yang, K. Carey, S. J. Rosner and K. Nauka, "GaAs to InP Wafer Fusion," *Journal of Applied Physics*, vol. 78, pp. 4227-4237 Sept. 15 1995.
9. R. J. Ram, E. Goobar, M. Peters, L. A. Coldren and J. E. Bowers, "Spontaneous Emission Factor in Post Microcavity Lasers," *IEEE Phot. Tech. Lett.*, May 1996.
10. A. Imamoglu and R. J. Ram, "Quantum Dynamics of Nonequilibrium Excitons," *Physics Letters A*, May 13, 1996.
11. A. Imamoglu, R. J. Ram, S. Pau, and Y. Yamamoto "Nonequilibrium Condensates and Lasers without Inversion," *Physical Review A* June 1996.
12. E. Goobar, R. J. Ram, J. Ko, G. Bjork, M. Oestreich and A. Imamoglu, "Vacuum Field Mixing of Light and Heavy Hole Excitons in a Semiconductor Microcavity," *Applied Physics Letters*, vol. 69, pp. 3465-3467 December 2, 1996.
13. Dalal RV, Ram RJ, Helkey R, Roussell H, Choquette KD. "Low distortion analogue signal transmission using vertical cavity lasers". *Electronics Letters*, vol.34, pp.1590-1, 6 Aug. 1998. *
14. Patterson SG, Petrich GS, Ram RJ, Kolodziejski LA. "Continuous-wave room temperature operation of bipolar cascade laser". *Electronics Letters*, vol.35, pp.395-7, 4 March 1999. *
15. Jianyao Chen, Ram RJ, Helkey R. "Linearity and third-order intermodulation distortion in DFB semiconductor lasers". *IEEE Journal of Quantum Electronics*, vol.35, pp.1231-7, Aug. 1999. *
16. Patterson SG, Petrich GS, Ram RJ, Kolodziejski LA. "X-ray diffraction analysis of bandgap-engineered distributed Bragg reflectors". *Journal of Electronic Materials*, vol.28, pp.1081-3, Oct. 1999. *
17. Knodl T, Choy HKH, Pan JL, King R, Jager R, Lullo G, Ahadian JF, Ram RJ, Fonstad CG Jr, Ebeling KJ. "RCE photodetectors based on VCSEL structures". *IEEE Photonics Technology Letters*, vol.11, pp.1289-91, Oct. 1999. *
18. Ross CA, Smith HI, Savas T, Schattenburg M, Farhoud M, Hwang M, Walsh M, Abraham MC, Ram RJ. "Fabrication of patterned media for high density magnetic storage". *J. of Vacuum Science & Technology B*, vol.17, pp.3168-76, Nov. 1999. *
19. Lee HLT, Dalal RV, Ram RJ, Choquette KD. "Dynamic range of vertical-cavity surface-emitting lasers in multimode links". *IEEE Photonics Technology Letters*, vol.11, pp.1473-5, Nov. 1999. *
20. Rana F, Ram RJ. "Photon noise and correlations in semiconductor cascade lasers". *Applied Physics Letters*, vol.76, pp.1083-5, 28 Feb. 2000. *
21. Hwang M, Abraham MC, Savas TA, Smith HI, Ram RJ, Ross CA. "Magnetic force microscopy study of interactions in 100 nm period nanomagnet arrays". *Journal of Applied Physics*, vol.87, pp.5108-10, pt.1-3, 1 May 2000. *
22. Schmidt H, Ram RJ. "All-optical wavelength converter and switch based on electromagnetically induced transparency". *Applied Physics Letters*, vol.76, pp.3173-5, 29 May 2000. *
23. Patterson SG, Lau EK, Pipe KP, Ram RJ. "Temperature characteristics of bipolar cascade lasers". *Applied Physics Letters*, vol.77, pp.172-4, 10 July 2000. *
24. Ram RJ, Sporer R, Blank H-R, York RA. "Chaotic dynamics in coupled microwave oscillators". *IEEE Transactions on Microwave Theory & Techniques*, vol.48, pp.1909-16, Nov. 2000.
25. Schmidt H, Ram RJ. "Coherent magnetization reversal of nanoparticles with crystal and shape anisotropy". *Journal of Applied Physics*, vol.89, pp.507-13, 1 Jan. 2001. *

26. Abraham MC, Schmidt H, Savas TA, Ross CA, Smith HI, and Ram RJ. "Magnetic properties and interactions of single-domain nanomagnets in a periodic array". *Journal of Applied Physics*, vol.89, pp.5667-70, 15 May 2001. *
27. Pipe KP, Ram RJ, and Shakhouri A, "Internal cooling in a semiconductor laser diode" *IEEE Photonics Technology Letters*, vol. 14, no. 4, April 2002. *
28. Rana F, Ram RJ, "Theory of current noise and photon noise in quantum cascade lasers," *Physical Review B*, vol. 65, no. 12, March 2002. *
29. Pipe KP and Ram RJ, "Bias-dependent Peltier coefficient and internal cooling in bipolar devices," *Physical Review B*, September 2002.*
30. Rana F, Harry LT Lee, RJ Ram, ME Grein, LA Jiang, EP Ippen, HA Haus, "Characterization of noise and correlations in harmonically mode-locked semiconductor lasers," *Journal of Optical Society of America B*, 2002. *
31. Mayer P., Rana F., and Ram R.J., "Noise Correlations in Coupled Semiconductor Lasers," *Applied Physics Letters*, January 2003.*
32. Pipe KP and Ram RJ, "Comprehensive Model for Heat Transfer in Semiconductor Lasers," *IEEE Photonics Technology Letters*, April 2003.*
33. Tepper T, Illievski F, Ross CA, Zaman TR, Ram RJ, Sung SY, Stradler BJJ, "Magneto-optical properties of iron oxide films," to appear *Journal of Applied Physics*, vol. 93, no. 10, 2003.*
34. Groenert ME, Pitera AJ, Ram RJ, Fitzgerald EA, "Improved room-temperature continuous wave GaAs/AlGaAs and InGaAs/GaAs/AlGaAs lasers fabricated on Si substrates via relaxed graded Ge_xSi_{1-x} buffer layers," *Journal of Vacuum Science and Technology B*, vol.21, no.3, pp.1064-69, May/June 2003.*
35. Groenert ME, Leitz CW, Pitera AJ, Yang V, Lee HLT, Ram RJ, Fitzgerald EA, "Monolithic integration of room-temperature cwGaAs/AlGaAs lasers on Si substrates via relaxed graded GeSi buffer layers," *Journal of Applied Physics*, vol.93, no.1, pp.362-3671, January 2003.*
36. Hudgings, J.A., Pipe K.P., and Ram R.J., "Thermal Profiling for Optical Characterization of Waveguide Devices," *Applied Physics Letters* **83**(19): p. 3882-3884 (2003).*
37. Ho-Ki Lyeo, A.A. Khajetoorians, Li Shi, Kevin P. Pipe, Rajeev J. Ram, Ali Shakouri, and C.K. Shih, "Profiling the Thermoelectric Power of Semiconductor Junctions with Nanometer Resolution", *Science* 2004.*
38. Lee, H.L.T, Boccazzi P, Gorret N, Ram R.J., and Sinskey, A.J., "*In situ* bioprocess monitoring for Escherichia Coli using Raman spectroscopy," *Vibrational Spectroscopy*, Volume 35, Issues 1-2, 17 June 2004, Pages 131-137 2004.*
39. Luerssen D, Ram R J, Hohl-AbiChedid A, Clausen E, Jr, Hudgings J A, "Thermal profiling: locating the onset of gain saturation in semiconductor optical amplifiers," *IEEE Photonics Technology Letters*, v 16, n 7, July 2004, pp. 1625-7.*
40. Rana, F., Ram, R.J.; Haus, H.A., "Quantum noise of actively mode-locked lasers with dispersion and amplitude/phase modulation," *IEEE Journal of Quantum Electronics*, v 40, n 1, Jan. 2004, p 41-56.*
41. F. Rana, P. Mayer, R. J. Ram, "Scaling of the photon noise in semiconductor cascade lasers," *Journal of Optics B*, vol. 6, no. 8, S771-S774 (2004).*
42. P. Mayer, R. J. Ram, "Optimization of Heat-sink Limited Thermoelectric Generators," *Nanoscale and Microscale Thermophysical Engineering*, May, 2006.*
43. Fuchs, E., Bruce E.J., Ram, R.J., Kirchain R.E. "Process Based Cost Modeling of Photonics Manufacture: The Cost Competitiveness of Monolithic Integration of a 1550nm DFB Laser and an Electro-Absorptive Modulator on an InP Platform" *IEEE Journal of Lightwave Technology*, accepted for publication 2006.*

44. Zaman, T., Guo X., and Ram R.J. "Proposal for a Polarization Independent Integrated Optical Circulator," IEEE Photonics Technology Letters, vol. 18, no. 12, pp. 1359-1361, 2006.*
45. Lee, H.L.T., Boccazzi P., Ram R.J., and Sinskey, A.J. "Microbioreactor arrays with integrated mixers and fluid injectors for high-throughput experimentation with pH and dissolved oxygen control," Lab On a Chip, vol. 6, pp. 1229-1235, 2006*
46. Zaman, T., X. Guo, R.J. Ram, "Faraday rotation in an InP waveguide," Applied Physics Letters, 3 pp., 2006.
47. T. Barwicz, H. Byun, F. Gan, M. Geis, M. Grein, C.W. Holzwarth, J.L. Hoyt, E.P. Ippen, F.X. Kärtner, T. Lyszczarz, O.O. Olubuyide, J.S. Orcutt, M.A. Popović, P.T. Rakich, R.J. Ram, H.I. Smith, S. Spector, V. Stojanovic, M.R. Watts, and J.U. Yoon "Silicon Photonics for Compact, Energy Efficient Interconnects," OSA Journal of Optical Networking, 14 pp., accepted, 2006.
48. Mayer, P., D. Lueerssen, R.J. Ram, J. Hudgings, "Theoretical and experimental investigation of the resolution and dynamic range of CCD-based thermorefectance imaging," Journal of the Optical Society of America A, 25 pp., accepted, 2006.
49. Liptay, T. and R.J. Ram, "Temperature Dependence of the Exciton Transition in Semiconductor Quantum Dots," Applied Physics Letters, vol. 89, pp. 223132, 2006.
50. Huang, R.K., R.J. Ram, M.J. Manfra, M.K. Connors, L.J. Missaggia, and G.W. Turner, "Heterojunction Thermophotovoltaic Devices with High Voltage Factor," Journal of Applied Physics, vol. 101, pp, 2007.
51. Lee, K.S., Lee, H.L.T, Ram, R.J. "Polymer Waveguide Backplanes for Optical Sensor Interfaces to Microfluidics," Lab-on-a-Chip, vol. 7, pp. 1539-1545, 2007.*
52. Liptay T. J., L. F. Marshall, P. S. Rao, R. J. Ram, and M. G. Bawendi, "Anomalous Stokes shift in CdSe nanocrystals," Physical Review B, vol. 76, 155314, 22 October 2007
53. Zaman T, X Guo, RJ Ram, "Semiconductor Waveguide Isolators," IEEE/OSA Journal of Lightwave Technology, vol 26, issue 2, pp. 291 - 301, Jan.15, 2008. (invited)
54. Amatya, R., C. H. Holzwarth, R. J. Ram, H. I. Smith, "Tunable Silicon Compatible Microring Filters," IEEE Photonics Technology Letters, vol. 20, issue 20 , pp. 1739-1741 2008.
55. C.W. Holzwarth, R. Amatya, M. Dahlem, A. Khilo, F.X. Kartner, E.P. Ippen, R.J. Ram and H.I. Smith, "Fabrication strategies for filter bands based on microring resonator," Journal of Vacuum Science and Technology B, vol. 26, no. 6, pp. 2164, December 2008
56. Kevin S. Lee and Rajeev J. Ram, "Plastic-PDMS bonding for high pressure hydrolytically stable active microfluidics," Lab on a Chip, vol. 9, pg. 1618, 2009.
57. M Farzaneh, K Maize, D Lüerßen, J A Summers, P M Mayer, P E Raad, K P Pipe, A Shakouri, R J Ram and J A Hudgings, "CCD-based thermorefectance microscopy: principles and applications," J. Phys. D: Appl. Phys., **42** 143001, 2009 (invited).
58. J. Montoya, K. Parameswaran, J. Hensley, M. Allen, and R. Ram, "Surface plasmon isolator based on nonreciprocal coupling," Journal of Applied Physics, v. 106, 023108, 2009.
59. Batten, C., Joshi, A.; Orcutt, J.; Khilo, A.; Moss, B.; Holzwarth, C.W.; Popovic, M.A.; Hanqing Li; Smith, H.I.; Hoyt, J.L.; Kartner, F.X.; Ram, R.J.; Stojanovic, V.; Asanovic, K, .Building many-core processor-to-DRAM networks with monolithic CMOS silicon photonics," IEEE Micro, v 29, n 4, p 8-21, July-Aug. 2009
60. Summers, J.A. Farzaneh, M.; Ram, R.J.; Hudgings, J.A. "Thermal and optical characterization of photonic integrated circuits by thermorefectance microscopy" IEEE Journal of Quantum Electronics, v 46, n 1, p 3-10, Jan. 2010

61. J. S. Orcutt and R. J. Ram, "Photonic Device Layout Within the Foundry CMOS Design Environment," *IEEE Photonics Technology Letters*, v 22, n 8, p 544-6, 5 April 2010
62. R. Amatya and R. J. Ram, "Solar thermoelectric generator for micropower applications," *Journal of Electronic Materials*, v 39, n 9, p 1735-1740, September 2010
63. P. Santhanam and R. J. Ram, "Self-Consistent Drift-Diffusion Transport in Thermoelectrics and Implications for Measuring the Scattering Parameter," *Journal of Electronic Materials*, v 39, n 9, p 1944-1949, September 2010
64. J. S. Orcutt, et al., "Nanophotonic Integration in State-of-the-Art CMOS Foundries," *Optics Express*, v 19, n 3, p 2335-2346, January 31, 2011.
65. W. Loh, et al. "Noise Figure of Watt-Class Ultralow-Confinement Semiconductor Optical Amplifiers," *IEEE Journal of Quantum Electronics*, v 47, n 1, p 66-75, 2011.
66. Kevin S. Lee and Rajeev J. Ram, "Microfluidic chemostat and turbidostat with flow rate, oxygen, and temperature control for dynamic continuous culture," *Lab on a Chip*, vol. 11, pg. 1730, 2011.
67. Joseph A. Summers and Rajeev J. Ram, "Thermal and optical characterization of resonant coupling between surface plasmon polariton and semiconductor waveguides," *Appl. Phys. Lett.* 99, 2011.
68. J.-H. Bahk, Z. Bian, M. Zebarjadi, P. Santhanam, R. Ram, and A. Shakouri, "Thermoelectric power factor enhancement by ionized nanoparticle scattering," *Applied Physics Letters*, vol. 99, August 2011.
69. Shu-Chuan Lin, San-Liang Lee, Han-Hyuan Lin, Gerd Keiser, and Rajeev J. Ram, "Cross-Seeding Schemes for WDM-Based Next-Generation Optical Access Networks," *Journal of Lightwave Technology*, Vol. 29, Issue 24, pp. 3727-3736 (2011).
70. Reja Amatya, Rajeev J. Ram, "Trend for Thermoelectric Materials and Their Earth Abundance," *Journal of Electronic Materials*, 2012, Volume 41, Number 6, Pages 1332-1336.
71. K.T. Settaluri, H. Lo, and R.J. Ram, "Thin Thermoelectric Generator System for Body Energy Harvesting," *Journal of Electronic Materials*, Volume 41, Number 6, Pages 984-988.
72. Hsinyi Lo, Rajeev J. Ram, "Submicron Mapping of Thermal Conductivity of Thermoelectric Thin Films," *Journal of Electronic Materials*, 2012, Volume 41, Number 6, Pages 1332-1336.
73. S.C. Chen, S.L. Lee, H. Lo, Y.J. Hung, K.Y. Lee, C.G. Tu, Y.T. Pan and R.J. Ram, "Silicon Platform with Vertically Aligned Carbon Nanotubes for Enhancing Thermal Conduction in Hybrid Optoelectronic Integration," *IEEE Transactions on Components, Packaging and Manufacturing Technology*. (Accepted)
74. Je-Hyeong Bahk, Parthiban Santhanam, Zhixi Bian, Rajeev Ram, Ali Shakouri, "Resonant carrier scattering by core-shell nanoparticles for thermoelectric power factor enhancement," *Applied Physics Letters*, vol. 100, January 2012.
75. Bower, D. M., Lee, K. S., Ram, R. J. and Prather, K. L.J. (2012), "Fed-batch microbio-reactor platform for scale down and analysis of a plasmid DNA production process." *Biotechnol. Bioeng*, 30 MAR 2012.
76. Parthiban Santhanam, Dodd Joseph Gray, Jr., and Rajeev J. Ram, "Thermoelectrically Pumped Light-Emitting Diodes Operating above Unity Efficiency," *Phys. Rev. Lett.* 108, (2012).
77. Anatol Khilo, Steven J. Spector, Matthew E. Grein, Amir H. Nejadmalayeri, Charles W. Holzwarth, Michelle Y. Sander, Marcus S. Dahlem, Michael Y. Peng, Michael W. Geis, Nicole A. DiLello, Jung U. Yoon, Ali Motamedi, Jason S. Orcutt, Jade P. Wang, Cheryl M. Sorace-Agaskar, Miloš A. Popović, Jie Sun, Gui-Rong Zhou, Hyunil

- Byun, Jian Chen, Judy L. Hoyt, Henry I. Smith, Rajeev J. Ram, Michael Perrott, Theodore M. Lyszczarz, Erich P. Ippen, and Franz X. Kärtner, "Photonic ADC: overcoming the bottleneck of electronic jitter," *Optics Express*, Vol. 20, Issue 4, pp. 4454-4469
78. Jason S. Orcutt, Benjamin Moss, Chen Sun, Jonathan Leu, Michael Georgas, Jeffrey Shainline, Eugen Zraggen, Hanqing Li, Jie Sun, Matthew Weaver, Stevan Urošević, Miloš Popović, Rajeev J. Ram, and Vladimir Stojanović, "Open foundry platform for high-performance electronic-photonics integration," *Optics Express*, Vol. 20, Issue 11, pp. 12222-12232 (2012).
 79. Jason S. Orcutt, Sanh D. Tang, Steve Kramer, Karan Mehta, Hanqing Li, Vladimir Stojanović, and Rajeev J. Ram, "Low-loss polysilicon waveguides fabricated in an emulated high-volume electronics process," *Optics Express*, Vol. 20, Issue 7, pp. 7243-7254 (2012)
 80. Georgas, M.; Orcutt, J.; Ram, R.J.; Stojanovic, V.; "A Monolithically-Integrated Optical Receiver in Standard 45-nm SOI, *IEEE J of Solid-State Circuits*, vol.47, no.7, pp.1693-1702, July 2012
 81. Amatya, R., P. M. Mayer, and R. J. Ram. "High temperature Z-meter setup for characterizing thermoelectric material under large temperature gradient." *Review of Scientific Instruments* 83.7 (2012): 075117-075117.
 82. Loh, W., et al. "Super-homogeneous saturation of microwave-photonics gain in optoelectronic oscillator systems." *Photonics Journal, IEEE* 4.5 (2012): 1256-1266.
 83. Mehta, Karan K., Jason S. Orcutt, and Rajeev J. Ram. "Fano line shapes in transmission spectra of silicon photonic crystal resonators." *Applied Physics Letters* 102 (2013): 081109.
 84. Loh, William, et al. "Unified Theory of Oscillator Phase Noise I: White Noise." *IEEE Transactions on Microwave Theory and Techniques* 61.6 (2013): 2371.
 85. Jeffrey M. Shainline, Jason S. Orcutt, Mark T. Wade, Kareem Nammari, Benjamin Moss, Michael Georgas, Chen Sun, Rajeev J. Ram, Vladimir Stojanović, and Miloš A. Popović, "Depletion-mode carrier-plasma optical modulator in zero-change advanced CMOS," *Opt. Lett.* **38**, 2657-2659 (2013)
 86. Shainline, Jeffrey M., Jason S. Orcutt, Mark T. Wade, Kareem Nammari, Ofer Tehar-Zahav, Zvi Sternberg, Roy Meade, Rajeev J. Ram, Vladimir Stojanović, and Miloš A. Popović. "Depletion-mode polysilicon optical modulators in a bulk complementary metal-oxide semiconductor process." *Opt. Lett.* 38, no. 15 (2013): 2729-2731.
 87. Santhanam, Parthiban, Duanni Huang, Rajeev J. Ram, Maxim A. Remennyi, and Boris A. Matveev. "Room temperature thermo-electric pumping in mid-infrared light-emitting diodes." *Applied Physics Letters* 103, no. 18 (2013): 183513.
 88. Gray Jr, Dodd J., Parthiban Santhanam, and Rajeev J. Ram. "Design for enhanced thermo-electric pumping in light emitting diodes." *Applied Physics Letters* 103, no. 12 (2013): 123503.
 89. Loh, William, Siva Yegnanarayanan, Rajeev J. Ram, and Paul W. Juodawlkis. "Unified Theory of Oscillator Phase Noise II: Flicker Noise." *IEEE Transactions on Microwave Theory and Techniques* (2013): 4132-4146.
 90. Jeremy L Schroeder, David A Ewoldt, Reja Amatya, Rajeev J Ram, Ali Shakouri, Timothy D Sands, "Bulk-Like Laminated Nitride Metal/Semiconductor Superlattices for Thermoelectric Devices," *J. Microelectromechanical Systems, Journal* (2014).
 91. Karan Mehta, Jason Orcutt, Ofer Tehar-Zahav, Zvi Sternberg, Reha Bafrafi, Roy Meade, and Rajeev Ram, "High-Q CMOS-integrated photonic crystal microcavity devices" *Scientific Reports* (2014): 4 4077..
 92. William Loh, Siva Yegnanarayanan, Rajeev Ram, and Paul Juodawlkis, "A nonlinear optoelectronic filter for electronic signal processing" *Scientific Reports* (2014): 4 3613..

93. Karan K. Mehta, Jason S. Orcutt, Jeffrey M. Shainline, Ofer Tehar-Zahav, Zvi Sternberg, Roy Meade, Miloš A. Popović, and Rajeev J. Ram, "Polycrystalline silicon ring resonator photodiodes in a bulk complementary metal-oxide-semiconductor process," *Opt. Lett.* **39**, 1061-1064 (2014).
94. Karan K. Mehta, A. M. Altony, C.D. Bruzewicz, I.L. Chuang, R. J. Ram, J.M. Sage, J. Chiaverini, "Ion traps fabricated in a CMOS foundry," *Applied Physics Letters*. **105** (2014) arXiv:1406.3643
95. Duanni Huang, Parthiban Santhanam, and Rajeev J. Ram, "Low-Power Communication with a Photonic Heat Pump," *Optics Express*, 107 (2014).
96. Singh, GP, Goh, S, Canzoneri, M, and Ram, RJ "Raman spectroscopy of complex defined media: biopharmaceutical applications." *J. Raman Spectrosc.*, v. 46, pp.545–550, 2015
97. Chen Sun, Chen Sun, Michael Georgas, Jason Orcutt, Benjamin Moss, Yu-Hsin Chen, Jeffrey Shainline, Mark Wade, Karan Mehta, Kareem Nammari, Erman Timurdogan, Daniel Miller, Ofer Tehar-Zahav, Zvi Sternberg, Jonathan Leu, Johanna Chong, Reha Bafrali, Gurtej Sandhu, Michael Watts, Roy Meade, Milos Popovic, Rajeev Ram, Vladimir Stojanovic' "A Monolithically Integrated Chip-to-Chip Optical Link in Bulk CMOS," *IEEE J of Solid State Circuits*, v 50, n 4, p 828-44, April 2015.
98. Alloatti, L.; Srinivasan, S.A.; Orcutt, J.S.; Ram, "Waveguide-coupled detector in zero-change complementary metal-oxide-semiconductor," *Applied Physics Letters*, v 107, n 4, p 041104 (4 pp.), 27 July 2015.
99. Nicholas J Mozdierz, Kerry R Love, Kevin S Lee, Harry LT Lee, Kartik A Shah, Rajeev Ram, J Christopher Love, "A perfusion-capable microfluidic bioreactor for assessing microbial heterologous protein production," *Lab on a Chip*, v. 15, pp.2918-2922, 2015
100. Alloatti, L., Wade, M.; Stojanovic, V.; Popovic, M.; Ram, R.J., "Photonics design tool for advanced CMOS nodes," *IET Optoelectronics*, v 9, n 4, p 163-7, Aug. 2015.
101. Jin Xue; Yuji Zhao; Sang-Ho Oh; Herrington, W.F.; Speck, J.S.; DenBaars, S.P.; Nakamura, S.; Ram, R.J., "Thermally enhanced blue light-emitting diode," *Applied Physics Letters*, v 107, n 12, p 121109, 21 Sept. 2015
102. Chen Sun*, Mark Wade*, Yunsup Lee*, Jason Orcutt*, Luca Alloatti Michael Georgas, Andrew Waterman, Jeff Shainline, Rimas Avizienis, Sen Lin, Rajesh Kumar, Fabio Pavanello, Amir Atabaki, Henry Cook, Albert Ou, Benjamin Moss, Jonathan Leu, Yu-Hsin Chen, Krste Asanovic, Rajeev Ram, Milos Popovic, Vladimir Stojanovic "Single-Chip Microprocessor with Integrated Photonic I/O," *Nature*, v. 528, pp 534–538, 24 December 2015.
103. H. Meng, A. Atabaki, J. Orcutt, and R. Ram, "Sub-bandgap polysilicon photodetector in zero-change CMOS process for telecommunication wavelength," *Optics Express* **23**, 32643-32653 (2015).
104. L. Alloatti, L. and R. J. Ram, , "Resonance-enhanced waveguide-coupled silicon-germanium detector," *Applied Physics Letters*, **108**, 071105 (2016),
- 105., Alloatti, L. and Cheian, D. and Ram, R. J., "High-speed modulator with interleaved junctions in zero-change CMOS photonics," *Applied Physics Letters*, **108**, 131101 (2016)
106. C. Sun *et al.*, "A 45 nm CMOS-SOI Monolithic Photonics Platform With Bit-Statistics-Based Resonant Microring Thermal Tuning," in *IEEE Journal of Solid-State Circuits*, vol. 51, no. 4, pp. 893-907, April 2016.
107. Erika Ye, Amir H. Atabaki, Ningren Han, and Rajeev J. Ram, "Miniature, sub-nanometer resolution Talbot spectrometer," *Opt. Lett.* **41**, 2434-2437 (2016)
108. Perez-Pinera, Pablo, Han, Ningren, Cleto, Sara, Cao, Jicong, Purcell, Oliver, Shah, Kartik A., Lee, Kevin, Ram, Rajeev, Lu, Timothy K., "Synthetic biology and microbioreactor

platforms for programmable production of biologics at the point-of-care,” *Nature Communications* 2016/07/29

109. Alloatti, L. and Ram, R. J., “Infrared vertically-illuminated photodiode for chip alignment feedback,” *AIP Advances*, 6, 085219 (2016)
110. Atabaki, Amir H. and Meng, Huaiyu and Alloatti, Luca and Mehta, Karan K. and Ram, Rajeev J., “High-speed polysilicon CMOS photodetector for telecom and Datacom,” *Applied Physics Letters*, 109, 111106 (2016)
111. Mehta, Karan K., Bruzewicz, Colin D., McConnell, Robert, Ram, Rajeev J., Sage, Jeremy M., Chiaverini, John, “Integrated optical addressing of an ion qubit,” *Nature Nanotechnology*, 2016/08/08/online
112. KK Mehta, RJ Ram, “Precise and diffraction-limited waveguide-to-free-space focusing gratings,” *Scientific Reports* 7 (1), 2019
113. J Xue, Z Li, RJ Ram, “Irreversible Thermodynamic Bound for the Efficiency of Light-Emitting Diodes,” *Physical Review Applied* 8 (1), 014017

Selected Conference Proceedings (from several hundred)

Harry L.T. Lee and Rajeev J. Ram, "Integrated fluid injectors and mixers for pH control in miniature bioreactor arrays," MicroTAS Proceedings, Sept 2005, Boston, MA, vol. 1, pp 34-36*

Lee, H. L. T., P. Boccazzi, R.J. Ram, and A.J. Sinskey, “Integrated Pipette Compatible Sterile Interface to Microfluidic Chambers,” MicroTAS Proceedings 2008.

Lee, K. S., Ram, R. J., “Plastic-PDMS Hybrid Devices for High Pressure Hydrolytically Stable Active Microfluidics” MicroTAS Proceedings 2008.

D.M. Bower, K. Lee, R.J. Ram, K.L.J. Prather, “Process design for plasmid DNA production using microbioreactors,” Proceedings American Institute of Chemical Engineers Annual Meeting, 2010

K. Lee and R. J. Ram, “Microscale controlled continuous cell culture,” Proceedings of MicroTAS, 2010

S. Goh and R. J. Ram, “Impedance Spectroscopy for *in situ* Biomass Measurements in Microbioreactors,” Proceedings of MicroTAS, 2010

Moss, Benjamin R., et al. "A 1.23 pJ/b 2.5 Gb/s monolithically integrated optical carrier-injection ring modulator and all-digital driver circuit in commercial 45nm SOI." *Solid-State Circuits Conference Digest of Technical Papers (ISSCC), 2013 IEEE International*. IEEE, 2013.

Meade, Roy, Ofer Tehar-Zahav, Zvi Sternberg, Efraim Megged, Gurtej Sandhu, J. S. Orcutt, R. Ram et al. "Integration of silicon photonics in a bulk CMOS memory flow." In *Optical Interconnects Conference, 2013 IEEE*, pp. 114-115. IEEE, 2013.

R. R. Meade, J. Orcutt, K. Mehta, O. Tehar-Zahav, D. Miller, M. Georgas, B. Moss, C. Sun, Y.-H. Chen, J. Shainline, M. Wade, R. Bafrali, Z. Sternberg, G. Machavariani, G. Sandhu, M. Popovic, R. Ram and V. Stojanovic, “Integration of Silicon Photonics in Bulk CMOS,” *VLSI Symposium*, (2014) **21.1**

C. Sun, M. Georgas, J. Orcutt, B. Moss, Y.-H. Chen, J. Shainline, M. Wade, K. Mehta, K. Nammari, E. Timurdogan, D. Mille, O. Tehar-Zahav, Z. Sternberg, J. Leu, J. Chong, R. Bafrali, G. Sandhu, M. Watts, R. Meade, M. Popovic, R. Ram and V. Stojanović, “A Monolithically Integrated Chip-to-Chip Optical Link in Bulk CMOS,” *VLSI Symposium* (2014), **6.3**.

M. Georgas, B. Moss, C. Sun, J. Shainline, J.S. Orcutt, M. Wade, Y.-H. Chen, K. Nammari, J. Leu, A. Srinivasan, R. Ram, M. Popovic and V. Stojanović, “A Monolithically-Integrated Optical Transmitter and Receiver in a Zero-Change 45nm SOI Process,” *VLSI Symposium* (2014), **6.4**.

N. Han, O. Purcell, K.S. Lee, T.K. Lu, R.J. Ram, "Microfluidics for Control of Synthetic Biology," *MicroTAS*, 2014.

Chen Sun (Univ. of California, Berkeley, Berkeley, CA, United States); Wade, M.; Georgas, M.; Sen Lin; Alloatti, L.; Moss, B.; Kumar, R.; Atabaki, A.; Pavanello, F.; Ram, R.; Popovic, M.; Stojanovic, V., "A 45nm SOI monolithic photonics chip-to-chip link with bit-statistics-based resonant microring thermal tuning," *2015 Symposium on VLSI Circuits*, p C122-3, 2015

S. Moazeni *et al.*, "29.3 A 40Gb/s PAM-4 transmitter based on a ring-resonator optical DAC in 45nm SOI CMOS," *2017 IEEE International Solid-State Circuits Conference (ISSCC)*, San Francisco, CA, 2017, pp. 486-487.

Invited Papers in Conference Proceedings

1. R. J. Ram, D. I. Babic, R. A. York, and J. E. Bowers, "Spontaneous Emission in Microcavities with Distributed Mirrors," IEEE Lasers and Electro-Optics Society Annual Meeting, Boston, Massachusetts, November 1994.
2. J. E. Bowers, D. I. Babic, J. J. Dudley and R. J. Ram, "Long Wavelength Vertical Cavity Lasers," Session 14D3-1, Fifth Optoelectronics Conference, Makuhari Messe, Chiba, Japan, July 12-15 1994.
3. A.Imamoglu, K. L. Campman, H. Schmidt, R. J. Ram, J. E. Bowers and A. C. Gossard, "Lasers without Inversion in Quantum Well Intersubband Transitions," International Conference on Coherence and Nonlinear Optics, St. Petersburg, Russia, June 27 to July 1 1995.
4. R. J. Ram, C.-K. Sun, J. Ko, G. Wang, E. Goobar, M. Oesterich, J. E. Bowers, and A.. Imamoglu, "Dynamics of Condensing Polaritons," Physics of Quantum Electronics, 26th Winter Colloquium on Quantum Electronics, Snowbird, Utah, January 7-10, 1996.
5. R. J. Ram, R. Sporer, H.-R. Blank, P. Maccarini, H.-C. Chang and R. A. York, "Chaos in Microwave Antenna Arrays," Microwave Theory and Techniques Symposium, San Francisco, California,, June 17-21, 1996.
6. A.Imamoglu and R. J. Ram, "From Bose-Einstein Condensation to Semiconductor Lasers," Satellite Conference on Quantum Optics, International Quantum Electronics Conference, Sydney, Australia, July 1996.
7. R. J. Ram, "High Speed Semiconductor Lasers," IEEE Microwave Theory and Techniques International Microwave Symposia, Boston, June, 2000.
8. R. J. Ram and C. H. Cox, "High Performance Microwave Optical Links," International Conference on Communications and Computing Devices, IIT Kharagpur, India, December 2000. *
9. M Groenert, C Leitz, A Pitera, V Yang, EA Fitzgerald, H Lee, and RJ Ram, "Room temperature CW GaAs/AlGaAs lasers on Si," Materials Research Society Spring Meeting 2002, San Francisco, April 2002. *
10. R. J. Ram, K. Pipe, and A. Shakhouri, "Thermoelectric effects in bipolar devices: Internally cooled semiconductor lasers," US-Japan Nanotherm Seminar, Berkeley, California, June 2002. *
11. R. J. Ram, "Semiconductor Cascade Lasers for Telecommunications," International Society for Optical Engineering ITCOM 2002, Boston, July 2002.*
12. R. J. Ram, "Semiconductor Cascade Lasers for RF Photonic Applications," IEEE Lasers and Electro-optical Society Annual Meeting, Edinburgh, Scotland, November 2002. *
13. Xiaoyun Guo, Tauhid Zaman, Rajeev J. Ram, "Magneto-Optical Semiconductor Waveguides for Integrated Isolators", Photonics West, Proc. SPIE Vol. 5729, p. 152-159, Optoelectronic Integrated Circuits VII; Louay A. Eldada, El-Hang Lee; Eds. Mar 2005.*
14. Rajeev J. Ram, "Novel Components For Large Scale Photonic Integration," XXVIIIth General Assembly of International Union of Radio Science (URSI), New Delhi, India, October 2005.
15. Lee H.L.T., Boccazzi P., Ram R.J., and Sinskey, A.J. "New microbio-reactor array technologies for rapid bioprocess development," IBC Cell Line Development and Engineering Conference 2007, La Jolla, CA.
16. H.L.T. Lee, G.A. Gil, P. Boccazzi, A.J. Sinskey, R.J. Ram, E.J. Bruce, "Raman spectroscopy for bioprocess development," Federation of Analytical Chemistry and Spectroscopy Societies Conference 2008, Reno, NV.

17. Rajeev J. Ram, Kevin Lee, "Photonic Integration for Lab on a Chip Systems," IEEE Photonics Society Annual Meeting, Antalya, Turkey, October 2009.
18. Rajeev J. Ram, Reja Amatya, "Solar Thermoelectric Generators," 12th International Conference on Modern Materials and Technologies, Italy, June 2010.
19. Rajeev J. Ram, "CMOS Photonic Integrated Circuits," Optical Fiber Communication Conference (OFC), Los Angeles, California, March 4, 2012
20. Rajeev J. Ram, "The Role of Power Magnetics in Cleantech," Power MEMs Workshop, Atlanta, Georgia, December 2012.
21. Santhanam, Parthiban, et al. "Electro-luminescent cooling: light emitting diodes above unity efficiency." *SPIE OPTO*. International Society for Optics and Photonics, 2013.
22. Orcutt, Jason S., Rajeev J. Ram, and Vladimir Stojanović. "Integration of silicon photonics into electronic processes." *SPIE OPTO*. International Society for Optics and Photonics, 2013.
23. R. J. Ram, "A Scaled CMOS Platform for Photonics," *IEEE Photonics Conference*, Seattle, Washington, 2013.
24. R. J. Ram, "CMOS Photonic Integrated Circuits and Systems," *European Conference on Integrated Optics (ECIO 17th) and the Asian MicroOptics Conference (MOC19th)*, Nice, France, 2014.
25. R. J. Ram, "Exploiting Micro and Nano-technologies for Real-time Process Analytics," *Bioprocess Development & Production, San Diego*, 2014.
26. Rajeev Ram, "CMOS Photonics for Low Energy Interconnects," *IEEE Les Eastman Conference on High Performance Devices*, Ithaca, 2014.
27. Milos Popovic, et al. "Monolithic silicon photonics in a sub-100nm SOI CMOS microprocessor foundry: progress from devices to systems," *SPIE Photonics West OPTO*, 2015.
28. Rajeev Ram, et al. "Photonic-electronic integration with polysilicon photonics in bulk CMOS," *SPIE Photonics West OPTO*, 2015.
29. Rajeev Ram, "Monolithic Receivers in Deep Submicron SOI and Bulk CMOS," *IEEE Photonics Society Summer Topicals*, 2015.
30. Rajeev Ram, "CMOS Photonics: Monolithic Integration of 70M Electronic and Photonic Devices," *IEEE-Photonics Society Boston Chapter Integrated Photonic Technologies Workshop*.
31. R. J. Ram, "CMOS photonics for direct microprocessor I/O," *2016 IEEE 13th International Conference on Group IV Photonics (GFP)*, Shanghai, 2016, pp. 176-177.
32. C. Sun, M. Wade, Y. Lee, J. Orcutt, L. Alloatti, M. Georgas, A. Waterman, J. Shainline, R. Avizienis, S. Lin, B. Moss, R. Kumar, F. Pavanello, A. Atabaki, H. Cook, A. Ou, J. Leu, Y. Chen, K. Asanovic, R. Ram, M. A. Popovic, and V. Stojanovic, "Microprocessor Chip with Photonics I/O," in *Optical Fiber Communication Conference*, OSA Technical Digest (online) (Optical Society of America, 2017), paper W1A.1.
33. Rajeev J. Ram; "Thermophotonics for ultra-high efficiency visible LEDs," *Proc. SPIE 10124, Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XXI*, 1012414 (February 16, 2017);

Plenary Presentations

1. R. J. Ram, "The Road Ahead for Integration and Convergence of Communication Technology" IEEE Interconnections within High Speed Digital Systems Santa Fe, New Mexico, 2005.
2. R. J. Ram, "Integrated Photonics for Lab-on-a-Chip," 6ª Reunión Española de Optoelectrónica, OPTOEL '09, Málaga, Spain, July, 2009.
3. R. J. Ram, "Stimulating Innovation in Energy Technology" IEEE Conference on Innovative Technologies for an Efficient and Reliable Electricity Supply Waltham, Waltham, Massachusetts, 2010.
4. R. J. Ram, "Stimulating Innovation in Energy Technology: The Role of Wide Bandgap Semiconductors" International Conference on Silicon Carbide and Related Materials Cleveland, Ohio, 2011.

Other Major Publications

- 1 R. J. Ram and A. Imamoglu, 'The Exciton Boser: Cooperative Phenomena in Microcavity Excitons,' Microcavities and Photonic Bandgaps, ed. J. Rarity and C. Weisbuch, Kluwer Academic Publishing, 1996.
- 2 R. J. Ram and HLT Lee, "Direct Modulation for Microwave Photonics", Microwave Photonics ed S. Iezekiel, John Wiley & Sons, 2009.
3. J. S. Orcutt, V. Stojanovic, and R. J. Ram "CMOS Photonics for High Performance Interconnects," Optical fiber telecommunications VI A.Ed. Kaminow, Ivan, Tingye Li, and Alan E. Willner. Academic press, 2013.