

Samuel James Bader

Curriculum Vitae

Contact Information

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Summary

I am a doctoral student at Cornell University in the Department of Applied and Engineering Physics. After earning my BS in Physics from the Massachusetts Institute of Technology and working for a year at Analog Devices, I enrolled in Cornell's PhD program and joined the Jena-Xing Research Group, which bridges Electrical Engineering, Materials Science, and Applied Physics. My research centers on modelling, characterization, design, and development of next-generation III-Nitride transistors, with strong interests in simulation techniques, device physics, quantum effects, and evaluating novel heterostructures.

Education

(Expected) Cornell University, Ithaca, NY
PhD, Department of Applied and Engineering Physics

2014 Massachusetts Institute of Technology, Cambridge, MA
BS, Department of Physics
Thesis: "Higher Levels of the Transmon Qubit"

Journal Publications

Links available on website: <http://sambader.net/works>

10. Large-area MBE growth of GaN/AlN heterojunction with polarization-induced 2-dimensional hole gas
Reet Chaudhuri, **Samuel James Bader**, Huili (Grace) Xing, Debdeep Jena,
in submission

9. High Breakdown Voltage in RF AlN/GaN/AlN Quantum Well HEMTs
Austin Hickman, Reet Chaudhuri, **Samuel James Bader**, Kazuki Nomoto,
Kevin Lee, Huili Grace Xing, Debdeep Jena,
IEEE Electron Device Letters 40(8), 1293-1296 (2019).
8. Wurtzite Phonons and the Mobility of a GaN / AlN 2D Hole Gas
Samuel James Bader, Reet Chaudhuri, Martin F. Schubert, Han Wui Then,
Huili Grace Xing, Debdeep Jena,
Applied Physics Letters 114(253501), 1-5 (2019).
7. A polarization-induced 2D hole gas in undoped gallium nitride quantum wells
Reet Chaudhuri, **Samuel James Bader**, Zhen Chen, David A. Muller, Huili
Xing, Debdeep Jena,
Science 365(6460), 1454-1457 (2019).
6. Gate-recessed E-mode p-channel HFET with high on-current based on GaN/AlN
2D hole gas
Samuel James Bader, Reet Chaudhuri, Kazuki Nomoto, Austin Hickman, Zhen
Chen, Han Wui Then, David A Muller, Huili Grace Xing, Debdeep Jena,
IEEE Electron Device Letters 39(12), 1848-1851 (2018).
5. A New Holistic Model of 2-D Semiconductor FETs
Enrique G. Marin, **Samuel James Bader**, Debdeep Jena,
IEEE Transactions on Electron Devices 65(3), 1239-1245 (2018).
4. Terahertz spectroscopy of an electron-hole bilayer system
in AlN/GaN/AlN quantum wells
H. Condori Quispe, S. M. Islam, **S. Bader**, A. Chanana, K. Lee, R. Chaudhuri,
A. Nahata, H. G. Xing, D. Jena, B. Sensale-Rodriguez,
Applied Physics Letters 111(7), 073102 (2017).
3. High breakdown single-crystal GaN p-n diodes by molecular beam epitaxy
Meng Qi, Kazuki Nomoto, Mingda Zhu, Zongyang Hu, Yuning Zhao, Vladimir
Protasenko, Bo Song, Xiaodong Yan, Guowang Li, Jai Verma, **Samuel Bader**,
Patrick Fay, Huili Grace Xing, Debdeep Jena,
Applied Physics Letters 107(23), 232101 (2015).
2. Coherence and decay of higher energy levels of a superconducting transmon qubit
Michael J. Peterer, **Samuel J. Bader**, Xiaoyue Jin, Fei Yan, Archana Kamal,
Theodore J. Gudmundsen, Peter J. Leek, Terry P. Orlando, William D. Oliver,
Simon Gustavsson,
Physical Review Letters 114(1), 010501 (2015).
1. Effective incidence angles of sky-diffuse and ground-reflected irradiance
for various incidence angle modifier types
Ehud Strobach, David Faiman, **Samuel James Bader**, Samuel J. Hile,
Solar Energy 89, 81-88 (2013).

Conference Publications

Links available on website: <http://sambader.net/works>

6. GaN/AlN Schottky-gate p-channel HFETs with InGaN contacts and 100 mA/mm on-current
Samuel James Bader, Reet Chaudhuri, Austin Hickman, Kazuki Nomoto, Shyam Bharadwaj, Han Wui Then, Huili Grace Xing, Debdeep Jena,
International Electron Devices Meeting (2019).
5. Molecular Beam Epitaxy of High Mobility AlN/GaN/AlN Quantum Well FET Structures on 6H-SiC
Reet Chaudhuri, **Samuel Bader**, Austin Hickman, SM Islam, Huili (Grace) Xing, Debdeep Jena,
Proceedings of IWPSD (2017).
4. Wide-bandgap Gallium Nitride p-channel MISFETs with enhanced performance at high temperature
Kazuki Nomoto, **Samuel James Bader**, Kevin Lee, Shyam Bharadwaj, Zongyang Hu, Huili Grace Xing, Debdeep Jena,
Device Research Conference - Conference Digest, DRC (2017).
3. S-shaped negative differential resistance in III-Nitride blue quantum-well laser diodes grown by plasma-assisted MBE
Henryk Turski, Rusen Yan, **Samuel J. Bader**, Grzegorz Muziol, Czeslaw Skierbiszewski, Huili Grace Xing, Debdeep Jena,
Device Research Conference - Conference Digest, DRC (2017).
2. Introducing the spiked p-n junction for tunnel devices and current gain
Samuel James Bader, Debdeep Jena,
Device Research Conference - Conference Digest, DRC (2016).
1. CPV Vs. PV from a grid-matching perspective
E. Strobach, **S. Bader**, D. Faiman, A. A. Solomon, G. Meron,
AIP Conference Proceedings (2012).

Conference Presentations

13. Fully passivated InAlN/GaN HEMTs on silicon with f_T/f_{MAX} of 144/141 GHz
Kazuki Nomoto, Ming Pan, Zongyang Hu, Jeffrey Miller, Wenshen Li, Austin Hickman, Kevin Lee, **Samuel James Bader**, Soo Min Lee, Debdeep Jena, Huili (Grace) Xing,
Topical Workshop on Heterostructure Microelectronics (2019).
12. The Mobility of a GaN-on-AlN Two-Dimensional Hole Gas
Samuel J. Bader, Reet Chaudhuri, Grace Xing, Debdeep Jena,
International Conference on Nitride Semiconductors (2019).

11. 2D Electron-Hole Gas Bilayers in Undoped AlN/GaN/AlN
Reet Chaudhuri, Jeffrey Miller, **Samuel James Bader**, Grace Xing, Debdeep Jena,
International Conference on Nitride Semiconductors (2019).
10. Record Small-Signal RF and Off-State Breakdown Characteristics in AlN GaNAIN HEMTs
Austin L. Hickman, Reet Chaudhuri, **Samuel James Bader**, Kazuki Nomoto, Debdeep Jena, Grace Xing,
International Conference on Nitride Semiconductors (2019).
9. Contactless Electroreflectance Studies of the Surface Fermi Level in GaN/ AlN Heterostructures with Buried 2D Hole Gas
Lukasz Janicki, Reet Chaudhuri, **Samuel James Bader**, Grace Xing, Debdeep Jena, Robert Kudrawiec,
International Conference on Nitride Semiconductors (2019).
8. GaN-on-AlN as a Superior Platform for Integrated Wide-bandgap Electronics
Samuel James Bader, Austin Hickman, Reet Chaudhuri, Kazuki Nomoto, Han Wui Then, Huili (Grace) Xing, Debdeep Jena,
Government Microcircuit Applications and Critical Technology Conference (2019).
7. The GaN-on-AlN Platform for Integrated Wide-bandgap Electronics
Samuel James Bader, Austin Hickman, Reet Chaudhuri, Kazuki Nomoto, Huili (Grace) Xing, Debdeep Jena,
SRC Student Poster at IEEE International Electron Devices Meeting (2018).
6. Enhancement-mode GaN-on-AlN p-channel HFETs with record on-current
Samuel James Bader, Reet Chaudhuri, Shyam Bharadwaj, Austin Hickman, Kazuki Nomoto, Han Wui Then, Huili (Grace) Xing, Debdeep Jena,
International Workshop on Nitrides (2018).
5. Polarization-induced 2D Hole Gas in Undoped GaN/AlN Heterostructures
Reet Chaudhuri, **Samuel Bader**, Zhen Chen, David Muller, Huili Xing, Debdeep Jena,
International Workshop on Nitrides (2018).
4. First RF Strained AlN/GaN/AlN Quantum Well HEMTs on 6H-SiC
Austin Hickman, **Samuel James Bader**, Reet Chaudhuri, Kazuki Nomoto, SM Islam, Huili (Grace) Xing, Debdeep Jena,
International Workshop on Nitrides (2018).
3. 2D Hole Gas in MBE grown GaN/AlN Heterostructures
Reet Chaudhuri, **Samuel Bader**, Austin Hickman, Ryan Page, Huili Xing, Debdeep Jena,
Electronic Materials Conference (2018).
2. High-Voltage Properties of Strained GaN Quantum Well HEMTs on AlN
Austin Hickman, **Samuel James Bader**, Reet Chaudhuri, Kazuki Nomoto, SM Islam, Huili (Grace) Xing, Debdeep Jena,
Compound Semiconductor Week (2018).

1. GaN/AlN Quantum Well FETs on AlN/SiC Platform Using High Temperature MBE Growth
Reet Chaudhuri, SM Islam, **Samuel Bader**, Austin Lee Hickman, Shyam Bharadwaj, Huili (Grace) Xing, Debdeep Jena,
Electronic Materials Conference (2017).

Books and Chapters

1. Linearity Aspects of High Power Amplification in GaN Transistors
Samuel James Bader, Keisuke Shinohara, Alyosha Molnar,
in *High-frequency GaN Electronic Devices* published by Springer (2020).

Patents

2. A high-voltage p-channel FET based on III-Nitride heterostructures
Samuel James Bader, Reet Chaudhuri, Debdeep Jena, Huili Grace Xing,
Pending (16676083), submitted 2019.
1. Polarization-induced 2D hole gases for high-voltage p-channel transistors
Reet Chaudhuri, **Samuel James Bader**, Debdeep Jena, Huili Grace Xing,
Pending (PCT/US2019/042584), submitted 2019.

Further Experience

- Summer 2019 **Google X**, Mountain View, CA
Resident
Initiated and developed a (confidential) early-stage moonshot
- Summer 2016 **Analog Devices**, Wilmington, MA
Design Intern
Established automated characterization/parameter extraction flow for Gallium Nitride transistors in development, and modelled HEMTs (Synopsys Sentaurus) to engineer appropriate field plates.
- 2014-2015 **Analog Devices**, Wilmington, MA
Design Intern

Led an process study to determine the effects of a new substrate treatment. Lead a combined simulation (EMX) and measurement effort to refine calibration structures for varactor diodes and BJTs. Specified and designed a database infrastructure (MySQL) and interface (HTML5/Javascript/PHP) to manage the data flow from external and internal foundries. Designed and coded custom yield and variability analysis tools (on the SAS JMP platform) for process development.

- Spring 2014 **Superconducting Circ./Quantum Comp. Group**, MIT
Thesis Intern
Tested and built simulations (in NumPy/SciPy) for superconducting circuits. Simulations captured previously unknown spectroscopic features, explaining the source of poor device operation.
- 2012-2013 **Quanta Research Group**, MIT
Undergraduate Researcher
Constructed an active-feedback laser stabilization mechanism to cool trapped ions for experimentation; this project required FPGA programming (Verilog), optical breadboarding, circuit design, machining work, and Python GUI design. Maintained and extended the lab control software (in Python), added automated database-logging functionality (MySQL) and a small web interface (PHP) to manage data and equipment outputs.
- Summer 2012 **Institute for Quantum Computing**, Waterloo, Ontario
Intern
Collaborated on a computational search for a super-additive quantum channel; this involved coding optimization problems on a parallelized MATLAB computing platform.
- Summer 2011 **Ben Gurion National Solar Energy Center**, Israel
Intern
Simulated (with MATLAB) large-scale photovoltaic and concentrator photovoltaic plants and grid/storage interaction to assess solar options for Israeli power needs, providing a numerical basis for solar policy.
- Spring 2011 **Department of Physics**, MIT
Course Tutor
Held twice-weekly office hours to tutor students of *Electricity and Magnetism*, and met weekly with the course faculty to discuss and coordinate the progress of the class.
- Summer 2010 **WeatherPredict Consulting, Inc**, Raleigh, NC
Intern

Researched the prospects of improving WeatherPredict's crop yield models by augmenting their private satellite data with underutilized but publicly available government statistics.

Mentorship and Outreach

During my PhD, I have overseen two undergraduate projects, one student running XRD measurements of nitride heterostructures, and another student setting up C-V measurement capability for an undergraduate lab. I maintain the probe stations in an undergraduate lab for use in ECE courses. In addition, I have been a regular participant in the annual month-long Adopt a Physicist program, where I'm matched with high school classrooms to discuss with students what it means to be a physics major.