



Rui Q. Yang

RESEARCH INTERESTS

Semiconductor quantum structures and devices, applied physics, optoelectronics and applications, mid-infrared lasers and detectors, photovoltaic devices for energy conversion, particularly thermophotovoltaic (TPV) cells for conversion of mid-infrared light.

Group website: <http://QDL.ou.edu/>

BIOGRAPHY

Dr. Yang is a professor in the School of Electrical and Computer Engineering at the University of Oklahoma. He is the inventor of interband cascade (IC) lasers, detectors, and photovoltaic devices with research activities ranging from condensed matter physics to semiconductor quantum devices such as tunneling diodes, mid-infrared lasers and detectors, and photovoltaic devices for converting infrared light to electricity. Prior to joining the University of Oklahoma in 2007, he was a Principal Member of Engineering Staff and a Task Manager at the Jet Propulsion Laboratory (JPL), California Institute of Technology, Pasadena, California, where he led the development of advanced mid-infrared interband cascade lasers for applications in Earth sciences and planetary explorations. He received the Edward Stone Award in 2007 from JPL for outstanding research publication and the successful accelerated infusion of cutting-edge interband cascade semiconductor laser technology into flight mission readiness. The lasers that he invented and developed with his colleagues at JPL have been landed with Curiosity on Mars for NASA flight missions and successfully detected organic molecules CH_4 . He has authored/co-authored more than 130 refereed journal articles and two book chapters with 8 patents and over 200 conference contributions, invited seminars, and talks. He has been the principal investigator on many tasks and contracts from NASA, DoD, DoE funding agencies, and NSF.

Education

PhD, Solid State Physics
Nanjing University, China, 1987
MS, Solid State Physics
Nanjing University, China, 1984
BS, Physics
Zhejiang University, China, 1982

Experience

Professor
University of Oklahoma
Principal/Senior Member of
Engineering Staff, Task Manager
Jet Propulsion Laboratory,
California Institute of
Technology, Pasadena, CA

AWARDS, HONORS AND PROFESSIONAL ACTIVITIES

Fellow: IEEE, OSA.
Edward Stone Award in 2007 from JPL.
Best Technical Section Paper Award at 22nd Army Science
Conference (Baltimore, 2000)

SELECTED PROJECTS

- NSF, “Quantum Engineered Long-Wavelength Infrared Photodetectors”, 06/01/2012-05/31/2017.
- AFOSR, “Carrier Transport in Semiconductor Quantum Structures”, 02/01/2015-01/31/2018.
- NSF, “Advancement of interband cascade lasers”, 09/01/2016-02/28/2018.
- NSF, “Narrow Bandgap Multi-Stage Structures for Thermophotovoltaics”, 07/01/2016-06/30/2019.
- Department of Energy EPSCoR program, “Interband cascade photovoltaic cells”, 07/01/2010-06/30/2014.
- National Science Foundation (NSF), “Energy-efficient interband cascade lasers”, 06/01/2010-05/30/2013.

SELECTED PUBLICATIONS

- “Monolithically integrated mid-IR interband cascade laser and photodetector operating at room temperature,” *Appl. Phys. Lett.* **109**, 151111, 2016 (with H. Lotfi, *et al.*).
- “Long wavelength interband cascade infrared photodetectors operating at high temperatures,” *J. Appl. Phys.* **120**, 193102, 2016 (with L. Lei, *et al.*).
- “High-frequency operation of a mid-infrared interband cascade system at room temperature,” *Appl. Phys. Lett.* **108**, 201101, 2016 (with H. Lotfi, *et al.*).
- “Low-threshold InAs-based interband cascade lasers operating at high temperatures,” *Appl. Phys. Lett.* **106**, 251102, 2015 (with L. Li, *et al.*).
- “Type-I interband cascade lasers near $3.2\ \mu\text{m}$,” *Appl. Phys. Lett.*, **106**, 041117, 2015 (with Y. Jiang *et al.*)
- “Theory of multiple-stage interband photovoltaic devices and ultimate performance limit comparison of multiple-stage and single-stage interband infrared detectors,” *J. Appl. Phys.* **114**, 104506, 2013 (with R. T. Hinkey).
- “Narrow-Bandgap Photovoltaic Devices Operating at Room Temperature and Above with High Open-Circuit Voltage,” *Appl. Phys. Lett.* **102**, 211103, 2013 (with H. Lotfi, *et al.*)
- “Interband Cascade (IC) Lasers”, Chap. 12, in *Semiconductor lasers: fundamentals and applications*, edited by A. Baranov and E. Tournie, Woodhead Publishing Limited, Cambridge, UK, 2013.
- “Interband Cascade Photovoltaic Devices for Conversion of Mid-IR Radiation”, *IEEE J. Photovoltaics*, **3**, 745, 2013 (with R. T. Hinkey, *et al.*).
- “Single-waveguide dual-wavelength interband cascade lasers”, *Appl. Phys. Lett.* **101**, 171118, 2012 (with L. Li, *et al.*)
- “InAs-based interband cascade lasers with emission wavelength at $10.4\ \mu\text{m}$ ”, *Electronics Lett.* **48**, 113, 2012 (with Z. Tian, *et al.*).
- “Reflectance spectrum of plasmon waveguide interband cascade lasers and observation of the Berreman effect”, *J. Appl. Phys.* **110**, No. 4, 043113, 2011 (with R. T. Hinkey, *et al.*).
- “Interband cascade infrared photodetectors with superlattice absorbers”, *J. Appl. Phys.* **107**, No. 5, article 054514, 2010 (with Z. Tian, Z. Cai, J. F. Klem, M. B. Johnson, and H. C. Liu).
- “Thermoelectrically cooled interband cascade laser for field measurements”, *Optical Engineering*, **49**, article 111119, 2010 (with L. E. Christensen, K. Mansour).
- “Interband cascade photovoltaic devices”, *Appl. Phys. Lett.* **96**, No. 6, article 063504, 2010 (with Z. Tian, J. F. Klem, T. D. Mishima, M. B. Santos, and M. B. Johnson).
- “Plasmon-Waveguide Interband Cascade Lasers Near $7.5\ \mu\text{m}$ ”, *Photonics Technol. Lett.* **21**, p. 1588, 2009 (with Z. Tian, T. D. Mishima, M. B. Santos, and M. B. Johnson).
- “InAs-based interband cascade lasers near $6\ \mu\text{m}$,” *Electronics Letters*, **45**, p. 48, 2009 (with Z. Tian, *et al.*).
- “Distributed feedback mid-infrared interband cascade lasers at thermoelectric cooler temperatures,” *IEEE J. Selected Topics of Quantum Electronics*, **13**, p. 1074, 2007 (with C. J. Hill, *et al.*).
- “Optical gain, loss and transparency current in high performance mid-IR interband cascade lasers”, *J. Appl. Phys.* **101**, article 093104, 2007 (with A. Soibel, K. Mansour, Y. Qiu, C. J. Hill).
- “Mid-IR interband cascade lasers at thermoelectric cooler temperatures”, *Electronics Letters*, **42**, p. 1034, 2006 (with K. Mansour, Y. Qiu, C. J. Hill, A. Soibel).
- “MBE Growth Optimization of Sb-Based Interband Cascade Lasers”, *J. Crystal Growth* **278**, p. 167, 2005 (with C. J. Hill).
- “Novel Concepts and Structures for Infrared Lasers,” Chap. 2, in *Long Wavelength Infrared Emitters Based on Quantum Wells and Superlattices*, edited by M. Helm (Gordon & Breach Pub., Singapore, 2000).

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