Parthiban Santhanam
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Education:

University of California at Berkeley, Berkeley, CA
BS in Engineering Physics with High Honors, Awarded May 2006

Massachusetts Institute of Technology, Cambridge, MA
MS in Electrical Engineering, Awarded June 2009
PhD in Electrical Engineering, Anticipated Fall 2013

Research Experience:

Characterization and Theory of Thermo-Electric Pumping in Light-Emitting Diodes
Prof. Rajeev Ram, Massachusetts Institute of Technology, Nov 2009 – present
Made first measurement of electrically-driven photon generation above unity efficiency using an existing infrared light-emitting diode (LED). Used simulations and experiments to characterize the low-voltage operating regime for LEDs and explain how internal thermo-electric heat exchange processes allow them to harvest thermal energy. Formulated novel designs to exploit this physics to improve LED efficiency. Explored applications in high-temperature mid-infrared spectroscopy and energy-efficient communication.

Modeling of Electron Transport in Nano-Structured Thermo-Electrics
Prof. Rajeev Ram, Massachusetts Institute of Technology, Jul 2007 – Jan 2012
Formulated Poisson-self-consistent model for thermo-electric transport. Developed unipolar transport code based on this model and used it to propose a new experimental technique. Collaboratively proposed and simulated electron transport in thermo-electric materials with epitaxial quantum dot structures.

Modeling of Electron Transport in THz Quantum Cascade Lasers
Prof. Qing Hu, Massachusetts Institute of Technology, Aug 2006 – Dec 2006
Simulated semi-classical electron transport in THz quantum cascade lasers with existing code.

Modeling of Single-Electron Transport in a Spheromak
Prof. Paul Bellan, California Institute of Technology, Jun 2005 – Aug 2005
Wrote simulation of single-particle motion in toroidal and poloidal coordinates.

Characterization of Exhaust Plume from a Colloidal Micro-Thruster
Dr. John Ziemer, NASA Jet Propulsion Lab, Jun 2004 – Aug 2004
Developed hardware-control interface for UHV plasma diagnostics in a Class 10 cleanroom.

Optimization of Beam Optics and Target Simulation for Heavy-Ion Inertial Fusion
Dr. John Barnard, Lawrence Berkeley National Lab, Jan 2003 – Dec 2005
Modeled magnetic lens sequences and beam-target interactions for heavy-ion inertial fusion.

Teaching Experience:

Teaching Assistant, Signals and Systems (MIT 6.003), Spring 2007
Instructor: Prof. Alan S. Willsky

HKN tutor for undergraduate courses, Fall 2011
Signals and Systems (MIT 6.003)
Probabilistic Systems Analysis and Applied Probability (MIT 6.041)

Other Professional Experience:

Research mentor for undergraduate and Master's candidate students
D J Gray (BS 2010, MEng 2011, currently at Stanford EECS), June 2009 – August 2011

D Huang (BS 2013, currently at UC Santa Barbara Elec. Eng.), September 2011 – May 2013
Co-wrote two research proposals, one funded ($100k/yr) by Weatherford, Int'l.
Wrote internal disclosure leading to US Patent application
P Santhanam, et al. "Phonon-Recycling Light Emitting Diode."
Provisional U.S. Patent, Application No.: 61/684315, Filing date: August 17, 2012.
Full U.S. Patent application filed August 16, 2013.
Session Chair on Electonic & Photonic Devices at student-run MARC 2012 Conference
Served as Network Administrator for Physical Optics and Electronics Group for 2 years

Awards, Fellowships, and Honors:

2012 *Physical Review Letters* publication chosen as Editors Suggestion
2012 *Physical Review Letters* publication highlighted by APS Physics and other outlets
Article by: APS Physics (physics.aps.org), Published February 29, 2012
Article by: Physics World (physicsworld.com), Published March 8, 2012
Also: www.physicscentral.com, wired.co.uk, slashdot.org, reddit.com, and others
US DoD National Defense Science and Engineering Graduate (NDSEG) Fellowship
Awarded September 2009, funding ended August 2011
Princeton PPPL Carl Oberman Prize for Theoretical Plasma Physics (school-specific)
Awarded May 2006 (declined)
US Department of Energy Fusion Energy Sciences Fellowship
Awarded May 2006 (declined)
2005 APS Division of Plasma Physics Meeting Undergraduate Poster Award
Awarded October 2005

Publications and Presentations:

Theses

P Santhanam. "Generalized Drift-Diffusion for Microscopic Thermoelectricity." M.S. Thesis, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, May 2009.

P Santhanam. "Thermo-Electrically Pumped Semiconductor Light Emitting Diodes." Ph.D. Thesis, Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, in preparation for submission Fall 2013.

First-Author Publications

P Santhanam, D Huang, R J Ram. "Room temperature thermo-electric pumping in mid-infrared light-emitting diodes." *Applied Physics Letters* **103**, 183513, Nov 2013.

P Santhanam, D Huang, D Gray, R J Ram. "Electro-luminescent cooling: light emitting diodes above unity efficiency." *Proc. SPIE* **8638**, 863807 (2013).

P Santhanam, D J Gray, and R J Ram. "Thermoelectrically Pumped Light-Emitting Diodes Operating above Unity Efficiency." *Physical Review Letters* **108**, 097403, Feb 2012.

J Bahk, **P Santhanam**, Z Bian, R J Ram, and A Shakouri. "Resonant Carrier Scattering by Core-Shell Nanoparticles for Thermoelectric Power Factor Enhancement." *Applied Physics Letters* **100**, 012102, Jan 2012.

P Santhanam and R J Ram. "Self-Consistent Drift–Diffusion Transport in Thermoelectrics and Implications for Measuring the Scattering Parameter." *Journal of Electronic Materials*, Volume 39, Issue 9, pp. 1944-1949, Sept 2010.

Other Publications and Presentations

P Santhanam. "Electro-luminescent cooling in the deep sub-bandgap bias regime." Invited talk and paper at Photonics West 2014, OPTO, *Laser Refrigeration of Solids VII*, upcoming February 2014.

D J Gray, P Santhanam, R J Ram. "Design for enhanced thermo-electric pumping in light emitting diodes." *Applied Physics Letters* **103**, 123503, Sept 2013.

P Santhanam, D J Gray, R J Ram. "Electro-luminescent cooling: light emitting diodes above unity efficiency." Invited talk at Photonics West 2013, OPTO, *Laser Refrigeration of Solids VI* (2013).

P Santhanam, R J Ram. "Light-Emitting Diodes Operating Above Unity Efficiency for Infrared Absorption Spectroscopy." Presentation at the IEEE Photonics Conference 2012, upcoming September 2012.

J Bahk, Z Bian, M Zebarjadi, **P Santhanam**, R J Ram, and A Shakouri. "Thermoelectric Power Factor Enhancement by Ionized Nanoparticle Scattering." *Applied Physics Letters* **99**, 072118, Aug 2011.

P Santhanam, R J Ram. "Drift-Diffusion Description of the Seebeck Effect and Implications for Measuring the Scattering Parameter." Presented at 2009 International Conference on Thermoelectrics, July 2009.

P Santhanam and P M Bellan. "Simulation of Single-Particle Motion in Spheromak Geometries." Poster presented at 2005 Meeting of the American Physical Society's Division of Plasma Physics, October 2005.

J J Barnard, J Armijo, R M More, A Friedman, I Kaganovich, B G Logan, M M Marinak, G E Penn, A B Sefkow, **P Santhanam**, P Stoltz, S Veitzer, and J S Wurtele. "Theory and Simulation of Warm Dense Matter Targets." Nuclear Instuments and Methods in Physics Research A, Volume 577, Issues 1-2, pp. 275-283. 2007.

J J Barnard, R O Bangerter, E Henestroza, I D Kaganovich, E P Lee, B G Logan, W R Meier, D Rose, **P Santhanam**, W M Sharp, D R Welch, and S S Yu. "A Final Focus Model for Heavy Ion Fusion Systems Codes." Nuclear Instruments and Methods in Physics Research A, Volume 544, Issues 1-2, pp. 243-254. 2005.

J J Barnard, R J Briggs, D A Callahan, R C Davidson, A Friedman, L Grisham, E P Lee, R W Lee, B G Logan, C L Olson, D V Rose, **P Santhanam**, A M Sessler, J W Staples, M Tabak, D R Welch, J S Wurtele, and S S Yu. "Accelerator and Ion Beam Tradeoffs for Studies of Warm Dense Matter." Proceedings of the Particle Accelerator Conference, pp. 2568-2570, UCRL-CONF-212342. 2005.