

## Rajeev J. Ram

Professor of Electrical Engineering and Computer Science  
Massachusetts Institute of Technology

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

### 2022 Milestones:

- Demonstrated sub-wavelength scale LEDs in silicon. These nanoLEDs were used as spatially coherent illumination for miniature digital holographic microscopes.

### Key Research Milestones

- Developed Swept-Source Raman spectroscopy for low-cost, low-power molecular analysis (2021).
- Demonstrated early detection of infection (biotic stress) in plants (2021).
- Demonstrated early detection of nutrient deficiency in plants (2020).
- Demonstration of integrated circuits at UV wavelengths (2019).
- Demonstration of photonic integrated circuits deposited on glass; electronic photonic integration on glass trenches embedded in bulk CMOS. Reported in *Nature* (2018).
- First single-mode, planar waveguide for ultraviolet light (2017).
- 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 (multi-junction 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 (applied at HP to 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 IBM, Intel, Samsung and Applied Materials as well as to tenured professorships at Cornell, the University of California, the University of Michigan, ETH Zurich, Yale 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 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

### Professional service:

Program Director, ARPA-E, Department of Energy	April 2010	May 2012
DARPA Defense Science Research Council	August 2005	January 2007
Guest Editor, Frontiers of Plant Science, Special Issue		2022
Guest Editor, Proceedings of National Academy of Science (PNAS)		2016

### 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, $\mu$ 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
Advisor, Top Ranked Student Paper ....IEDM 2020	2020

## **Entrepreneurship Experience**

Founder, Advisory Board, AyarLabs Incorporated	2015-present
Founder, Advisory Board, erbi bio (formerly Pharyx, acquired Merck KGaA)	2018-2022
Advisory Board, Breakthrough Energy Ventures	2017-present
Founder, Board of Directors, Pharyx	2007-2018
Scientific Advisory Board (founding), Joule Unlimited	2007-2010

## 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. SG Frank, C Powers, A Qian, OZ Welling, B Simpson, R Amatya, R Ram “Solar concentrator assembly and methods of using same,” US Patent 9,647,192
15. R Meade, K Mehta, E Megged, J Orcutt, M Popovic, R Ram, J Shainline “Method and optoelectronic structure providing polysilicon photonic devices with different optical properties in different regions,” US Patent 9,768,330
- 16 Erika, Y.E., Atabaki, A.H., Han, N., Ram, R.J. and Herrington, W.F., Massachusetts Institute of Technology, 2020. Apparatus, systems, and methods for talbot spectrometers. U.S. Patent Application 16/704,444.
17. Popovic, M., Ram, R., Stojanovic, V., Sun, C., Wade, M. T., & Wright, A. C. (2020). U.S. Patent No. 10,581,215. Washington, DC: U.S. Patent and Trademark Office.
- 19.Sun, C., Meade, R. E., Wade, M., Wright, A., Stojanovic, V., Ram, R., ... & Davenport, M. (2020). U.S. Patent No. 10,749,603 & 10,771,160. Washington, DC: U.S. Patent and Trademark Office.
20. Orcutt, J.S., Mehta, K.K., Ram, R.J. and Atabaki, A.H., Massachusetts Institute of Technology, 2020. Waveguide formation using CMOS fabrication techniques. U.S. Patent 10,768,368.22.
- 21 Atabaki, A. H., Ram, R. J., & Herrington, W. F. (2020). U.S. Patent No. 10,656,012. Washington, DC: U.S. Patent and Trademark Office.
22. Meng, H. and Ram, R., Massachusetts Institute of Technology, 2020. Systems and methods for genome mapping. U.S. Patent 10,866,229.

23. Alloatti, L., Ram, R.J. and Cheian, D., Massachusetts Institute of Technology, 2021. Semiconductor devices with curved-shape silicon germanium structures and optical resonator structures. U.S. Patent 10,978,608.
24. Meade, R., Mehta, K., Megged, E., Orcutt, J., Popovic, M., Ram, R., Shainline, J., Sternberg, Z., Stojanovic, V. and Tehar-Zahav, O., Micron Technology Inc, 2021. Method and optoelectronic structure providing polysilicon photonic devices with different optical properties in different regions. U.S. Patent 10,903,377.
25. Goh, S., Ram, R.J., Lee, K.S.K., Canzoneri, M. and Blum, H., Sanofi SA and Massachusetts Institute of Technology, 2022. Humidity control in chemical reactors. U.S. Patent 11,459,538.
26. Sun, C., Meade, R.E., Wade, M., Wright, A., Stojanovic, V., Ram, R., Popovic, M. and Van Orden, D., Ayar Labs Inc, 2022. Laser module for optical data communication system. U.S. Patent 11,424,830.
27. Sun, C., Meade, R.E., Wade, M., Wright, A., Stojanovic, V., Ram, R., Popovic, M., Van Orden, D. and Davenport, M., Ayar Labs Inc, 2022. Laser module for optical data communication system within silicon interposer. U.S. Patent 11,394,465.
28. Meade, R., Mehta, K., Megged, E., Orcutt, J., Popovic, M., Ram, R., Shainline, J., Sternberg, Z., Stojanovic, V. and Tehar-Zahav, O., Micron Technology Inc, 2022. Method and optoelectronic structure providing polysilicon photonic devices with different optical properties in different regions. U.S. Patent 11,322,629.
29. Atabaki, A.H., Ram, R.J. and Herrington, W.F., Massachusetts Institute of Technology, 2022. Swept-source Raman spectroscopy systems and methods. U.S. Patent 11,307,092.
30. Wright, A., Wade, M., Sun, C., Stojanovic, V., Ram, R., Popovic, M., Meade, R.E. and Van Orden, D., Ayar Labs Inc, 2022. Chip-to-chip optical data communication system. U.S. Patent 11,249,260.
31. Popovic, M., Ram, R., Stojanovic, V., Sun, C., Wade, M.T. and Wright, A.C., Ayar Labs Inc, 2022. Multi-wavelength laser system for optical data communication links and associated methods. U.S. Patent 11,233,371.
32. Ram, Rajeev J., Dodd Joseph Gray, Amir H. Atabaki, and Marc De Cea Falco. "Forward-biased modulator for cryogenic optical readout." U.S. Patent 11,506,951, issued November 22, 2022.

#### Papers in Refereed Journals

1. R. J. Ram, L. Yang, K. Nauka, M. Ludowise, Y. M. Houg, D. E. Mars, J. J. Dudley, and S. Y. Wang, "Analysis of Wafer Fusing for 1.3 $\mu$ 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 BJB, "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<sub>x</sub>Si<sub>1-x</sub> 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.\*
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34. Rajeev J. Ram "One Shot Learning Using Bayesian Modeling for Metabolites in CHO Cell Culture," SciX, Federation of Analytical Chemistry and Spectroscopy Societies (FACSS)
35. Rajeev J. Ram, "Nanoscale Foundries: Electronics, Photonics, Ionics, Fluidics," Center for Advanced Electronics, IIT Indore, August 2020
36. Rajeev J. Ram, "Nanoscale Foundries: Electronics, Photonics, Ionics, Fluidics," Stanford Optical Society, January 2020
37. Rajeev J. Ram, "Hacking CMOS: Electronics, Photonics, Ionics, Fluidics," UC Berkeley Solid State and Devices Seminar, Jan 2020
38. Rajeev J. Ram, "Integrated Light Sources from Quantum Clocks to Computational Imaging," Cornell University,

#### 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.



5. "Tera-Scale CMOS Photonics" 25th Optoelectronics and Communications Conference (OECC2020, Taiwan)
6. "High Performance Photonic Interfaces", European Conference on Integrated Optics (ECIO 2022, Milan Italy)
7. "High Performance Electronic-Photonic Interfaces: From AI to Quantum" SPIE Photonics West (OPTO, 2023, San Francisco)

#### Other Major Publications

- 1 R. J. Ram and A. Imamoglu, 'The Exciton Bose: 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.