

SANJAY KRISHNA

- EDUCATION** *DOCTOR OF PHILOSOPHY (APPLIED PHYSICS)* University of Michigan, 2001
MASTER OF SCIENCE (ELECTRICAL ENGINEERING) University of Michigan, 1999
MASTER OF SCIENCE (PHYSICS) Indian Institute of Technology, Madras, 1996
BACHELOR OF SCIENCE, B.SC. (HON. PHYSICS.) S.S.S.I.H.L, Bangalore, 1994
- EXPERIENCE** Associate Professor, (ECE Dept, 07/06-present) University of New Mexico, Albuquerque
Assistant Professor, (ECE Dept, 07/01-07/06) University of New Mexico, Albuquerque
Graduate Student Research Assistant (05/98– 06/01), University of Michigan. Ann Arbor
Graduate Student Instructor (09/97– 05/98), University of Michigan, Ann Arbor
Graduate Student Assistant (06/96-06/97), Tata Inst. of Fundamental Research, India.
Visiting Student Researcher (05/95-07/95), Tata Inst. of Fundamental Research, India.

RESEARCH EXPERTISE

- **Fundamental Physics Studies**

Theoretical and experimental investigation of bandstructure and carrier dynamics in novel nanoscale semiconductor material systems using spectral methods, pump-probe spectroscopy and Fourier transform infrared spectroscopy.

- **Epitaxial Growth**

Extensive molecular beam epitaxial growth of nanoscale InGaAs/GaAs self-assembled quantum dot structures, InAs/InGaSb Type II strain layer superlattices and metamorphic buffer layers for mid infrared lasers and sensors

- **Device Fabrication and Characterization**

Fabrication of state-of-the-art GaAs and GaSb based lasers, detectors and focal plane arrays in class-100 clean room equipped with facilities for metallization with optical lithography, wet and dry etching, wire bonding, substrate thinning and detector/laser characterization using rapid scan and step scan FTIR spectroscopy. Set up a Mid-infrared Imaging Application and Characterization (MICA) laboratory for focal plane array measurements at the University of New Mexico.

AWARDS AND HONORS

- SPIE Early Career Achievement Award (2008)
- IEEE-Nanotechnology Council Early Career Achievement Award (2008)
- North American Molecular Beam Epitaxy Young Investigator Award (2007)
- Defense Intelligence Agency Chief Scientist Award for Excellence (2007)
- Oak Ridge Associated Universities Ralph Powe Jr. Faculty Enhancement Award (2004)
- School of Engineering Junior Faculty Teaching Award (2005)
- ECE Outstanding Researcher Award (2004)
- Outstanding Young Engineer Award by IEEE Albuquerque Chapter (2003)
- Nomination for the Rackham Distinguished Doctoral Thesis Award by University of Michigan (2001)
- Gold Medal from the Indian Institute of Technology, Madras for the best academic performance in the Master's program in Physics (1996)
- Best Student Paper Award at the 16th North American Molecular Beam Epitaxy Conference in Banff, Canada, (1999)
- Fellowship, Department of Physics, University of Michigan (1997-1998)
- First in the Graduate School of Physics at Tata Institute of Fundamental Research, Mumbai in Fall 1996 and Spring 1997.
- Prof. Chilukuri Ramasastry Memorial for the best academic performance by a first year student at the Indian Institute of Technology, Madras (1995)
- Merit Scholarship for academic excellence during study at IIT, Madras, 1995-1996.
- Second rank in the University in the undergraduate honors program in Physics (1994)

RESEARCH GROUP

- **Research Professors:** Ralph Dawson & Andreas Stintz
- **Research Scientist:** Yagya Sharma, PhD
- **Post Doctoral Researchers:** T. Vandervelde, PhD & E. Plis, PhD
- **Graduate Students:**
 - Jiayi Shao (Started PhD in Fall 2005)
 - Rajeev Shenoj (Started PhD in Fall 2006)
 - Jonathan Andrews (PhD Track, passed PhD Qualifying Examination)
 - Chris Wilcox (Started Fall 2006)
 - Peter Hill: (Masters (Thesis), ABD, Working with Intel)
 - Yaxin Yu (Fall 2005, PhD Track)
 - Greg Bishop (Fall 2006, M.S. Track)
 - Ha Sul Kim (Fall 2006, PhD Track)
 - Arezou Khoshakhlagh (Fall 2006, PhD Track)
 - Nina Wiese Bernstein (Fall 2007, MS Track)
 - Ajit Barve (Fall 2007, PhD Track)
 - Andrea Scott (Fall 2007, M.S. Track)
- **Undergraduate Students:**
 - Nina Rae Weisse-Bernstein (Summer 2004-Spring 2005, LANL)
 - Shawn Humphrey (Spring 2005, Naval Postgrad School)
 - Darren Formann (Spring 2004, Industry)
 - Mark Spencer (Spring 2005)
 - Nicole Escude (Summer 2005, Biola Univ)
 - Rasika Behl (Summer 2006, USC)
- **High School Students:**
 - Mathew Rush (Fall'03/Spr'04)
 - Victoria Fowler (Summer'03)
 - Mallory Mallet (Summer 07, Fall 07)
- **Past Group Members:**
 - *Postdoctoral Fellows:* Dr. Jean Baptiste Rodriguez, Dr. Jay Brown, Dr. Abdenour Amtout, Dr. Phil Dowd
 - Research Engineer: Paul Rotella
 - *PhD Students:* Greg von Winckel, Zhimei Zhu, Elena Plis, Ram Attaluri, Fred Newmann,
 - *M.S. Students:* Michael Lenz, Eric Varley, Kalyan Teja Posani, Senthil Annamalai, Diana Jepson, Chris Wilcox, Mario Serna, Sunil Raghavan,

GRADUATED STUDENTS (5 PhD and 8 M.S)

- Greg von Winckel, PhD “Spectral Element Modeling of Semiconductor Nanostructures” (Spring 2006) (Postdoc at University of Linz)
- Zhimei Zhu, PhD “Materials Characterization of InAs/GaInSb Type II Superlattices ” (Spring 2006) (Working in Law Firm in DC)

- Elena Plis, PhD, “ InAs/(In,Ga)Sb Strain Layer Superlattice (SLS) Photovoltaic Infrared Detectors” (Summer 2007) (Postdoc at UNM)
- Ram Attaluri, PhD “Growth and Optimization of Dot-in-well (DWELL) Infrared Photodetectors” (Summer 2007) (Post doc at Lehigh University)
- Fred Newmann, PhD “Study of Techniques to Obtain Metamorphic Low Bandgap Devices on GaAs Substrates” (Fall 2007) (Emcore Corp)
- Eric Varley, M.S. (Thesis), Spring 2007, “Two color quantum dots in a well focal planer arrays”. (Sandia National Lab)
- Diana Jepson, M.S. (Thesis), Spring 2007, “ 1/f Noise measurements in HgCdTe Detectors”. (Air Force Research Lab)
- Michael Lenz, M.S. (Thesis) Summer 2007, “ Characterizing Spectral Response of Quantum Dots in a Well Focal Plane Arrays” (Sandia National Lab)
- Kalyan Teja Posani M.S. (Thesis), Fall 2006 “Nanoscale Quantum Dot Photonic Crystal Detectors” (Qualcomm, San Diego)
- Christopher Wilcox, M.S. (Thesis), Fall 2005, “The Design of an Adaptive Tip/Tilt Mirror for Adaptive Optics”, (Continuing with PhD) (Naval Research Lab)
- Senthil Annamalai, M.S. (Thesis), Spring 2006, “Quantum Dots in a Well Detector grown by Molecular Beam Epitaxy and Metal Organic Chemical Vapor Deposition” (Triquint Semiconductors)
- Capt. Mario Serna, M.S. (Thesis) Summer 03, “Model and Fabrication of a Proof of Concept Polarimeter in a Pixel” (Presently Teaching Physics at the Airforce Academy in Colorado Springs)
- Sunil Raghavan, M.S. (Thesis), **with distinction**, Summer 03, “Intersubband Quantum Dots in a Well Infrared Detectors” (Research Engineer in India)

RESEARCH GRANTS

Cumulative External Funding Awarded from NSF, DARPA, AFRL, ARL, AFOSR, ARO, DIA, MDA, NRO, OARU > **\$7M**

- PI: "Study of Carrier Dynamics In InAs/InGaAs Strain Layer Superlattices and Self-Assembled Quantum Dots" Army Research Office, July 2002-July 2005: \$195,000
- PI: "Fabrication of Tunable, Polarization Sensitive QWIPs and Enhanced Coupling Grating Structures" Air Force Research Laboratory, awarded April 2001-July 2005: \$550,538
- PI: “Study of Carrier Dynamics Within Quantum Confined Energy Levels In Self-Assembled Quantum Dots”, Basic Energy Sciences, Department of Energy, Sept 2002-Sept 2005 : Total Award: \$675,000 (PI: Krishna, Co-PI: Huffaker)
- Oak Ridge Associated Universities Ralph E. Powe Junior Faculty Enhancement Award, June 2002-Dec 2003 : Total Award: \$10,000
- PI: “Self Assembled Quantum Dot Detectors for Chemical Agent Monitoring from Remote Sensing Platforms”, National Reconnaissance Organization, Performance Period: 10/27/2003 - 07/27/2004, Total Award: \$350,000 (PI: Krishna, Co-PI: Hayat and Tyo)
- PI: “High Power Mid Wave Infrared Semiconductor Lasers”, Missile Defense Agency: Period : 09/15/2003 - 09/14/2005 Total Award: \$302,122
- PI: “Femtosecond Mid Infrared Pump-Probe Spectroscopy System”, Army Research Office, June 2003-May 2004, Total Award: \$211, 235

- PI: “Development of High Temperature Long Wave Infrared Quantum Dot Detectors For Large Area Focal Plane Arrays”, Sandia University Research Program, Sept 2002-Sept 2004: \$70,000
- PI: “Polarimeter in a Pixel”, Air Force Office of Scientific Research Dec 2003-Nov 2006: Award: \$100K
- PI: “Long Wave Difference Frequency Spectroscopy System”, Army Research Office, June 2004-May 2005, Total Award: \$127, 805
- PI: “Spectrally Adaptive Smart Sensors Based on Nanoscale Quantum Dots”, National Science Foundation, Performance Period: 05/01/2004 - 04/30/2007, Total Award: \$210,000 (PI: Krishna, Co-PI: Hayat and Tyo)
- PI: “Quantum Dot Avalanche Photodiodes”, National Science Foundation, Performance Period: 10/01/2004 - 09/30/2007, Total Award: \$400,000 (PI: Krishna, Co-PI: Hayat)
- PI: “Bias Tunable Quantum Dot Detectors for MASINT Applications”, National Science Foundation and Defense Intelligence Agency, Performance Period: 08/01/2004 - 07/31/2007, Total Award: \$566,000 (PI: Krishna, Co-PI: Hayat and Tyo)
- Co-PI: "Advanced Sensors Consortium for Technological Alliance" Army Research Laboratory, June 2001-June 2006: \$100K year for my task on “Development of InAs/InGaSb Strain Layer Superlattices for MWIR/LWIR sensors”.
- PI: “Mid Infrared Focal Plane Array Characterization System”, Air Force Office of Scientific Research, May 2005-April 2006, Total Award: \$241K
- PI: “Spectrally Adaptive Nanoscale Sensors”, Director of Central Intelligence Program, July 2005-July 2008, Award: \$120K/year
- PI: “Mid Wave Infrared Semiconductor Lasers Based on GaAs Substrates”, Missile Defense Agency: Period : 10/2005-10/2007 Total Award: \$300K
- Co-PI: “High Operating Temperature (HOT) Mid-Wave Infrared Focal Plane Arrays” (Co-PI: Brueck; \$865K UNM Award in Phase I, Jan 2006-Jan 2007; Phase II Awarded: Jun 07, \$350K)
- PI: "Nanoscale Quantum Dot and Strain Layer Superlattice Based Sensors" Air Force Research Laboratory, awarded Oct 2006 \$327K
- Co-PI: Collaborative Research: Impact Ionization Engineered and Nanoscale Quantum-dot Based Avalanche Photodiodes”, NSF, May 2006-Apr2009) \$150K
- PI: “Fabrication and Characterization of Quantum Dot Detectors”, Sandia National Laboratories 08/01/06-09/30/07, \$150K
- PI: “Hyperspectral Sensors with Nanoscale Quantum Dots and Plasmon Assisted Photonic Crystal Cavities”, AFOSR/Caltech, May 2006-Apr 2009 \$361K
- Co-PI: “Intelligent and Adaptable Spectral Sensing Systems Based on Tunable Infrared Quantum-Dot Focal Plane Arrays” DIA/Caltech, July 2007-July 2008 \$411K
- PI: “Nanoscale Based Far Infrared and THz Detectors” Global Research Laboratory Program, Dec 2007-Dec 2013 \$750K
- PI: “Astronomical Application of Extended-Wavelength InGaAs Arrays and Development of Multi-Wavelength Vertical InGaAs Structures” University of Virginia and NSF, June 2007-May 2008 \$42K
- PI: “Aligner/Bonder for Fabricatio of Nanoscale Spectral and Polarimetric Sensors” AFOSR, June 2007-Aug 2008 \$125K
- PI: “North American Molecular Beam Epitaxy Conference” AFOSR and ARO, May 2008-Feb 2008 \$9K
- PI: “Development of Very Long Wave Infrared Detectors Based on Type II Strain Layer Superlattices” MDA-STTR, Nov 2007-Apr 2008 \$35K
- PI: “InAs/GaSb Based Type II Strain Layer Superlattice” MDA-STTR, Feb 2008-Jun 2008 \$40K

SIGNIFICANT RESEARCH ACHIEVEMENTS

- **Demonstration of the first FPA with strain layer superlattice based on nBn Design**
In collaboration with QmagiQ LLC, we have demonstrated the first MWIR InAs/GaSb SLS array with a nBn design using a 320x256 focal plane array with a noise equivalent temperature difference of 24mK at 77K
- **Demonstration of the first 640x512 Quantum Dot based Camera**
In collaboration with NASA JPL, we have demonstrated the first quantum dot camera using a 640x512 focal plane array with a noise equivalent temperature difference of 40mK at 60K
- **Demonstration of the first two color Quantum Dot based Camera**
In collaboration with QmagiQ LLC, we have demonstrated the first two color (MWIR/LWIR) quantum dot camera using a single bump 320x256 focal plane array.
- **Demonstration of the first long wave infrared Quantum Dot based Camera**
Recently, in collaboration with BAE systems and a spin-off from UNM, Zia Laser Inc, we have demonstrated the first two long wave infrared (LWIR) QD camera based on a 320x256 focal plane array.
- **Demonstration of MWIR InAs/GaSb SLS detector operating at Room Temperature**
Recently, we have demonstrated an InAs/InGaSb detector with $\lambda_c \sim 5\mu\text{m}$ operating at room temperature.
- **Demonstration of three color (MWIR/LWIR/VLWIR) DWELL detector**
We have recently demonstrated a 3 color quantum dot in a well detector with response in the MWIR ($\lambda_p \sim 4\mu\text{m}$), LWIR ($\lambda_p \sim 8\mu\text{m}$) and VLWIR ($\lambda_p \sim 23\mu\text{m}$) at 80K. This is the highest reported temperature for any intersubband VLWIR detector.
- **Operating Wavelength Control in DWELL detectors**
By heterostructure engineering of the DWELL structure, we have obtained spectral response tailorable from 7.2 to 10 μm , culminating in a single pixel detector spanning the entire LWIR atmospheric window (8-12 μm).
- **Demonstration of Smart DWELL Sensors**
We have observed quantum confined Stark effect in the DWELL detectors that we have fabricated. The raw data was fed into a projection algorithm developed by Prof. Hayat and Prof. Tyo to realize a “smart” detectors whose center wavelength and spectral width could be independently controlled.
- **Demonstration of LWIR QD detector with large responsivity and detectivity**
In collaboration with ARL and AFRL, we demonstrated a normal incidence QD detector operating at $\lambda = 7.2\mu\text{m}$ (spectral width $\sim 35\%$) with a large responsivity ($R_{\text{peak}} = 3.58\text{ A/W}$ at $T = 78\text{K}$) and a large detectivity ($D_{\text{peak}}^* = 2.7 \times 10^9\text{ cmHz}^{1/2}/\text{W}$, $T = 78\text{K}$).
- **Demonstration of MWIR QD detector at T=150K**
In collaboration with ARL, we demonstrated a normal incidence QD detector operating at 4 μm at $T = 150\text{K}$.
- **Strain patterning of growth front to achieve uniform QDs**
Using a layer of buried InAlAs stressor dots, InAs QDs with very low size fluctuations (PL linewidth = 19 meV at $T = 17\text{K}$) and increased areal density ($\sim 2 \times 10^{11}\text{ cm}^{-2}$) were grown on a GaAs substrate

- **Demonstration of the first quantum dot laser grown on a Si substrate**
Using a thermally cycled buffer layer, we demonstrated the first InGaAs QD laser grown on a silicon substrate. The large lattice and thermal mismatch between GaAs and Si created many dislocations and an optimized buffer layer was designed to filter these dislocations.
- **First demonstration of intersubband emission from QDs**
Demonstration of the first quantum dot intersubband LED and first demonstration of intraband gain and stimulated emission from self organized quantum dots at $13 \mu\text{m}$.

SELECTED PEER-REVIEWED PUBLICATIONS

- Fan, W; Zhang, S; Panoiu, NC; Abdenour, A; Krishna, S; Osgood, RM; Malloy, KJ; Brueck, SRJ “Second harmonic generation from a nanopatterned isotropic nonlinear material” NANO LETTERS; MAY 2006; v.6, no.5, p.1027-1030
- Sarath D. Gunapala, Sumith V. Bandara, Cory J. Hill, David Z. Ting, John K. Liu, Sir B. Rafol, Edward R. Blazewski, Jason M. Mumolo, Sam A. Keo, Sanjay Krishna, Y.-C. Chang, and Craig A. Shott, “640 512 Pixels Long-Wavelength Infrared (LWIR) Quantum-Dot Infrared Photodetector (QDIP) Imaging Focal Plane Array” IEEE JOURNAL OF QUANTUM ELECTRONICS, VOL. 43, NO. 3, MARCH 2007
- A. B. Weerasekara, M. B. M. Rinzan, S. G. Matsik, A. G. U. Perera, M. Buchanan, H. C. Liu, G. von Winckel, A. Stintz, and S. Krishna "n-type GaAs/AlGaAs Heterostructure detector with a 3.2 threshold frequency” Optics Letters, 32 (10), 1335-1337, (2007)
- S. Mallick, K. Banerjee, S. Ghosh, J. B. Rodriguez, and S. Krishna, “Midwavelength Infrared Avalanche Photodiode Using InAs–GaSb Strain Layer Superlattice”, IEEE Photonics Technology Letters, Vol. 19, No. 22, November 15(2007)
- E. Varley, M. Lenz, S. J. Lee, J. S. Brown, D. A. Ramirez, A. Stintz, and S. Krishna, Axel Reisinger and Mani Sundaram, “Single bump,two-color quantum dot camera”, APPLIED PHYSICS LETTERS 91, 081120(2007)
- Kartik Srinivasan, Matthew Borselli, Oskar Painter, Andreas Stintz and Sanjay Krishna “Cavity Q, mode volume, and lasing threshold in small diameter AlGaAs microdisks with embedded quantum dots”, Optics Express, Vol. 14, 1094, Feb 2006
- Statistical adaptive sensing by detectors with spectrally overlapping bands Ünal Sakoglu, Majeed M. Hayat, J. Scott Tyo, Philip Dowd, Senthil Annamalai, Kalyan T. Posani, and Sanjay Krishna Appl. Opt. 45, 7224 (2006)
- G. von Winckel, E. A. Coutias and S. Krishna "Spectral element modeling of semiconductor heterostructures" Mathematical and Computer Modeling, Volume 43, Issues 5-6, Pages 582-591 (March 2006)
- K.T. Posani, V. Tripathi, S. Annamalai, N.R. Weisse-Bernstein, S. Krishna, R. Perahia, O. Crisafulli and O.J. Painter, “Nanoscale Quantum-Dot Infrared Sensors with Photonic Crystal Cavity”, Appl. Phys. Lett, 88, 151104, 2006.
- Sanjay Krishna, “InAs/InGaAs Quantum Dots in a Well Photodetectors”, Journal of Physics D (Applied Physics); 7 July 2005; vol.38, no.13, p.2142-50
- S.Krishna, D. Forman, S. Annamalai, P. Dowd, P. Varangis, T. Tumolillo, A. Gray, J.Zilko, K. Sun, M. Liu, J. Campbell, D. Carothers “Demonstration of a 320 x 256 Two-Color Focal Plane Array Using InAs/InGaAs Quantum Dots in a Well Detectors” Appl. Phys. Lett, **86**, 193501, 2005.

- U. Sakoglu, J. S. Tyo, M. M. Hayat, S. Raghavan, and S. Krishna, " Spectrally adaptive infrared photodetectors using bias-tunable quantum dots" J. Opt. Soc. Am. B. Vol 21, p.7, Jan 2004.
- Kartik Srinivasan, Andreas Stintz, Sanjay Krishna, and Oskar Painter" Photoluminescence measurement of quantum-dot-containing semiconductor microdisk resonators using optical fiber taper waveguides" Physical Review B 72, 205318 (2005)
- G. Balakrishnan, S.H. Huang, A. Khoshakhlagh, P. Hill, A. Amtout, S. Krishna, G.P. Donati, L.R. Dawson and D.L. Huffaker, "Room-temperature optically-pumped InGaSb quantum well lasers monolithically grown on Si(100) substrate", IEE Electronics Letters, Vol. 41, No. 9, pg 531, 2005.
- Kartik Srinivasan, Matthew Borselli, Thomas J. Johnson, Paul E. Barclay, Oskar Painter, Andreas Stintz and Sanjay Krishna "Optical loss and lasing characteristics of high-quality-factor AlGaAs microdisk resonators with embedded quantum dots" Applied Physics Letters, v.86, no.15, p.151106, 2005.
- B. Kochman, A.D. Stiff-Roberts, S. Chakrabarti, J.D. Phillips, S. Krishna, J. Singh and P. Bhattacharya, " Absorption, Carrier Lifetime, and Gain in InAs-GaAs Quantum Dot Infrared Photodetectors", IEEE. J. Quant. Electron., **39**, 459, 2003.
- Matsik, SG; Rinzan, MBM; Esaev, DG; Perera, AGU; von Winckel, G; Stintz, A; Krishna, S; Liu, HC; Byloos, MD; Oogarah, T; Sproule, GI ; Liu, K ; Buchanan, M., "Effect of doped substrate on GaAs-AlGaAs interfacial workfunction IR detector response through cavity effect" IEEE Transactions on Electron Devices; v.52, no.3, p.413-418, Mar 2005
- P. Hill, N. Weisse-Bernstein, L. R. Dawson, P. Dowd, and S. Krishna, "Activation energies for Te and Be in metamorphically grown AlSb and InxAl1-xSb layers", Appl. Phys. Lett. **87**, 092105 (2005)
- E. Plis, P. Rotella, S. Raghavan, L. R. Dawson, S. Krishna, D. Le and C. P. Morath, "Growth of room-temperature "arsenic free" infrared photovoltaic detectors on GaSb substrate using metamorphic InAlSb digital alloy buffer layers" *Appl. Phys. Lett.*, **82**, 1658, 2003
- S. Krishna, S. Raghavan, G von Winckel, A. Stintz, , G. Ariyawansa, S.G. Matsik and A.G.U. Perera, "Three-Color ($\lambda_{p1} \sim 3.8 \mu\text{m}$, $\lambda_{p2} \sim 8.5 \mu\text{m}$ and $\lambda_{p3} \sim 23.2 \mu\text{m}$) InAs/InGaAs Quantum Dots In a Well Detector", *Appl. Phys. Lett.*, **83**, 2745, October 2003
- S. Krishna, A. Stiff, P. Bhattacharya, and S. Kennerly " Hot Dot Detectors", *IEEE Circuits and Devices*, p.14, January 2002.
- S. Raghavan, P. Rotella, A. Stintz, B. Fuchs, S. Krishna, C. Morath, D. A. Cardimona, and S.W. Kennerly, "High-Responsivity, Normal-Incidence Long-Wave Infrared ($\lambda \sim 7.2 \mu\text{m}$) InAs/In_{0.15}Ga_{0.85}As Dots-in-a-Well Detector", *Appl. Phys. Lett.*, **81** (6), 2002
- S. Krishna, P. Bhattacharya, J. Singh, T. Norris and J. Urayama, P.J. McCann and K. Namjou, "Intersubband Gain and Stimulated Emission in Long Wavelength ($\lambda=13 \mu\text{m}$) Intersubband Quantum Dot Emitters", *IEEE J. Quant. Electronics*, **37**, 1066, 2001.
- K. M. Lewis, Ç. Kurdak, S. Krishna and P. Bhattacharya, "Charge transformer to enhance noise performance of single-electron transistor amplifiers in high-capacitance applications", *Appl. Phys. Lett.*, **80**, 142, 2002.
- J. Sabarinathan, P. Bhattacharya, P-C. Yu, S. Krishna, J. Cheng, D. G. Steel, "An electrically injected InAs/GaAs quantum-dot photonic crystal microcavity light-emitting diode", *Appl. Phys. Lett.*, **81**, 3876, , 2002
- S. Krishna, K. Linder, and P. Bhattacharya, " Photoluminescence linewidth of self-organized In_{0.4}Ga_{0.6}As/GaAs quantum dots grown on InGaAlAs stressor dots", *J. Appl. Phys.*, **86**, 4691, 1999.

- S. Krishna, D. Zhu, J. Xu, K. K. Linder, O. Qasaimeh, P. Bhattacharya and D. L. Huffaker, " Structural and luminescence characteristics of cycled submonolayer InAs/GaAs quantum dots with room temperature emission at 1.3 μm ", *J. Appl. Phys.*, **86**, 6135, 1999.

PATENTS

- S. Krishna, M. Hayat, J. S. Tyo, U. Sakoglu and S. Raghavan "Spectrally Adaptive Quantum Dots In A Well Detector", US Patent Number 7,217,951, May 2007
- S. Krishna, M. Hayat, and J.P. David, "Intersubband detector with avalanche multiplier region", US Patent Number 7,271,405, September 2007.
- P. Dowd, P. Hill, L.R. Dawson and S. Krishna, "Semiconductor Conductive Layers", Provisional Patent Filed, June 2004. Docket number 1863.047PRV
- G.von Winckel, E.A. Coutsias and S. Krishna" Spectral Element Eigensolver for Inhomogenous Media", Utility Patent Filed, June 2005.
- S. Krishna and O. J. Painter, "High Performance Hyperspectral Detectors Using Photon Controlling Cavities" Utility Patent Filed, September 2005.
- S. Krishna, M.M. Hayat and J.S. Tyo, " The infrared retina", Provisional Patent filed, May 2007.
- S. Krishna, J.R. Meyer, I. Vurgaftman, "Heteroengineered pBp Semiconductor Devices with Optimized Carrier Transport", Provisional Patent Filed, March 2008

BOOK CHAPTERS

- S.Krishna, "Optoelectronic Properties of Self Assembled InAs/InGaAs Quantum Dots" in III-V Compound Semiconductor Heterojunctions: Physics And Devices, Publisher, Transworld Research, ISBN 81-7736-170-8, Editor: Will Z. Cai, 2003.
- P. Bhattacharya, S. Krishna, A. D. Stiff, " Quantum Dot Infrared Detectors and Sources", Int. Journal of High Speed Electronics and Systems, vol. 12, No. 4, pp. 969-994, 2002 (World Scientific Publishing Company)

LIST OF COLLABORATORS

Academic Institutions: Brueck and Hayat Group (UNM); Painter Group (Caltech); Campbell Group (UVA); Tyo Group (U of Arizona); Huffaker Group (UCLA); Perera Group (Georgia State Univ); Ghosh Group (UIC).

National and Federal Laboratories: Gunapala Group (NASA/JPL)Cardimona/Hubbs Group (AFRL/VSSS); Kennerly/Little/Svensson (ARL); Toni Taylor Group (LANL); Cederberg/Biefeld/Barbour(SNL)

Industry: Sundaram and Reisinger (QmagiQ LLC); Carothers and Uppal (BAE Systems); Jones (Santa Barbara Focal Plane and Lockheed Martin Co)

