

# Nathan Siwak

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## Education

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### **PhD Candidate in Electrical Engineering, 2008-present**

- University of Maryland, College Park
  - Advisor: Reza Ghodssi
  - Dissertation topic: "Integrated Indium Phosphide MEMS Cantilever Chemical Sensors"
  - Expected graduation: Winter 2010

### **M.S. in Electrical Engineering, 2007**

- University of Maryland, College Park
  - Major: Microelectronics
  - Advisor: Reza Ghodssi
  - Thesis: "Indium Phosphide MEMS Cantilever Waveguides for Chemical Sensing with Integrated Optical Readout"
  - Cumulative GPA: 3.884

### **B.S. in Electrical Engineering and Physics, 2004**

- University of Maryland, College Park
  - Completed credits: 159
  - Cumulative GPA: 3.807

## Work/Research Experience

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### **MEMS Sensors and Actuators Laboratory – University of Maryland (2004-present)**

*Currently PhD candidate working on III-V MOEMS devices toward chemical sensing applications.*

#### Projects

- Designed, fabricated, and tested improved III-V cantilever resonator sensors with integrated photodetectors
- Utilized cantilever resonator sensors to measure absorption of chemical vapors
- Performing initial design and fabrication of a fully integrated III-V chemical sensor using Indium phosphide laser growths

### **Laboratory for the Physical Sciences - Quantum Computing Group (2003-2005)**

*Undergraduate research assistant. Assisted grad students working on quantum nano-mechanical research, low temperature, high precision physics.*

#### Projects

- Interfaced low-excitation resistance bridge using Labview programming language.
- Re-design of cooling stage on dilution refrigerator to achieve lower sample temperatures
- Began development of ultra-sensitive gyroscope device (NASA affiliated).

### **University of Maryland Physics Machine Shop (2001-2003)**

*Student machinist, chemical process specialist.*

#### Projects

- Designed and fabricated sample holders for Solomon's island water quality experiments.
- Assisted senior machinists in fabrication of scientific test equipment, including:
  - Thin film deposition device.
  - Spin-mass interaction detector.

# Technical Skills

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## Computer programs

- Computer Aided Design
  - AutoCAD, PSpice, L-Edit.
- Applications
  - Adobe Photoshop, Corel Suite, Microsoft Office, Origin, Matlab, Mathematica.
- Programming languages
  - Labview, C, Matlab, Mathematica, HTML.

## Design & Measurement

- Experience and knowledge operating scanning electron Microscopes for process characterization and meteorology.
- Measurement and design of optical systems, pulsed laser and photodetector characterization, fiber-optic components.
- Common laboratory measurement apparatus: Oscilloscopes, spectrum analyzers, network analyzers, semiconductor parameter analyzers.
- Knowledge of advanced principles in designing scientific apparatus.
- Machining experience with a wide range of materials and applications.
- High speed, RF, signal mixing, low temperature measurement techniques.

## Chemical processes

- Various plating processes and techniques.
  - Anodizing, irriditing, electropolishing, stripping.
- Cleanroom processes
  - Metal deposition (thermal and e-beam), RIE and wet etching techniques, photolithography (contact and projection), ICP etching, PECVD deposition, wafer thinning.

# Accomplishments

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- Received the Achievement Rewards for College Scholars (ARCS) foundation fellowship and nominated as the Lockheed Martin Scholar ('09-'10)
- Awarded "Best poster" at the *3rd annual IEEE LEOS Baltimore and Washington-Northern Virginia Graduate Student Poster Competition* ('07)
- Fundraising chair of Eta Kappa Nu Electrical and Computer Engineering society ('04).
- Member of Golden Key International Honor Society ('02).
- Joined National Collegiate Honor Society ('01).
- Achieved academic honors 8 of 9 semesters enrolled at University Of Maryland as an undergraduate.

# Thesis

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## Conference Presentations

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- N. Siwak, X. Z. Fan, and R. Ghodssi, "Indium Phosphide Resonant Chemical Sensor with a Monolithically Integrated Optical Readout Scheme," *Proceedings of The 6th Annual IEEE Conference on Sensors (IEEE Sensors 2007)*, Atlanta, Georgia, USA, October 28 - 31, 2007.
- D. Hines, E. Williams, N. Siwak, and R. Ghodssi, "The Application of Nanoimprint Lithography and Transfer Printing in the Fabrication of Electronic and Mechanical Systems onto Flexible Substrates," *2009 Nanoelectronic Devices for Defense & Security (NANO-DDS)*, Fort Lauderdale, FL, September 28-October 2, 2009.
- X. Z. Fan, N. Siwak, S. Kanakaraju, C. Richardson, and R. Ghodssi, "A Chemical Sensing Microsystem Utilizing an Adaptive Feedback Circuit," *The 15th International Conference on Solid-State Sensors, Actuators, and Microsystems (Transducers '09)*, Denver, CO, June 21 - 25, 2009.
- N. Siwak, X. Z. Fan, and R. Ghodssi, "Towards an Integrated Chemical Sensor Microsystem Utilizing Indium Phosphide Cantilevers and a Novel Feedback Circuit," *EUROPTROBE IX*, Dublin, Ireland, March 30 - April 2, 2008.
- X. Z. Fan, N. Siwak, and R. Ghodssi, "Towards a Smart Adaptive Feedback Circuit for Microsensors," *International Semiconductor Device Research Symposium (ISRS 2007)*, College Park, MD, December 11 - 14, 2007.
- N. Siwak, X. Z. Fan, and R. Ghodssi, "Indium Phosphide Resonant Chemical Sensor with a Monolithically Integrated Optical Readout Scheme," *Proceedings of The 6th Annual IEEE Conference on Sensors (IEEE Sensors 2007)*, Atlanta, Georgia, USA, October 28 - 31, 2007.
- N. Siwak, X. Z. Fan, D. Hines, E. Williams, N. Goldsman, and R. Ghodssi, "Chemical Sensor Utilizing Indium Phosphide Cantilevers and Pentacene as a Functionalization Layer" *20th IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2007)*, Kobe, Japan, January 21 - 25, 2007.
- R. Ghodssi and N. Siwak, "InP-based MEMS and NEMS devices for biosensing," *SPIE Symposium on Optics & Photonics*, San Diego, California, USA, August 13-17, 2006, *Invited Talk*.
- N. Siwak, J. McGee, and R. Ghodssi, "Indium Phosphide Optical MEMS for Chemical and Biological Sensing," *IEEE/NLM Life Science Systems and Applications Workshop*, Bethesda, MD, July 13-14, 2006.
- N. Siwak, J. McGee, and R. Ghodssi, "InP Optical MEMS for Integrated Sensing and Photonics Applications," *2006 Solid-State Sensor, Actuator and Microsystems Workshop (Hilton Head 2006)*, Open Poster Session, Hilton Head, SC, June 4-8, 2006.
- N. Siwak, M. W. Pruessner, J. McGee, and R. Ghodssi, "Indium Phosphide MEMS for Integrated Bio-Sensing," *International Semiconductor Device Research Symposium 2005 (ISDRS 2005)*, Bethesda, MD, December 7-9, 2005.

## Journal Publications

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- N. Siwak, X. Z. Fan, D. Hines, S. Kanakaraju, E. Williams, N. Goldsman, and R. Ghodssi, "Indium Phosphide MEMS Cantilever Resonator Sensors Utilizing a Pentacene Absorption Layer," *Journal of Microelectromechanical Systems (JMEMS)*, In press March 2009.
- M. W. Pruessner, N. Siwak, K. Amarnath, S. Kanakaraju, W.-H. Chuang and R. Ghodssi, "End-coupled Optical waveguide MEMS Devices in the Indium Phosphide Material System," *Journal of Micromechanics and Microengineering (JMM)*, Vol. 16, pp. 832-842, April 2006.