

## Scott Daniel Sifferman

Microelectronics Research Center  
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**CITIZENSHIP**     United States of America

### EDUCATION

Aug. 2020 (*exp.*)     Ph.D. Candidate, Electrical Engineering, The University of Texas at Austin  
                                   Advisor: Professor Seth R. Bank  
                                   Dissertation: *Mid-Infrared Type-I Diode Laser Design using Molecular Beam Epitaxy*

June 2006             M.S., Electrical Engineering, Stanford University

May 2004             B.S.E., Electrical Engineering, Arizona State University  
                                   Minor, Mathematics  
                                   Honors Thesis: *An Active Antenna for a General Coverage Receiver and the Use of Negative Impedance Converters to Improve Frequency Bandwidth*

### PROFESSIONAL EXPERIENCE

2012–Present        Graduate Research Assistant, The University of Texas at Austin  
                                   Professor Seth R. Bank, Laboratory for Advanced Semiconductor Epitaxy

- Research and develop crystal growth techniques for highly-strained III-V and dilute bismide III-V semiconductor mid-infrared (3-5  $\mu\text{m}$ ) optoelectronic materials and devices using molecular beam epitaxy.
- Demonstrated the longest wavelength emission ( $>3.6 \mu\text{m}$ ) from a GaSb-based type-I diode laser with an aluminum-free active region.
- Demonstrated the first epitaxial growth of and first room-temperature photoluminescence from GaInAsSbBi alloys.
- Developed device growth and fabrication processes for III-V-based semiconductor lasers.
- Designed and implemented tools and techniques to maintain, repair, and operate two molecular beam epitaxy systems while avoiding time-consuming vacuum system bake-outs.
- Designed and built a pump-probe transmission test bench with sub-picosecond resolution to measure carrier recombination lifetimes in semiconductors.
- Improved several experimental test stations by adding automated testing capabilities.
- Repurposed an underutilized lab space into a Fourier transform infrared (FTIR) spectroscopy and infrared microscope analysis station.
- Supervised and directed the work of eight individuals participating in summer and semester research experiences.

2010–2012            Research and Development Engineer, MSS, Inc.

- Designed, prototyped, and tested optical sensing and object detection systems for automated recyclables sorting.
- Worked with mechanical, electrical, and software engineers to design sorting systems for materials recovery facilities.
- Designed and tested CPLD-based data processing and handling sub-systems.
- Created quality control checklists for electronics assembly and production.
- Created statistical models to improve material sorting and extraction probabilities.

2007–2010

Senior Engineer–Systems, General Dynamics Advanced Information Systems

- Supervised the operation of the General Dynamics Advanced Information Systems photonics laboratory and technical staff.
- Investigated emerging photonics technologies and collaborated with several teams to integrate devices into a proposed spacebased high-speed optical communications system.
- Created a graphical user interface using LabVIEW for a high-speed optical communications switch test bed.
- Performed system trades studies for satellite-based photonics communications systems.
- Measured transmission degradation in diffractive optics and polymer waveguides exposed to simulated space radiation.
- Designed and implemented regression testing of a GPS receiver module in development, and reported the test results.
- Simulated optical signal linearization techniques using oversampling methods.

2006–2007

Systems Engineer II, General Dynamics C4 Systems

- Supervised the General Dynamics C4 Systems photonics laboratory and expanded its testing capability and equipment.
- Calculated link budgets and size, weight, and power (SWaP) budgets for satellite-based optical communication systems.
- Measured light transmission in diffractive optical elements after exposure to various radiation levels.
- Investigated emerging photonics technology for space-based high-speed optical communications applications.

2005–2006

Graduate Research Assistant, Stanford University

Professor Martin M. Fejer, Center for Nonlinear Optical Materials

- Investigated nonlinear and ultrafast optical processes in periodically-poled lithium niobate.
- Built and tested a synchronously-pumped optical parametric oscillator to generate coherent mid-infrared radiation.
- Performed experimental investigations on the operation of synchronously-pumped optical parametric oscillators..
- Developed mathematical models of synchronously-pumped optical parametric oscillator characteristics using MATLAB.
- Supervised the optical test bench for a photoacoustic imaging experi-

ment.

- 2003–2004      Electrical Engineering Intern, General Dynamics C4 Systems (formerly Spectrum Astro, Inc.)
- Maintained the test bench and wrote data analysis software using Perl and MATLAB for a space fuel cell research project.
  - Designed a Thermal Interface Board for the Fermi Gamma-ray Space Telescope using Mentor Graphics Design Architect.
  - Assisted the Lead Engineer for Command and Data Handling on the NFIRE satellite.

## LEADERSHIP AND MENTORING EXPERIENCE

- Spring 2017      Research supervisor to an undergraduate student during the Spring semester, The University of Texas at Austin
- Summer 2016      Mentor, NNCI Summer Research Experience for Undergraduates, The University of Texas at Austin
- Spring 2016      Research supervisor to an undergraduate student during the Spring semester, The University of Texas at Austin
- Summer 2015      Mentor, NNIN and NASCENT Summer Research Experience, The University of Texas at Austin
- Spring 2015      Research supervisor to two undergraduate students during the Spring semester, The University of Texas at Austin
- Summer 2014      Mentor, National Science Foundation (NSF) Summer Research Experience for Teachers, The University of Texas at Austin
- 2009              Member, New Employee Engagement Committee, General Dynamics AIS
- 2003–2004      Treasurer, Eta Kappa Nu Student Chapter, Arizona State University
- 2002–2003      Senator, College of Engineering and Applied Sciences, Associated Students of Arizona State University
- Committees: Appropriations, Elections Screening Selection (Chair)
- Spring 2002      Representative, College of Engineering and Applied Sciences, Associated Students of Arizona State University Constitutional Convention

## COMMUNITY INVOLVEMENT AND OUTREACH

- Edison Lecture Series, The University of Texas at Austin (January 2020)
- Organized and presented demonstrations of waveguiding, birefringence, and linear polarization to middle- and high-school students.
- Redeemer Lutheran School Science Enrichment (May 2019)
- Presented demonstrations of waveguiding, birefringence, and linear polarization to elementary students.
- Northwest Family YMCA of Austin (Spring 2019)
- Coached youth (ages 4-6) soccer.
- Hope Children’s Center Science Days (February 2019)
- Presented demonstrations of light-matter interactions, light polarization, and birefringence to early education students.
- Redeemer Lutheran School, Pack 413 (2018-present)
- Assistant Den Leader; Pack Committee Chair

## Hope Children’s Center Science Days (March 2018)

- Presented demonstrations of light-matter interactions and light polarization to early education students.

## Austin Children’s Museum (Summer 2017)

- Led guided tours of the Microelectronics Research Center at the University of Texas at Austin for K-5 summer camp students.

## Hope Children’s Center Science Days (March 2017)

- Presented demonstrations of light polarization and light transit through waveguides to early education students.

## Northwest Family YMCA of Austin (Fall 2016 to Spring 2017)

- Coached youth (ages 4-6) soccer.

## Wonders of Light: Family Science Fun – International Year of Light 2015 (September 2015)

- Designed and implemented a set of interactive demonstrations to teach about light polarization and some of its applications in photonics systems and everyday life.

## Last Lecture Selection Board Member (Spring 2004)

- Selected several faculty from across Arizona State University to participate in an honorary lecture series.

## Honors Impact Talent Match Mentor (February 2001–December 2002)

- Coached soccer for elementary school-aged children.

**HONORS AND AWARDS**

2017–2020	Dr. Brooks Carlton Fowler Endowed Presidential Graduate Fellowship in Electrical and Computer Engineering, The University of Texas at Austin
2012–2016	Engineering Doctoral Fellowship, The University of Texas at Austin
2000–2004	Dean’s List, Arizona State University
2000–2004	Arizona State University Merit Scholarship, Arizona State University
2000	National Merit Finalist, National Merit Scholarship Corporation
1999	Eagle Scout, Boy Scouts of America

**MEMBERSHIPS AND AFFILIATIONS**

Member: IEEE (2001), The Optical Society (OSA) (2005), Tau Beta Pi (2002), Eta Kappa Nu (2003)

Licensed Amateur Radio Operator (Extra class, 2008)

**RELEVANT PROFESSIONAL SKILLS****Laboratory and Technical**

Molecular beam epitaxy; ultra-high vacuum equipment operation and maintenance (effusion cells, cryopumps, residual gas analyzers, etc.); electronic test bench (oscilloscope, function generator, power supplies, network analyzer, etc.); soldering and circuit assembly; nanofabrication and clean room techniques (photolithography, chemical vapor deposition, reactive ion etching, inductively-coupled plasma etching, electron beam metal evaporation, wet-bench, etc.); testing and analysis (photoluminescence, electroluminescence, X-ray diffractometry, reciprocal space mapping, transmission/reflection spectroscopy, Hall effect measurements, Fourier transform infrared spectroscopy, ellipsometry, optical microscopy,

atomic force microscopy (AFM), scanning electron microscopy (SEM))

### Technical software

MATLAB, Origin, NI LabVIEW, Altium Designer, Quartus FPGA Design, Mathematica, Advanced Design System (ADS), Mentor Graphics Design Manager and Design Architect, MathCad, Visual C++

### Programming languages

Perl, Python, C/C++, XML, Altera HDL, VHDL, HTML, PHP, CSS, JavaScript, SPICE, BASIC, Java,

### Other software

$\text{\TeX}/\text{\LaTeX}$ , Microsoft Office Suite, Adobe Photoshop and Illustrator

## PUBLICATIONS

Online (with links and PDFs):

<http://lase.ece.utexas.edu/publications.php?last=Sifferman>

### Refereed Journal Articles

1. R. Salas, S. Guchhait, **S.D. Sifferman**, K.M. McNicholas, V.D. Dasika, D. Jung, E.M. Krivoy, M.L. Lee, and S.R. Bank, "Growth rate and surfactant-assisted enhancements of rare-earth arsenide InGaAs nanocomposites for terahertz generation," *APL Materials*, vol. 5, no. 9, pp. 096106, Sept. 2017.
2. R. Salas, S. Guchhait, K.M. McNicholas, **S.D. Sifferman**, V.D. Dasika, D. Jung, E.M. Krivoy, M.L. Lee, and S.R. Bank, "Surfactant-assisted growth and properties of rare-earth arsenide InGaAs nanocomposites for terahertz generation," *Appl. Phys. Lett.*, vol. 108, no. 18, pp. 182102, May 2016.
3. (*Invited*) **S.D. Sifferman**, H.P. Nair, R. Salas, N.T. Sheehan, S.J. Maddox, A.M. Crook, and S.R. Bank, "Highly strained mid-infrared type-I diode lasers on GaSb," *IEEE J. Sel. Topics Quantum Electron.*, vol. 21, no. 6, pp. 248–257, Nov.-Dec. 2015.
4. R. Salas, S. Guchhait, **S.D. Sifferman**, K.M. McNicholas, V.D. Dasika, E.M. Krivoy, D. Jung, M.L. Lee, and S.R. Bank, "Growth and properties of rare-earth arsenide InGaAs nanocomposites for terahertz generation," *Appl. Phys. Lett.*, vol. 106, no. 8, pp. 081103, Feb. 2015.

### Conference Presentations

1. **S.D. Sifferman**, A.F. Briggs, S.J. Maddox, H.P. Nair, and S.R. Bank, "Highly strained, high indium content III-V materials toward 4-micron type-I emitters," *accepted to the 62th Electronic Materials Conf. (EMC)*, Columbus, OH, June 2020.
2. A.F. Briggs, **S.D. Sifferman**, K.J. Underwood, J.T. Gopinath, and S.R. Bank, "Externally applied strain on GaSb-based GaInAsSb quantum well membranes," *61th Electronic Materials Conference (EMC)*, Ann Arbor, MI, June 2019.
3. R. El-Jaroudi, N.T. Sheehan, K.M. McNicholas, D.J. Ironside, A.F. Briggs, A.M. Skipper, **S.D. Sifferman**, and S.R. Bank, "Strain engineering of nanomembranes with amorphous silicon," *60th Electronic Materials Conf. (EMC)*, Santa Barbara, CA, June 2018.
4. K.M. McNicholas, D.J. Ironside, R. El-Jaroudi, H. Maczko, G. Cossio, L.J. Nordin, **S.D. Sifferman**, R. Kudrawiec, E.T. Yu, D. Wasserman, and S. Bank, "BGaAs/GaP heteroepitaxy for strain-free luminescent layers on Si," *60th Electronic Materials Conf. (EMC)*, Santa Barbara, CA, June 2018.

5. A.K. Rockwell, Y. Yuan, S.D. March, A. Jones, M. Woodson, M. Ren, **S.D. Sifferman**, S.J. Maddox, J.C. Campbell, and S.R. Bank, "III-V digital alloys for mid-ir photodetectors," *60th Electronic Materials Conference (EMC)*, Santa Barbara, CA, June 2018.
6. **S.D. Sifferman**, M. Motyka, A.F. Briggs, K.J. Underwood, K.M. McNicholas, R. Kudrawiec, J.T. Gopinath, and S.R. Bank, "Dilute-bismide alloys for GaSb-based mid-infrared semiconductor lasers," *Conf. on Lasers and Electro Optics (CLEO)*, San Jose, CA, May 2018.
7. K.J. Underwood, A.F. Briggs, **S.D. Sifferman**, S.R. Bank, and J.T. Gopinath, "Auger recombination in mid-infrared active regions," *Conf. on Lasers and Electro Optics (CLEO)*, San Jose, CA, May 2018.
8. K.M. McNicholas, R.H. El-Jaroudi, A.F. Briggs, S.D. March, **S.D. Sifferman**, and S. Bank, "Growth and properties of Boron-III-As alloy," *59th Electronic Materials Conference (EMC)*, South Bend, IN, June 2017.
9. K.M. McNicholas, R. Salas, **S.D. Sifferman**, D. Jung, M.L. Lee, and S.R. Bank, "Growth rate dependent surface morphology of rare earth arsenide films," *59th Electronic Materials Conference (EMC)*, South Bend, IN, June 2017.
10. A.K. Rockwell, M. Woodson, M. Ren, S.J. Maddox, **S.D. Sifferman**, J.C. Campbell, and S.R. Bank, "Surfactant-mediated epitaxy of III-V digital alloys," *59th Electronic Materials Conference (EMC)*, South Bend, IN, June 2017.
11. **S.D. Sifferman**, A.K. Rockwell, K.M. McNicholas, Y. Sun, R. Salas, S.J. Maddox, H.P. Nair, M.L. Lee, and S.R. Bank, "The effects of a bismuth flux on strained-layer III-V optical materials," *59th Electronic Materials Conference (EMC)*, South Bend, IN, June 2017.
12. A.K. Rockwell, S.J. Maddox, Y. Sun, D. Jung, **S.D. Sifferman**, S.D. March, M.L. Lee, and S.R. Bank, "Growth and properties of broadly-tunable AlInAsSb digital alloys on GaSb," *32nd North American Conference on Molecular Beam Epitaxy (NAMBE)*, Saratoga Springs, NY, Sept. 2016.
13. A.K. Rockwell, S.J. Maddox, D. Jung, Y. Sun, **S.D. Sifferman**, W. Sun, M. Ren, J. Guo, J.C. Campbell, M.L. Lee, and S.R. Bank, "The effect of period thickness on AlInAsSb digital alloys on GaSb," *58th Electronic Materials Conf. (EMC)*, Newark, DE, June 2016.
14. (**Invited**) S.R. Bank, **S.D. Sifferman**, H.P. Nair, R. Salas, N.T. Sheehan, S.J. Maddox, and A.M. Crook, "Highly strained type-I diode lasers on GaSb," *SPIE Photonics West OPTO*, San Francisco, CA, Feb. 2016.
15. K.M. McNicholas, E.M. Krivoy, R. Salas, **S.D. Sifferman**, and S.R. Bank, "Tunable, lattice-matched, epitaxial semimetals," *57th Electronic Materials Conf. (EMC)*, Columbus, OH, June 2015.
16. R. Salas, N.T. Sheehan, S. Guchhait, K.M. McNicholas, **S.D. Sifferman**, V.D. Dasika, E.M. Krivoy, and S.R. Bank, "Properties of growth enhanced ErAs:InGaAs nanocomposites," *57th Electronic Materials Conf. (EMC)*, Columbus, OH, June 2015.
17. **S.D. Sifferman**, R. Salas, S.J. Maddox, H.P. Nair, N.T. Sheehan, E.M. Krivoy, E.S. Walker, and S.R. Bank, "Surfactant-mediated growth of highly strained materials for mid-infrared applications," *57th Electronic Materials Conf. (EMC)*, Columbus, OH, June 2015.
18. R. Salas, S. Guchhait, **S.D. Sifferman**, K.M. McNicholas, V.D. Dasika, D. Jung, M.L. Lee, and S.R. Bank, "Surfactant-mediated growth of RE-As:InGaAs nanocomposites," *International Molecular Beam Epitaxy Conf. (IMBE)*, Flagstaff, AZ, Sept. 2014.
19. R. Salas, S. Guchhait, **S.D. Sifferman**, K.M. McNicholas, V.D. Dasika, D.J. Ironside, E.M. Krivoy, S.J. Maddox, D. Jung, M.L. Lee, and S.R. Bank, "Properties of RE-As:InGaAs nanocomposites," *56th Electronic Materials Conf. (EMC)*, Santa Barbara, CA, June 2014.
20. **S.D. Sifferman**, J.W. Schwede, D.C. Riley, R.T. Howe, Z.-X. Shen, N.A. Melosh, and S.R. Bank, "Compositionally-graded structures for photon-enhanced thermionic emitters," *56th Electronic Materials Conf. (EMC)*, Santa Barbara, CA, June 2014.

21. S. Vaithilingam, I.O. Wygant, **S. Sifferman**, X. Zhuang, Y. Furukawa, Ö. Oralkan, S. Keren, S.S. Gambhir, and B.T. Khuri-Yakub, “1E-3 tomographic photoacoustic imaging using capacitive micromachined ultrasonic transducer (CMUT) technology,” *2006 IEEE Ultrasonics Symposium*, pp. 397–400, Vancouver, BC, Oct. 2006.