

Brandon Redding, Ph.D.

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Education	Ph.D. Electrical & Computer Engineering University of Delaware, Newark, DE	2010
	B.S Physics and Computer Science Allegheny College, Meadville, PA	2005
Professional Experience	Research Physicist Naval Research Laboratory, Washington, DC	2015-present
	Senior Research Scientist Army Research Laboratory, Adelphi, MD	2014-2015
	Associate Research Scientist Yale University, New Haven, CT	2013-2015
	Postdoctoral Associate with Dr. Hui Cao Yale University, New Haven, CT	2010-2013
	Graduate Research Assistant with Dr. Dennis Prather University of Delaware, Newark, DE	2005-2010
	Research Assistant with Dr. Steven Levitan, University of Pittsburgh, Pittsburgh, PA	2004
Awards & Honors	NRL Annual Research Publication Award for 2016 Optics & Photonics News "Optics in 2016" selection Microscopy Today Innovation Award 2016 Optics & Photonics News "Optics in 2015" selection Microscopy Today Innovation Award Best Speaker Award at OSA's Applied Industrial Optics Conference Optics & Photonics News "Optics in 2013" selection Optics & Photonics News "Optics in 2012" selection Bendett Graduate Fellowship (Merit scholarship for graduate student photonics research) Richard L. Brown Physics Prize (Award for best physics thesis at Allegheny College)	

Professional Activities	<p>Member of the Optical Society of America (OSA)</p> <p>Member of the International Society for Optics and Photonics (SPIE)</p> <p>Reviewer (100+ articles) for: Nature Photonics, Nature Communications, Light, Scientific Reports, Optica, Optics Letters, Optics Express, Biomedical Optics Express, Applied Optics, JOSA, JSTQE, J. Luminescence, Physical Review Letters, Physical Review A, Applied Physics Letters, IEEE PTL</p> <p>Served on NSF Review Panel (2016)</p> <p>Committee member for OSA's Applied Industrial Optics Conference (2015-2017)</p>
Teaching Experience	<p>Guest lecturer for Principles of Optics (Applied Physics course at Yale)</p> <p>Guest lecturer for Biomedical Optical Imaging (Biomedical Engineering course at Yale)</p> <p>Mentored undergraduate and graduate student research at Yale and Delaware</p> <p>Teaching assistant for Computational Physics at Allegheny College</p> <p>Writing tutor at Allegheny College</p>
Conference Presentations	<ol style="list-style-type: none"> 1. B. Redding, S.F. Liew, P. Ahmadi, V. Mogan, M. Seifert, M.A. Choma, H. Cao, "Low-spatial-coherence broadband fiber source for optical coherence tomography," <i>Applied Industrial Optics (invited)</i>, July 2016. 2. B. Redding, A. Davis, C. Kirkendall, A. Dandridge, "The influence of underwater turbulence on optical phase measurements," <i>SPIE Defense & Commercial Sensing</i>, April 2016. 3. B. Redding, A. Cerjan, X. Huang, M. L. Lee, M. A. Choma, H. Cao, "Low-Spatial Coherence Electrically Pumped Semiconductor Laser for Speckle-Free Full-Field Imaging," <i>Applied Industrial Optics</i>, June 2015. 4. B. Redding, L. Ge, Q. Song, G. Solomon, H. Cao, "Manipulating high-order scattering processes in ultrasmall optical resonators to control far-field emission," <i>Photonics West, (invited) February 2015</i>. 5. B. Redding, H. Cao, "Using speckle to build compact, high-resolution spectrometers," <i>Photonics West, (invited) February 2015</i>. 6. B. Redding, A. Cerjan, X. Huang, M. L. Lee, M. A. Choma, H. Cao, "Low-Spatial Coherence Chaotic Cavity Laser for Speckle-Free Full-Field Imaging," <i>Photonics West, February 2015</i>. 7. B. Redding, Y. Bromberg, M.A. Choma, H. Cao, "Full-field interferometric confocal microscopy using a VCSEL array," <i>Photonics West, February 2015</i>. 8. B. Redding, A. Cerjan, X. Huang, M. L. Lee, M. A. Choma, H. Cao, "Low-Spatial Coherence Chaotic Cavity Laser for Speckle-Free Full-Field Imaging," <i>Physics of Quantum Electronics, (invited) January 2015</i>. 9. B. Redding, Y. Bromberg, M.A. Choma, H. Cao, "Full-field interferometric confocal microscopy using a VCSEL array," <i>Frontiers in Optics, October 2014</i>.

10. **B. Redding**, A. Cerjan, X. Huang, M. L. Lee, M. A. Choma, H. Cao, "Low-Spatial Coherence Chaotic Cavity Laser for Speckle-Free Full-Field Imaging," *Frontiers in Optics*, October 2014.
11. **B. Redding**, H. Cao, "Using a multimode fiber as a compact, high-resolution spectrometer," *OSA Imaging and Applied Optics*, (invited) July 2014.
12. **B. Redding**, Y. Bromberg, M.A. Choma, H. Cao, "Full-field interferometric confocal microscopy using a VCSEL array," *OSA Imaging and Applied Optics*, July 2014.
13. **B. Redding**, H. Cao, "On-Chip Random Spectrometer," *OSA Imaging and Applied Optics*, (invited) July 2014.
14. **B. Redding**, H. Cao, "Using a multimode fiber as a high-resolution low-loss spectrometer," *SPIE Defense Sensing and Security*, (invited) May 2014.
15. **B. Redding**, Y. Pan, C. Wang, G. Videen, H. Cao, "Polarization resolved angular optical scattering of aerosol particles," *SPIE Defense Sensing and Security*, May 2014.
16. **B. Redding**, S.F. Liew, R. Sarma H. Cao, "On-Chip Random Spectrometer," *SPIE Defense Sensing and Security*, May 2014.
17. **B. Redding**, Y. Pan, H. Cao, "Polarization resolved angular optical scattering of aerosol particles," *Optical Characterization of Atmospheric Aerosols*, November 2013.
18. **B. Redding**, S. Popoff, H. Cao, "Using a multimode fiber as a high resolution, low loss spectrometer," *Conference on Lasers and Electro-Optics*, June 2013
19. **B. Redding**, G. Allen, E. Dufresne, H. Cao, "Low-loss, high-speed speckle reduction using a colloidal dispersion," *Conference on Lasers and Electro-Optics*, June 2013
20. **B. Redding**, H. Cao, "Using a multimode fiber as a high resolution, low loss spectrometer," *Frontiers in Optics (post-deadline)*, October 2012.
21. **B. Redding**, J. Ma, H. Cao, "Ultra-compact High-resolution On-chip Spectrometer Based on Random Nanostructures," *Conference on Lasers and Electro-Optics*, May 2012.
22. **B. Redding**, L. Ge, Q. Song, G.S. Solomon, H. Cao, "Directional waveguide coupling from a wavelength-scale deformed microdisk," *Conference on Lasers and Electro-Optics*, May 2012.
23. **B. Redding**, M. A. Choma, H. Cao, "Speckle-free Laser Imaging," *Conference on Lasers and Electro-Optics*, May 2012.
24. **B. Redding**, M. A. Choma, H. Cao, "Spatial coherence of random laser emission," *SPIE Optics & Photonics (invited)* August 2011.
25. **B. Redding**, M. A. Choma, H. Cao, "Spatial coherence of random laser emission," in *Conference on Lasers and Electro-Optics (post-deadline)*, June 2011.
26. **B. Redding**, T. Creazzo, E. Marchena, S. Shi, D. Prather, "Design of a Two-Stage Si Pumped Er:SiO₂ Laser Based on Concentric Microdisks," in *IEEE Conference on Group IV Photonics*, September 2009.

27. **B. Redding**, T. Creazzo, E. Marchena, S. Shi, D. Prather, "Concentric Microdisk Design for a Two-Stage Silicon Laser," in *OSA Conference on Integrated Photonics and Nanophotonics Research and Applications, June 2009*.
28. **B. Redding**, T. Creazzo, E. Marchena, S. Shi, D. Prather, "Design of Active Photonic Devices for Enhanced Emission from Si Nanocrystals," in *Conference on Lasers and Electro-Optics, June 2009*.
29. **B. Redding**, X. Long, N. Faleev, S. Shi, D. Prather, "Enhanced Electro-optic Effect in InAs/GaAs Quantum Dots," in *Conference on Lasers and Electro-Optics (CLEO)*, (2008).
30. **B. Redding**, T. Creazzo, E. Marchena, S. Shi, D. Prather, "Design, Fabrication, and Characterization of a 1D Microcavity for Enhanced Luminescence from Silicon Nanocrystals," in *IEEE Conference on Group IV Photonics, September 2008*.

Refereed
Journal
Publications

1. P. Ambichl, W. Xiong, Y. Bromberg, **B. Redding**, H. Cao, S. Rotter, "Super- and anti-principal modes in multi-mode waveguides," (in review).
2. Y. Bromberg, **B. Redding**, S. M. Popoff, H. Cao, "Remote key establishment by mode mixing in multimode fibers and optical reciprocity," (in review).
3. **B. Redding**, A. Davis, "Measuring vibrational motion from a moving platform," *Applied Optics* **56**, 25442 (2017).
4. B. H. Hokr, J.V. Thompson, J. N. Bixler, D. T. Nodurft, G. Noojin, **B. Redding**, R. J. Thomas, H. Cao, B. A. Rockwell, M. O. Scully, V. V. Yakovlev "Lighting up microscopy with random Raman lasing" *Scientific Reports* **7**, 44572 (2017).
5. W. Xiong, P. Ambichl, Y. Bromberg, **B. Redding**, S. Rotter, "Principal modes in multimode fibers: exploring the crossover from weak to strong mode coupling," *Optics Express* **25**, 2709 (2017).
6. S. F. Liew, S. Knitter, S. Weiler, J. F. Monjardin-Lopez, M. Ramme, **B. Redding**, M. A. Choma, H. Cao, "Intracavity frequency doubled degenerate laser" *Optics Letters* **42**, 411 (2017).
7. A. Cerjan, **B. Redding**, Li Ge, Seng Fatt Liew, Hui Cao, A. Douglas Stone, "Controlling mode competition by tailoring the spatial pump distribution in a laser cavity" *Optics Express* **24**, 26006 (2016).
8. N. Coluccelli, M. Cassinerio, **B. Redding**, H. Cao, P. Laporta, G. Galzerano, "The optical frequency comb spectrometer," *Nature Communications* **7**, 12995 (2016).
9. **B. Redding***, S. F. Liew*, Y. Bromberg, R. Sarma, H. Cao, "Evanesciently coupled multimode spiral spectrometer," *Optica* **3**, 956 (2016). *equal contribution
10. W. Xiong, P. Ambichl, Y. Bromberg, **B. Redding**, S. Rotter, H. Cao, "Spatiotemporal control of light transmission through a multimode fiber with strong mode coupling" *Physical Review Letters* **117**, 053901 (2016).
11. S. F. Liew, **B. Redding**, M. Choma, H. Tagare, H. Cao, "Broadband multimode fiber spectrometer," *Optics Letters* **41**, 2029 (2016).
12. S. Knitter, C. Liu, **B. Redding**, M. K. Khoka, M. A. Choma, H. Cao, "Coherence switching of vertical-cavity semiconductor-laser for multimodality imaging," *Optica* **3**, 403 (2016).
13. **B. Redding**, A. Davis, C. Kirkendall, A. Dandridge, "Measuring vibrational motion in the presence of speckle using off-axis holography," *Applied Optics* **55**, 1406 (2016). *Selected for NRL ARPAD award
14. Y. Bromberg, **B. Redding**, S. M. Popoff, H. Cao, "Breaking optical reciprocity to manipulate coherent backscattering in multimode fibers," *Phys. Rev. A* **93**, 023826 (2016).

15. S. F. Liew, L. Ge, **B. Redding**, G. S. Solomon, H. Cao, "Controlling a microdisk laser by local refractive index perturbation," *Applied Physics Letters* **108**, 051105 (2016).
16. B. Hokr, M. S. Schmidt, J. N. Bixler, P. N. Dyer, G. D. Noojin, **B. Redding**, R. J. Thomas, B. A. Rockwell, H. Cao, V. V. Yakovlev, M. O. Scully, "A narrow-band speckle-free light source via random Raman lasing," *J. Modern Optics* **63**, 46 (2016).
17. **B. Redding**, P. Ahmadi, V. Mogan, M. Seifert, M. A. Choma, H. Cao, "Low-spatial-coherence broadband fiber source for speckle free imaging," *Optics Letters* **40**, 4607 (2015).
18. **B. Redding**, M. Schwab, Y. L. Pan, "Raman Spectroscopy of Optically Trapped Single Biological Micro-Particles," *Sensors* **15**, 19021 (2015).
19. **B. Redding**, Y. L. Pan, "Optical trap for both transparent and absorbing particles in air using a single shaped laser beam," *Optics Letters* **40**, 2798 (2015). *Featured in spotlight on optics
20. C. A. Schutt, **B. Redding**, H. Cao, E. Michaelides, "The illumination characteristics of operative microscopes," *American Journal of Otolaryngology* **36**, 356 (2015).
21. S. F. Liew, L. Ge, **B. Redding**, G. Solomon, H. Cao, "Pump-controlled modal interactions in microdisk lasers," *Physical Review A*, **91** 043828 (2015).
22. **B. Redding**, S. C. Hill, D. Alexson, C. Wang, Y. Pan, "Photophoretic trapping of airborne particles using pulsed and CW ultraviolet illumination," *Optics Express* **23**, 3630 (2015).
23. **B. Redding**, A. Cerjan, X. Huang, M. L. Lee, M. A. Choma, H. Cao, "Low-Spatial Coherence Chaotic Cavity Laser for Speckle-Free Full-Field Imaging," *PNAS* **112**, 1305 (2015).
24. C. Wang, Y. Pan, S. C. Hill, **B. Redding**, "Photophoretic trapping-Raman spectroscopy for single pollens and fungal spores trapped in air," *Journal of Quantitative Spectroscopy Radiative Transfer* **153**, 4 (2015).
25. **B. Redding**, M. Alam, M. Seifert, H. Cao, "High-resolution and broadband all-fiber spectrometers," *Optica* **1**, 175 (2014).
26. **B. Redding**, Y. Bromberg, M. A. Choma, H. Cao, "Full-field interferometric confocal microscopy using a VCSEL array," *Optics Letters* **39**, 4446 (2014).
27. **B. Redding**, Y. L. Pan, C. Wang, H. Cao, "Polarization-resolved near-backscattering of airborne aggregates composed of different primary particles," *Optics Letters* **39**, 4076 (2014).
28. S. F. Liew, **B. Redding**, L. Ge, G. S. Solomon, H. Cao, "Active control of emission directionality of semiconductor microdisk lasers," *Applied Physics Letters* **104**, 231108 (2014).
29. **B. Redding**, L. Ge, Q. Song, G. S. Solomon, H. Cao, "High-order scattering and multipath interference in wavelength-scale optical cavities," *Physical Review Letters* **112**, 163902 (2014).
30. C. Wang, Y. Pan, D. James, A. Wetmore, **B. Redding**, "Direct on-strip analysis of size- and time-resolved aerosol impactor samples using laser induced fluorescence spectra excited at 263 nm and 351 nm," *Analytica Chimica Acta* **820**, 119 (2014).
31. A. G. Yamilov, R. Sarma, **B. Redding**, B. Payne, H. Noh, H. Cao, "Position-dependent diffusion of light in disordered waveguides," *Physical Review Letters* **112**, 023904 (2014).
32. **B. Redding**, S. M. Popoff, Y. Bromberg, M. A. Choma, H. Cao, "Noise analysis of spectrometers based on speckle pattern reconstruction," *Applied Optics* **53**, 410 (2014).
33. L. Ge, Q. Song, **B. Redding**, A. Eberspacher, J. Wiersig, H. Cao, "Controlling multimode coupling by boundary wave scattering," *Physical Review A* **88**, 043801 (2013).
34. M. Nixon, **B. Redding**, A. A. Friesem, H. Cao, N. Davidson, "Efficient method for controlling the spatial coherence of a laser," *Optics Letters* **38**, 3858 (2013).

35. **B. Redding**, S. F. Liew, R. Sarma, H. Cao, "Compact spectrometer based on a disordered photonic chip," *Nature Photonics* **7**, 746 (2013).
36. **B. Redding**, S. M. Popoff, H. Cao, "All-fiber spectrometer based on speckle pattern reconstruction," *Optics Express* **21**, 6584 (2013). *Featured in Optics & Photonics News highlights of 2013
37. **B. Redding**, G. Allen, E. Dufresne, H. Cao, "Low-loss high-speed speckle reduction using a colloidal dispersion," *Applied Optics* **52**, 1168 (2013).
38. L. Ge, Q. Song, **B. Redding**, H. Cao, "Extreme output sensitivity to subwavelength boundary deformation in microdisks," *Physical Review A* **87**, 023833 (2013).
39. **B. Redding**, H. Cao, "Using a multimode fiber as a high resolution, low loss spectrometer," *Optics Letters* **37**, 3384 (2012).
40. **B. Redding**, L. Ge, Q. Song, J. Wiersig, G.S. Solomon, H. Cao, "Local chirality of optical resonances in ultrasmall resonators," *Physical Review Letters* **108**, 253902 (2012).
41. Q. Song, L. Ge, **B. Redding**, H. Cao, "Channeling chaos into unidirectional output: a direct approach in deformed microcavities with long-lived resonances," *Physical Review Letters* **108**, 243902 (2012).
42. **B. Redding**, M. A. Choma, H. Cao, "Speckle-free laser imaging using random laser illumination," *Nature Photonics*, **6**, 355 (2012). *Featured in Optics & Photonics News highlights of 2012
43. **B. Redding**, L. Ge, G.S. Solomon, H. Cao, "Directional waveguide coupling from a wavelength-scale deformed microdisk laser," *Applied Physics Letters* **100**, 061125 (2012).
44. **B. Redding**, M. A. Choma, H. Cao, "Spatial coherence of random laser emission," *Optics Letters* **36**, 3404 (2011).
45. E. Marchena, **B. Redding**, T. Creazzo, D. Prather, "Mitigation of Si nanocrystal free carrier absorption loss at 1.5 μm in a concentric microdisk structure," *Optics Letters* **35**, 2182 (2010).
46. **B. Redding**, E. Marchena, T. Creazzo, S. Shi, D. Prather, "Comparison of Raised Microdisk Whispering Gallery Mode Characterization Techniques," *Optics Letters* **35**, 998 (2010).
47. **B. Redding**, S. Shi, T. Creazzo, E. Marchena, D. Prather, "Design and Characterization of Silicon Nanocrystal Microgear Resonators," *Photonics and Nanostructures* **8**, 177 (2010).
48. T. Creazzo, **B. Redding**, E. Marchena, J. Murakowski, D. Prather, "Free-carrier absorption modulation in silicon nanocrystal slot waveguides," *Optics Letters* **35**, 3691 (2010).
49. T. Creazzo, **B. Redding**, E. Marchena, J. Murakowski, D. Prather, "Pulsed Pumping of Silicon Nanocrystal Light Emitting Devices," *Optics Express* **18**, 10924 (2010).
50. T. Creazzo, **B. Redding**, E. Marchena, R. Hao, J. Murakowski, S. Shi, D. Prather, "Distributed Bragg Reflector Enhancement of Electroluminescence from a Silicon Nanocrystal Light Emitting Device," *Thin Solid Films* **518**, 4394 (2010).
51. T. Creazzo, **B. Redding**, E. Marchena, J. Murakowski, D. Prather, "Tunable Photoluminescence and Electroluminescence of Size-controlled Silicon Nanocrystals in a-Si/SiO₂ Superlattices," *Journal of Luminescence* **130**, 631 (2010).
52. E. Marchena, **B. Redding**, T. Creazzo, S. Shi, D. Prather, "Whispering gallery modes at 800 nm and 1550 nm in concentric Si-nc/Er:SiO₂ microdisks," *Journal of Nanophotonics* **4**, 049501 (2010).
53. D.W. Prather, **B. Redding**, T. Creazzo, E. Marchena, S. Shi, "Integration of Silicon Nanocrystals and Erbium Ring Cavities for an Extrinsic Two-Stage Silicon-Based Laser," *Journal of Nanoscience and Nanotechnology* **10**, 1 (2010).

54. **B. Redding**, S. Shi, D. Prather, "Electromagnetic Analysis of Ring Cavity Assisted Amplified Spontaneous Emission in Er:SiO₂/a-Si Horizontal Slot Waveguides," *IEEE Journal of Quantum Electronics* **45**, 825 (2009).
55. **B. Redding**, T. Creazzo, E. Marchena, S. Shi, D. Prather, "Coupling Si Nanocrystal Microdisk Emission to Whispering Gallery Modes in a Concentric SiO₂ Ring," *Optics Letters* **34**, 1384 (2009).
56. S. Shi, **B. Redding**, T. Creazzo, D. Prather, "Modeling of Light Amplification and Enhanced Spontaneous Emission in Silicon Nanocrystals," *Journal of Nanophotonics* **3**, 033503 (2009).
57. **B. Redding**, S. Shi, T. Creazzo, D. Prather, "Electromagnetic Modeling of Active Silicon Nanocrystal Waveguides," *Optics Express* **16**, 8792 (2008).
58. S. Shi, **B. Redding**, T. Creazzo, E. Marchena, D. Prather, "Quantum Electrodynamics Modeling of Silicon-Based Active Devices," *Advances in Optical Technologies*, **2008**, 615393 (2008).

Non-refereed
Journal
Articles

1. R. Chriki, V. Pal, C. Tradonsky, G. Barach, A. Friesem, N. Davidson, S. Knitter, C. Liu, **B. Redding**, M. Khokha, M. Choma, H. Cao, "Controlling Spatial Coherence," *Optics and Photonics News*, Dec. 2016.
2. **B. Redding**, P. Ahmadi, H. Cao, "An alternative to LEDs for Full-Field Imaging," *Photonics Spectra*, May 2016.
3. **B. Redding**, A. Cerjan, X. Huang, M. L. Lee, A. D. Stone, H. Cao, "A chaotic approach to speckle-free lasing," *Optics and Photonics News*, Dec. 2015.
4. **B. Redding**, S. Popoff, H. Cao, "Multimode fiber as a high-resolution low-loss spectrometer," *Optics and Photonics News*, Dec. 2013.
5. **B. Redding**, H. Cao, M. A. Choma, "Speckle-free laser imaging with random laser illumination," *Optics and Photonics News*, Dec. 2012.

Patents

1. **B. Redding**, M. Choma, H. Cao, "Systems and Methods for Imaging using a Random Laser," Patent # 2012/142595 (2012).
2. **B. Redding**, H. Cao, "Multimode optical fiber spectrometer," Patent # 2013/188520A3 (2013).
3. **B. Redding**, Y. Pan, "Optical trap using a focused hollow-beam for trapping and holding both absorbing and non-absorbing airborne particles," Patent # 9443631 (2016).
4. **B. Redding**, P. Ahmadi, M. Siefert, H. Cao, "Optical fibers, sources of optical radiation and methods for providing low-speckle optical radiation," Patent # 2016/0352066 A1 (2016).