

Joseph Bernhardt Geddes III

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Education Doctor of Philosophy in Engineering Science

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 Optics and Optical Materials

Postdoctoral Fellow, Beckman Institute, U. of Illinois at Urbana-Champaign (2006–2007)

- Predicted properties of metal-dielectric metamaterials exhibiting enhanced nonlinear optical properties (*PI: Paul Braun*).
- Performed calculations and built systems for development of optical coherence tomography 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 optical coherence tomography exhibiting molecular specificity.

Optics of 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.

SPIRIT Sounding Rocket

Undergraduate Research Assistant, Penn State University (1998–2001)

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

Atmospheric Science

Undergraduate Research Assistant, Penn State University (1998–2000)

- Worked in Atmospheric Sensing and Lidar Lab (*PI: Timothy Kane*).
- Helped build and program a prototype photometer for attempts at optical detection of micrometeors (*PI: David Meisel*).
- Aided installation and test of experiment at Arecibo Observatory, Puerto Rico.

Greenland Lidar Studies

Undergraduate Research Assistant, Sondrestrom, Greenland (Summer 1998)

- Operated, experimented upon, and helped maintain two lidar atmospheric remote sensing instruments (*PI: Timothy Kane*).
- Experimented with optogalvanic tuning system for dye laser.

Antarctica Lidar Studies

Undergraduate Research Assistant, South Pole, Antarctica (Fall 1997)

- Worked for three weeks at South Pole Station with NSF sponsorship (*PI: George Papen*).
- Helped repair lidar atmospheric remote sensing instrument.
- Conducted outreach activities for elementary and high school students.

Honors

- SPIE Educational Scholarship (2004)
- SPIE Travel Grant (2003)
- National Science Foundation Graduate Research Fellowship (2001–2004)
- Xerox Award for research accomplishment by an MS student (2001)
- Dean’s Award for research accomplishment by a BS student (2001)
- Proctor & Gamble Summer Undergraduate Research Fellowship (2000)
- Eagle Scout (1996)

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.

Chapters

- 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).
- 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:

- A. Lakhtakia, T. G. Mackay, and J. B. Geddes III, On the inapplicability of a negative-phase-velocity condition for active materials, submitted to *Microwave Opt. Technol. Lett.* (25 Aug. 2008).
- D. L. Marks, J. B. Geddes III, and S. A. Boppart, Molecular identification by generating coherence between molecular normal modes using stimulated Raman scattering, submitted to *Opt. Lett.* (31 Oct. 2008).
- 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.
- 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.
- 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.
- 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.
- 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.
- J. B. Geddes III and A. Lakhtakia, Swamping of circular Bragg phenomenon and shaping of videopulses, *Microwave Opt. Technol. Lett.* 49 (2007) 776–779.
- A. Lakhtakia and J. B. Geddes III, Scattering by a nihility cylinder, *AEÜ Int. J. Electron. Commun.* 61 (2007) 62–65.
- 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.
- 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.
- A. Lakhtakia and J. B. Geddes III, Nanotechnology for optics is a phase-length-time sandwich, *Opt. Eng.* 43 (2004) 2410–2417.
- 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.

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

Conference Publications—Full Papers:

- 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.
- 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.
- 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.
- J. B. Geddes III and A. Lakhtakia, Pulsed-beam propagation through a chiral sculptured thin film, *Proc. SPIE* 5509 (2004) 83–93.
- 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.
- 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:

- W. A. Benalcazar, Z. Jiang, D. L. Marks, J. B. Geddes III, and S. A. Boppart, Validation of nonlinear interferometric vibrational imaging by the use of Raman microscopy, accepted by SPIE Photonics West, San Jose, CA, USA (24–29 Jan. 2009).
- 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, accepted by SPIE Photonics West, San Jose, CA, USA (24–29 Jan. 2009).
- 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).
- 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).
- 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).
- 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).

- 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).
- 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).
- 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).

- Service**
- 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).

- Reviewer**
- Applied Optics
 - Electromagnetics
 - Journal of Nanophotonics
 - Journal of Raman Spectroscopy
 - Optics Communications
 - Optics Express
 - Optics Letters

- 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)
 - Optical Society of America (OSA)
 - Materials Research Society (MRS)
 - Society for Amateur Scientists (SAS)