Joseph Bernhardt Geddes III

Contact

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Experience

Founder and Chief Engineer
Advanced Synthetic Materials (2015–)

Technical Consultant
Independent Contractor (2011–)

Engineer and Scientist
Technical Staff
Rolith Incorporated (2012–2015)

Postdoctoral Research Associate
Three-Dimensional Micro- and Nano-Systems Laboratory
Beckman Institute and Department of Materials Science & Engineering
University of Illinois at Urbana-Champaign (2010–2012)

Postdoctoral Research Associate
Biophotonics Imaging Laboratory
Beckman Institute, University of Illinois at Urbana-Champaign (2009)

Beckman Postdoctoral Fellow
Beckman Institute, University of Illinois at Urbana-Champaign (2006–2009)

Software Developer
Remcom, State College, PA (2006)

Education

Doctor of Philosophy in Engineering Science and Mechanics
The Pennsylvania State University, University Park, PA (2002–2006)

— Graduated: May 2006
— Thesis: Manipulation of optical pulses with chiral sculptured thin films
— Advisor: Akhlesh Lakhtakia

Master of Science in Engineering Science
The Pennsylvania State University, University Park, PA (2000–2001)

— Graduated: May 2001
— Thesis: Traversal of optical pulses through dielectric thin-film helicoidal bianisotropic mediums
— Advisor: Akhlesh Lakhtakia

Bachelor of Science in Engineering Science
The Pennsylvania State University, University Park, PA (1997–2001)

— Graduated: May 2001 with Honors and Minor in Engineering Mechanics
— Thesis: Circular Bragg phenomenon and pulse bleeding in cholesteric liquid crystals
— Advisor: Akhlesh Lakhtakia

Research

Founder and Chief Engineer
Advanced Synthetic Materials, Pleasanton, CA (2015–)

— Invented key method for scaling dynamic holographic lithography to large material dimensions and high patterning rates, which is needed for manufacturing three-dimensional nanostructured materials by industry.
— Responsible for all business and technical development.

Rolling Mask Lithography for Large-Area Nanopatterning
Member of the Technical Staff, Rolith Incorporated, Pleasanton, CA (2012–2015)

— Contributed theoretical insights and experimental development for novel contact photolithographic process using a rolling phase mask to create nanostructured coatings over large areas.
— Constructed mathematical models of broadband moth-eye antireflection coatings; identified key structural parameters to ensure coating performance.
— Lithographed antireflection coatings and measured their resulting optical properties.
— Improved rolling mask lithography process to improve nanopatterning quality and increase patterned substrate area up to meter length.
— Constructed mathematical models of transparent metal electrodes, and developed a lithography process for patterning them.

Design and Testing of Optical Materials and Systems
Postdoctoral Fellow, Beckman Institute and Department of Materials Science & Engineering University of Illinois at Urbana-Champaign (2006–2012)

— Led project to model properties, design device targets, and make nanoporous silicon exhibiting gradient refractive index via controlled electrochemical etching *(PI: Paul Braun)*.
— Designed applications for overlapping transfer-printed optical scales, and made functional tethers for scales via photolithography *(PIs: Paul Braun & John Rogers)*.
— Modeled process for holographic fabrication of photonic crystals and compared models to x-ray computed tomography data *(PI: Paul Braun)*.
— Made band structure calculations and helped develop density of states calculations for inverse opal photonic crystals with embedded light-emitting planar defects *(PI: Paul Braun)*.
— Built spectrophotometer and mechanical testing rig to measure remittance spectra of polymers incorporating mechanochemical moieties *(PI: Paul Braun)*.
— Designed optics, assembled hardware, wrote codes, and installed software for four-circle optical diffractometer *(PIs: Pierre Wiltzius & Paul Braun)*.
— Led project to develop metal-dielectric metamaterials exhibiting enhanced nonlinear optical properties; designed metamaterials and supervised experiments *(PI: Paul Braun)*.
— Performed calculations and built systems for development of nonlinear optical vibrational spectroscopy exhibiting molecular specificity *(PI: Stephen Boppart)*.
— Modeled and designed experiment to demonstrate advantages of electronic eye comprising semiconductor photodetectors transferred to curved substrates *(PI: John Rogers)*.
— Modeled optics of microlens concentrators for silicon solar cells arrays on semi-transparent, mechanically flexible substrates *(PI: John Rogers)*.
— Developed algorithms to calculate reflection and transmission spectra of holographic photonic crystals *(PI: Pierre Wiltzius)*.
— Performed calculations that resolved controversy concerning refractive index of active two-component media.
— Mentored graduate students in conduct of research on optics of metamaterials, photonic crystals, and nonlinear optical vibrational spectroscopy exhibiting molecular specificity.

Electromagnetic Wave Propagation Codes
Software Developer, Remcom, State College, PA (2006)

— Extended capability of finite-difference time-domain codes used to predict characteristics of radio pulse propagation over long distances.
— Explained puzzling numerical group dispersion phenomenon.

Optics of Nanoengineered Sculptured Thin Films
Graduate/Undergraduate Research Assistant, Penn State University (1998–2006)

— Developed numerical models of optical pulsed plane wave and beam propagation through cholesteric liquid crystals and chiral sculptured thin films *(PI: Akhlesh Lakhtakia)*.

— Treated electromagnetic properties in completely causal way, an important advance over previous calculations on such materials.

— Identified spatiotemporal signature of circular Bragg phenomenon as pulse bleeding.

— Studied effects of carrier phase and nonlinearity on shaping of pulsed plane waves.

— Identified new connections between phase, length, and time in nanotechnology for optics.

— Quantified effects of sculptured thin films on durations and average speeds of pulsed plane waves.

— Implemented new finite-difference algorithms at Pittsburgh Supercomputing Center.

Remote Sensing and Atmospheric Science
Undergraduate Research Assistant, Penn State University (1997–2001)

— Worked in Atmospheric Sensing and Lidar Lab *(PI: Timothy Kane)*.

— Helped build and program a prototype photometer for attempts at optical detection of micrometeors; aided installation and test of experiment at Arecibo Observatory, Puerto Rico *(PI: David Meisel)*.

— Designed and built pair of Langmuir probes for SPIRIT sounding rocket with two other students; helped build smaller rocket payload to test flight hardware *(PI: Timothy Wheeler)*; constructed circuits for optical experiment on payload *(PI: David Meisel)*.

— Operated, experimented upon, and helped maintain two lidar atmospheric remote sensing instruments at Sondrestrom, Greenland research station; experimented with optogalvanic tuning system for dye laser *(PI: Timothy Kane)*.

— Worked for three weeks at South Pole Station, Antarctica with NSF sponsorship; helped repair lidar atmospheric remote sensing instrument; conducted outreach activities for elementary and high school students *(PI: George Papen)*.

Consulting

— Provided technical consulting and mathematical modeling skills for varied projects, including optical filter design and colorimetry.

— Proposed method for using coherent Raman spectroscopy for monitoring steroid metabolism (2014); the solution was selected for award by the Cleveland Clinic through an InnoCentive open innovation competition (http://www.innocentive.com).

— Proposed method for using coherent Raman spectroscopy for remote chemical detection (2011); the solution was selected for award by Los Alamos National Laboratory through an InnoCentive open innovation competition (http://www.innocentive.com).

Honors

— Penn State Department of Engineering Science and Mechanics Early Career Recognition Award (2014)

— Best Technical Development Manufacturing Award, presented to Rolith Incorporated at the IDTechEx Printed Electronics USA 2013 conference, Santa Clara, CA, USA (2013)

— Beckman Postdoctoral Fellowship (2006–2009)

— SPIE Educational Scholarship (2004)

— SPIE Travel Grant (2003)

— National Science Foundation Graduate Research Fellowship (2001–2004)

— Xerox Award for research accomplishment by a MS student (2001)

— Dean's Award for research accomplishment by a BS student (2001)

— Proctor & Gamble Summer Undergraduate Research Fellowship (2000)

— Eagle Scout (1996)

Inventing

Patents:

— D. L. Marks, **J. B. Geddes III**, and S. A. Boppart, "Matched pulse stimulated Raman scattering," United States Patent # US8300228 B2 (2012).

Provisional:

1. **J. B. Geddes III**, "Scalable holographic lithography with continuous matter-patterning capability," United States Provisional Patent Application # 62214202 (2015).
2. B. Kobrin and **J. B. Geddes III**, "Transparent ultrasonic transducer fabrication method and device," United States Provisional Patent Application # 62117906 (2015).
3. B. Kobrin, **J. B. Geddes III**, and O. Seitz, "Active glazing using transparent electromagnet or electrode," United States Provisional Patent Application # 62118437 (2015).

Disclosures:

1. D. L. Marks, **J. B. Geddes III**, and S. A. Boppart, "Molecular identification by simultaneous coherent stimulated radiation from multiple molecular vibrational modes," University of Illinois at Urbana-Champaign (2008).
2. **J. B. Geddes III**, A. Lakhtakia, R. Messier, and F. Wang, "Sculptured thin film based lasers, chemical separators, and sensors," Pennsylvania State University (2002).

Monograph — **J. B. Geddes III**, "Large-scale lithography for energy applications," proposal accepted and manuscript in preparation under contract, SPIE Press: Bellingham, WA, USA (2015).

Chapters

1. **J. B. Geddes III**, O. Seitz, and B. Kobrin, "Transparent metal mesh conductors for touch screen displays," submitted to Handbook of Visual Display Technology, Springer: London, UK (2015).
2. A. Lakhtakia and **J. B. Geddes III**, "Thin-film metamaterials called sculptured thin films," in Trends in Nanophysics: Theory, Experiment and Technology, A. Aldea and V. Bârsan, Eds., Springer-Verlag: New York, NY, USA (2010).
3. **J. B. Geddes III** and A. Lakhtakia, "Sculptured thin films," in Nanosciences and Nanotechnology, V. N. Kharkin, C. Bai, O. O. Awaldekarim, and S. Kapitsa, Eds., Encyclopedia of Life Support Systems (EOLSS), developed under the auspices of the UNESCO, EOLSS Publishers: Oxford, UK (2009) 6–152–4.
4. **J. B. Geddes III**, "Towards shaping of pulsed plane waves in the time domain via chiral sculptured thin films," in Frontiers in Optical Technology: Materials and Devices, P. K. Choudhury and O. N. Singh, Eds., Nova Science Publishers: Hauppauge, NY, USA (2006).
5. **J. B. Geddes III**, "Prospects for thermoacoustic technology," in Innovations and Materials for Green Engineering, Volume III, A. Lakhtakia and C. E. Bakis, Eds., Pennsylvania State University: University Park, PA, USA (2001).

Papers **Journal Articles:**

1. Y.-C. Chen, **J. B. Geddes III**, L. Yin, P. Wiltzius, and P. V. Braun, "X-ray computed tomography of holographically fabricated three-dimensional photonic crystals," Adv. Mater. 24 (2012) 2863–2868.
2. H. Ning, A. Mihi, **J. B. Geddes III**, M. Miyake, and P. V. Braun, "Radiative lifetime modification of LaF_3: Nd nanoparticles embedded in three dimensional silicon photonic crystals," Adv. Mater. 24 (2012) OP153–OP158.
3. S. Kim, Y. Su, A. Mihi, S. Lee, Z. Liu, T. K. Bhandakkar, J. Wu, **J. B. Geddes III**, H. T. Johnson, Y. Zhang, J.-K. Park, P. V. Braun, Y. Huang, and J. A. Rogers, "Imbricate scales as a design construct for microsystems technologies," Small 8 (2012) 901–906.
4. A. Lakhtakia, T. G. Mackay, and **J. B. Geddes III**, "Response to 'Comment on: On the inapplicability of a negative-phase-velocity condition as a negative refraction condition for active materials'," Microwave Opt. Technol. Lett. 52 (2010) 1681.
5. D. L. Marks, **J. B. Geddes III**, and S. A. Boppart, "Molecular identification by generating coherence between molecular normal modes using stimulated Raman scattering," Opt. Lett. 34 (2009) 1756–1758.

6. A. Lakhtakia, T. G. Mackay, and **J. B. Geddes III**, "On the inapplicability of a negative-phase-velocity condition for active materials," Microwave Opt. Technol. Lett. 51 (2009) 1230.
7. J. Yoon, A. J. Baca, S.-I. Park, P. Elvikis, **J. B. Geddes III**, L. Li, R. H. Kim, J. Xiao, S. Wang, T.-H. Kim, M. J. Motala, B. Y. Ahn, E. B. Duoss, J. A. Lewis, R. G. Nuzzo, P. M. Ferreira, Y. Huang, A. Rockett, and J. A. Rogers, "Ultrathin silicon solar microcells for semitransparent, mechanically flexible and microconcentrator module designs," Nature Mater. 7 (2008) 907–915.
8. H. C. Ko, M. P. Stoykovich, J. Song, V. Malyarchuk, W. M. Choi, C.-J. Yu, **J. B. Geddes III**, J. Xiao, S. Wang, Y. Huang, and J. A. Rogers, "A hemispherical electronic eye camera based on compressible silicon optoelectronics," Nature 454 (2008) 748–753.
9. A. Lakhtakia, **J. B. Geddes III**, and T. G. Mackay, "When does the choice of the refractive index of a linear, homogeneous, isotropic, active, dielectric medium matter?," Opt. Express 15 (2007) 17709–17714.
10. Y. C. Chen, **J. B. Geddes III**, J. T. Lee, P. V. Braun, and P. Wiltzius, "Holographically fabricated photonic crystals with large reflectance," Appl. Phys. Lett. 91 (2007) 241103.
11. **J. B. Geddes III**, T. G. Mackay, and A. Lakhtakia, "On the refractive index for a nonmagnetic two-component medium: resolution of a controversy," Opt. Commun. 280 (2007) 120–125.
12. **J. B. Geddes III** and A. Lakhtakia, "Swamping of circular Bragg phenomenon and shaping of videopulses," Microwave Opt. Technol. Lett. 49 (2007) 776–779.
13. A. Lakhtakia and **J. B. Geddes III**, "Scattering by a nihility cylinder," AEÜ Int. J. Electron. Commun. 61 (2007) 62–65.
14. **J. B. Geddes III** and A. Lakhtakia, "Quantification of pulsed-plane-wave-shaping by chiral sculptured thin films," J. Mod. Opt. 53 (2006) 2763–2783.
15. **J. B. Geddes III** and A. Lakhtakia, "Numerical investigation of reflection, refraction, and diffraction of pulsed optical beams by chiral sculptured thin films," Opt. Commun. 252 (2005) 307–320.
16. A. Lakhtakia and **J. B. Geddes III**, "Nanotechnology for optics is a phase-length-time sandwich," Opt. Eng. 43 (2004) 2410–2417.
17. **J. B. Geddes III** and A. Lakhtakia, "Effects of carrier phase on reflection of optical narrow-extent pulses from axially excited chiral sculptured thin films," Opt. Commun. 225 (2003) 141–150.
18. J. Wang, A. Lakhtakia, and **J. B. Geddes III**, "Multiple Bragg regimes exhibited by a chiral sculptured thin film half-space on axial excitation," Optik 113 (2002) 213–221.
19. **J. B. Geddes III** and A. Lakhtakia, "Videopulse bleeding in axially excited chiral sculptured thin films in the Bragg regime," Eur. Phys. J. Appl. Phys. 17 (2002) 21–24.
20. **J. B. Geddes III** and A. Lakhtakia, "Pulse-coded information transmission across an axially excited chiral-sculptured thin film in the Bragg regime," Microw. Opt. Technol. Lett. 28 (2001) 59–62.
21. **J. B. Geddes III** and A. Lakhtakia, "Time-domain simulation of the circular Bragg phenomenon exhibited by chiral sculptured thin films," Eur. Phys. J. Appl. Phys. 14 (2001) 97–105; Erratum: 16 (2001) 247.
22. **J. B. Geddes III** and A. Lakhtakia, "Reflection and transmission of optical narrow-extent pulses by axially excited chiral sculptured thin films," Eur. Phys. J. Appl. Phys. 13 (2001) 3–14; Erratum: 16 (2001) 247.
23. **J. B. Geddes III** and A. Lakhtakia, "Time-domain signature of an axially excited cholesteric liquid crystal. Part II: Rectangular wide-extent pulses," Optik 112 (2001) 62–66.
24. **J. B. Geddes III**, M. W. Meredith, and A. Lakhtakia, "Circular Bragg phenomenon and pulse bleeding in cholesteric liquid crystals," Opt. Commun. 182 (2000) 45–57.

Working Papers:

1. **J. B. Geddes III**, "Optimal design of shaped optical pulses for selective excitation of coherent Raman scattering," in preparation (2015).
2. **J. B. Geddes III**, E. C. Nelson, and P. V. Braun, "Design of uniaxial metal-dielectric composites possessing enhanced third-order optical nonlinearity," in preparation (2015).

Conference Publications—Full Papers:

1. M. Aryal, **J. B. Geddes III**, O. Seitz, J. Wassei, I. McMackin, and B. Kobrin, "Submicron transparent metal mesh conductor for touch screen displays," SID Symp. Digest Tech. Papers 45 (2014) 194–196.
2. O. Seitz, **J. B. Geddes III**, M. Aryal, J. Perez, J. Wassei, I. McMackin, and B. Kobrin, "Antireflective surface patterned by rolling mask lithography," Proc. SPIE 8974 (2014) 89740V.
3. **J. B. Geddes III**, D. L. Marks, and S. A. Boppart, "Optical pulse shaping for selective excitation of coherent molecular vibrations by stimulated Raman scattering," Proc. SPIE 7183 (2009) 718311.
4. W. A. Benalcazar, Z. Jiang, D. L. Marks, **J. B. Geddes III**, and S. A. Boppart, "Validation of nonlinear interferometric vibrational imaging as a molecular OCT technique by the use of Raman microscopy," Proc. SPIE 7168 (2009) 71680T.
5. Z. Jiang, D. L. Marks, **J. B. Geddes III**, and S. A. Boppart, "Nonlinear interferometric vibrational imaging of biological tissue," Proc. SPIE 6860 (2008) 68600Y.
6. **J. B. Geddes III** and A. Lakhtakia, "Swamping of circular Bragg phenomenon revealed by durations and average speeds of videopulses transmitted through chiral sculptured thin films," Proc. SPIE 6638 (2007) 66380O.
7. **J. B. Geddes III** and A. Lakhtakia, "Durations and average speeds of ultrashort pulses shaped by chiral sculptured thin films," Proc. SPIE 6328 (2006) 632811.
8. **J. B. Geddes III** and A. Lakhtakia, "Pulsed-beam propagation through a chiral sculptured thin film," Proc. SPIE 5509 (2004) 83–93.
9. **J. B. Geddes III** and A. Lakhtakia, "Phase effects on reflection of narrow-extent pulses from axially excited chiral sculptured thin films," Proc. SPIE 5219 (2003) 83–91.
10. **J. B. Geddes III**, M. W. Meredith, and A. Lakhtakia, "Pulse bleeding in thin-film helicoidal bianisotropic mediums," Proc. SPIE 4097 (2000) 352–355.

Conference Publications—Summaries and Abstracts:

1. **J. B. Geddes III**, "Syncing of modes via nonlinear coupling between closely spaced plasmonic structures," submitted to the Materials Research Society Fall Meeting, Boston, MA (29 Nov.–04 Dec. 2015).
2. I. McMackin, **J. B. Geddes III**, O. Seitz, J. Perez, M. Aryal, J. Wassei, and B. Kobrin, "'Rolling mask' nanopatterning of advanced glass products," Nanoimprint and Nanoprint Technology, Barcelona, Spain (21–23 Oct. 2013).
3. I. McMackin, **J. B. Geddes III**, M. Aryal, O. Seitz, and B. Kobrin, "Nanopatterned coatings for advanced glass products," Nanotech Conference & Expo, Washington, DC, USA (12–16 May 2013).
4. I. McMackin, **J. B. Geddes III**, M. Aryal, A. F. Renaldo, and B. Kobrin, "Meter-long substrate nanopatterning using rolling mask optical lithography," SPIE Advanced Lithography, San Jose, CA, USA (24–28 Feb. 2013).
5. B. Kobrin, **J. B. Geddes III**, M. Aryal, and I. McMackin, "Nanostructured antireflective coatings by high throughput optical lithography," SPIE Photonics West, San Francisco, CA, USA (2–7 Feb. 2013).
6. B. Kobrin, I. McMackin, A. Renaldo, M. Aryal, and **J. B. Geddes III**, "Cylindrical mask optical lithography for advanced surface engineering," International Conference on Micro and Nano Engineering, Toulouse, France (16–20 Sep. 2012).

7. **J. B. Geddes III**, S. Kim, P. V. Braun, and J. A. Rogers, "Imaging and nonimaging transfer-printed gradient index optical devices," Materials Research Society Fall Meeting, Boston, MA, USA (28 Nov.–2 Dec. 2011).
8. **J. B. Geddes III**, E. C. Nelson, and P. V. Braun, "Third-order nonlinear optical properties of uniaxial metal-dielectric composites," Materials Research Society Fall Meeting, Boston, MA, USA (28 Nov.–2 Dec. 2011).
9. Y.-C. Chen, **J. B. Geddes III**, M. Miyake, P. V. Braun, and P. Wiltzius, "Fabrication and characterization of three-dimensional photonic crystals templated by interference lithography," Micro Nano Breakthrough Conference, Portland, OR, USA (8–10 Sep. 2008).
10. **J. B. Geddes III**, E. C. Nelson, and P. V. Braun, "Design of uniaxial metallodielectric metamaterials having large optical nonlinearities," APS March Meeting, New Orleans, LA, USA (10–14 Mar. 2008).
11. **J. B. Geddes III**, T. G. Mackay, and A. Lakhtakia, "Determination of sign of refractive index of active media via time-domain calculation," OSA Annual Meeting, San Jose, CA, USA (16–20 Sep. 2007).
12. Y.-C. Chen, **J. B. Geddes III**, P. V. Braun, and P. Wiltzius, "Optical characterization of 3D photonic crystals fabricated by holographic lithography," APS March Meeting, Denver, CO, USA (5–9 Mar. 2007).
13. **J. B. Geddes III** and A. Lakhtakia, "Average speeds and durations of pulsed plane waves transmitted through chiral sculptured thin films," APS March Meeting, Baltimore, MD, USA (13–17 Mar. 2006).
14. **J. B. Geddes III** and A. Lakhtakia, "Shaping of electromagnetic pulsed beams by chiral sculptured thin films," Asia Pacific Microwave Conference, New Delhi, India (15–18 Dec. 2004).
15. **J. B. Geddes III** and A. Lakhtakia, "Time-domain manifestation of the circular Bragg phenomenon in an axially excited chiral sculptured thin film," OSA Annual Meeting, Long Beach, CA, USA (14–18 Oct. 2001).

Technical Periodical Articles:

— **J. B. Geddes III**, D. L. Marks, and S. A. Boppart, "Design of matched optical pulses for coherent Raman imaging," Opt. Photon. News 20 (2009) 31.

Invited Talks

External:

1. "Nanostructured materials for optics," Research Seminar, Department of Electrical and Computer Engineering, University of Iowa, Iowa City, IA, USA (5 Mar. 2009).
2. "New materials for optics at multiple length scales," Research Seminar, Center for Metamaterials and Integrated Plasmonics, Duke University, Durham, NC, USA (2 Feb. 2009).

Internal:

1. "Integration of optical lamina with active and passive soft materials," Soft Materials Seminar, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, USA (31 Jan. 2012).
2. "Shaped optical pulses for coherent nonlinear vibrational spectroscopy with potential nanoscale thermal transport applications," Nanoscale Thermal Transport Seminar, Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, IL, USA (14 Mar. 2011).
3. "Enmeshment of optical phase and material morphology in nanophotonics illustrated by sculptured thin films and holographic photonic crystals," Nanohour Seminar, Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, USA (3 Mar. 2011).
4. "Optical system design constraints relaxed by employment of soft materials," Soft Materials Seminar, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, USA (9 Nov. 2010).

5. "Materials with geometric flexibility for imaging and nonimaging optical devices," iOptics Seminar, Micro and Nanotechnology Laboratory, University of Illinois at Urbana-Champaign, Urbana, IL, USA (8 Oct. 2009).
6. "A pair of design and inverse problems in nanostructured nonlinear optical materials," Nanohour Seminar, Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, USA (23 Sep. 2009).
7. "Optical pulse shaping for nonlinear imaging techniques," Director's Seminar, Beckman Institute for Advanced Science and Technology, University of Illinois at Urbana-Champaign, Urbana, IL, USA (7 Mar. 2008).

Teaching

Department of Engineering Science and Mechanics

Instructor and Teaching Assistant, Penn State University (2004-2006)

— Earned Teaching with Technology Certificate (Spring 2006).
— As instructor, had full responsibility for teaching introductory course in engineering dynamics (Summer 2004, 2005).
— Earned Graduate School Teaching Certificate (Spring 2005).
— Served as teaching assistant for upper level course in laboratory techniques and experimental statistics. Delivered several lectures and created optics laboratory exercises for students (Fall 2004, 2005).
— Served as teaching assistant for introductory course in engineering statics. Lead recitation sections and tutored students on homework problems (Fall 2004).
— Served as teaching assistant for introductory course in numerical methods. Delivered several lectures and helped students complete in-class programming exercises (Spring 2004).

Villanova Summer Research Institute

Teaching Assistant and Counselor, Villanova University (1999, 2001)

— Worked as counselor and teaching assistant for high school students in summer enrichment program in biology, mathematics, and computing *(PI: William Fleischman)*.
— Served as research guide for group of students investigating mathematical models of HIV and language evolution.
— Taught basic programming techniques in the Maple computer language.

Service

— Member of Engineering Science and Mechanics Alumni Advisory Board (Fall 2013–).
— Organized lecture series for Beckman Postdoctoral Fellows lunch meetings (Fall 2008–Spring 2009).
— First president of Engineering Science and Mechanics (ESM) Graduate Student Council; worked to improve ESM department through increased communication between faculty and graduate students (Fall 2004–Spring 2005).
— Helped organize first graduate student symposium in ESM department (Spring 2005).
— Vice president of the Penn State Student Chapter of SPIE (Fall 2004–Spring 2005).
— Served in the Graduate Student Association (Fall 2004–Spring 2005).

Skills

Theoretical:

— Applied physics: extensive knowledge in electromagnetics and optics, condensed matter physics, and nanotechnology.
— Numerical optics and electromagnetics: finite-difference time-domain methods; rigorous coupled wave analysis; ray tracing; transfer matrix methods; homogenization and effective-medium theories; optical system design; iterative signal design and optimization; electromagnetic materials design.

Experimental:

— General optics: operating ultrafast laser systems; optical spectroscopic measurements.
— Materials fabrication: photolithography; thin film deposition; wet and dry etching techniques; basic wet chemistry, electrochemistry, and clean room operations.
— Materials characterization: spectroscopy; optical and electron microscopy.

General:

— Computation: Bash shell and Unix tools; extensive programming in Fortran, Matlab, and Mathematica; running calculations with supercomputers; version control and other software development practices.

— Communication: writing technical papers and reports; writing proposals for grants and contracts; lecturing and technical speaking; LaTeX and related tools.

Reviewer

— Applied Optics
— Electromagnetics
— Journal of Lightwave Technology
— Journal of Modern Optics
— Journal of Nanophotonics
— Journal of the Optical Society of America A
— Journal of Raman Spectroscopy
— Optics Communications
— Optics Express
— Optics Letters
— Photonics and Nanostructures – Fundamentals and Applications

Workshops

— Global Sustainability Summer School, Santa Fe Institute, Santa Fe, NM, USA (12–25 Jul. 2009).

— Gordon Research Conference on Quantum Control of Light and Matter, Mount Holyoke College, South Hadley, MA, USA (2–7 Aug. 2009).

Member

— American Association for the Advancement of Science (AAAS)
— American Physical Society (APS)
— Institute of Electrical and Electronics Engineers (IEEE)
— International Society for Optical Engineering (SPIE)
— Materials Research Society (MRS)
— Optical Society of America (OSA)