

Dr. Alexander Cerjan

CONTACT INFORMATION	Senior Member of the Technical Staff Center for Integrated Nanotechnologies Sandia National Laboratory Albuquerque, NM 87123 USA	<i>Mobile:</i> +1-925-683-6454 <i>E-mail:</i> alexcerjan@gmail.com <i>Website:</i> www.alexcerjan.com
RESEARCH POSITIONS	Senior Member of the Technical Staff Sandia National Laboratories Postdoctoral Scholar Department of Physics, Pennsylvania State University Advisor: Professor Mikael Rechtsman Postdoctoral Scholar Department of Electrical Engineering, Stanford University Advisor: Professor Shanhui Fan Postdoctoral Associate Department of Applied Physics, Yale University Advisor: Professor A. Douglas Stone	January 2021 to present August 2017 to January 2021 August 2015 to August 2017 June 2015 to July 2015
EDUCATION	Yale University , New Haven, CT Ph.D., Physics, May 2015 Thesis Topic: <i>Fundamental Physics and Device Design using the Steady-state Ab initio Laser Theory</i> Advisor: Professor A. Douglas Stone Area of Study: Theoretical Optics and Photonics M.Phil., January, 2013 M.S., May, 2011 Brown University , Providence, RI B.S., Physics, Philosophy, May 2009 With Honors in Physics Undergraduate Thesis: <i>The Search for High Redshift Clusters</i> Advisor: Professor Ian Dell'Antonio Area of Study: Cosmology	
RESEARCH INTERESTS	<ul style="list-style-type: none">◇ Topological photonics◇ Bound states in the continuum◇ Non-linear light-matter interactions◇ Non-Hermitian optical media◇ Chaotic cavities◇ Quasicrystals and Hyperuniform structures	
JOURNAL PUBLICATIONS	[33] S. Vaidya, J. Noh, A. Cerjan, C. Jörg, G. von Freymann, and M. C. Rechtsman, "Observation of a Charge-2 Photonic Weyl Point in the Infrared," <i>Phys. Rev. Lett.</i> , 125 , 253902 (2020). – Selected as an APS Editors' Suggestion [32] A. Cerjan, M. Jürgensen, W. A. Benalcazar, S. Mukherjee, and M. C. Rechtsman, "Observation of a higher-order topological bound state in the continuum," <i>Phys. Rev. Lett.</i> , 125 , 213901 (2020). – Selected as an APS Editors' Suggestion	

- [31] A. Cerjan, M. Wang, S. Huang, K. P. Chen, and M. C. Rechtsman, “Thouless pumping in disordered photonic systems,” *Light Sci. Appl.* **9**, 178 (2020).
- [30] M. Benzaouia, A. Cerjan, and S. G. Johnson, “Is single-mode lasing possible in an infinite periodic system?” *Appl. Phys. Lett.* **117**, 051102 (2020).
– *Selected as an Editor’s Pick*
- [29] A. Cerjan, A. Oskooi, S.-L. Chua, S. G. Johnson “Modeling lasers and saturable absorbers via multilevel atomic media in the Meep FDTD software: Theory and implementation,” arXiv: 2007.09329.
- [28] W. A. Benalcazar and A. Cerjan, “Bound states in the continuum of higher-order topological insulators,” *Phys. Rev. B - Rapid Communication* **101**, 161116(R) (2020).
- [27] A. Cerjan, S. Bittner, M. Constantin, M. Guy, Y. Zeng, Q. J. Wang, H. Cao, and A. D. Stone, “Multimode lasing in wave-chaotic semiconductor microlasers,” *Phys. Rev. A* **100**, 063814 (2019).
- [26] A. Cerjan, “A Whole Surface of Exceptional Points,” *Physics* **12**, 138 (2019).
- [25] A. Cerjan, C. W. Hsu, and M. C. Rechtsman, “Bound States in the Continuum through Environmental Design,” *Phys. Rev. Lett.* **123**, 023902 (2019).
- [24] A. Cerjan, S. Huang, M. Wang, K. P. Chen, Y. D. Chong, and M. C. Rechtsman, “Experimental realization of a Weyl exceptional ring,” *Nat. Photonics* **13**, 623 (2019).
- [23] A. Pick, A. Cerjan, and S. G. Johnson, “*Ab initio* theory of quantum fluctuations and relaxation oscillations in multimode lasers,” *J. Opt. Soc. Am. B* **36**, C22 (2019).
- [22] A. Cerjan, M. Xiao, L. Yuan, and S. Fan, “Effects of non-Hermitian perturbations on Weyl Hamiltonians with arbitrary topological charges,” *Phys. Rev. B* **97**, 075128 (2018).
– *Selected as an APS Editors’ Suggestion*
- [21] A. Cerjan and S. Fan, “Complete photonic bandgaps in supercell photonic crystals,” *Phys. Rev. A - Rapid Communication* **96**, 051802(R) (2017).
- [20] A. Cerjan and S. Fan, “Achieving Arbitrary Control over Pairs of Polarization States Using Complex Birefringent Metamaterials,” *Phys. Rev. Lett.* **118**, 253902 (2017).
- [19] Y. Shi, A. Cerjan, S. Fan, “Acousto-optic finite-difference frequency-domain algorithm for first-principles simulations of on-chip acousto-optic devices,” *APL Photonics* **2**, 020801 (2017).
- [18] A. Cerjan and S. Fan, “Effects of non-uniform distributions of gain and loss in photonic crystals,” *New J. Phys.* **18**, 125007 (2016).
- [17] A. Cerjan, B. Redding, L. Ge, S. F. Liew, H. Cao, A. D. Stone, “Controlling mode competition by tailoring the spatial pump distribution in a laser: a resonance-based approach,” *Opt. Express* **24**, 26006 (2016).
- [16] A. Cerjan and S. Fan, “Eigenvalue dynamics in the presence of non-uniform gain and loss,” *Phys. Rev. A* **94**, 033857 (2016).
- [15] Y. Shen, G. Fang, A. Cerjan, Z. Chi, S. Fan, and C. Jin, “Slanted gold mushroom array: a switchable bi/tridirectional surface plasmon polariton splitter,” *Nanoscale* **8**, 15505 (2016).
- [14] A. Cerjan, A. Raman, and S. Fan, “Exceptional Contours and Band Structure Design in Parity-Time Symmetric Photonic Crystals,” *Phys. Rev. Lett.* **116**, 203902 (2016).

- [13] B. H. Hokr, A. Cerjan, J. V. Thompson, L. Yuan, S. F. Liew, J. N. Bixler, G. D. Noojin, R. J. Thomas, H. Cao, A. D. Stone, B. A. Rockwell, M. O. Scully, and V. V. Yakovlev, “Evidence of Anderson localization effects in random Raman lasing,” *Proc. of SPIE* **9731**, 973110 (2016).
- [12] L. Ge, D. Liu, A. Cerjan, S. Rotter, H. Cao, S. G. Johnson, H. E. Türeci, and A. D. Stone, “Interaction-induced mode switching in steady-state microlasers,” *Opt. Express* **24**, 41 (2016).
- [11] A. Cerjan and A. D. Stone, “Why the laser linewidth is so narrow: A modern perspective,” *Phys. Scr.* **91**, 013003 (2016).
- [10] A. Cerjan, A. Pick, Y. D. Chong, S. G. Johnson, and A. D. Stone, “Quantitative test of general theories of the intrinsic laser linewidth,” *Opt. Express* **23**, 28316 (2015).
- [9] A. Pick, A. Cerjan, D. Liu, A. W. Rodriguez, A. D. Stone, Y. D. Chong, and S. G. Johnson, “Ab-initio multimode linewidth theory for arbitrary inhomogeneous laser cavities,” *Phys. Rev. A* **91**, 063806 (2015).
– Selected as an APS Editors’ Suggestion
- [8] A. Cerjan, Y. D. Chong, and A. D. Stone, “Steady-state *ab initio* laser theory for complex gain media,” *Opt. Express* **23**, 6455 (2015).
– Featured in *Advances In Engineering*
- [7] B. Redding, A. Cerjan, X. Huang, M. L. Lee, A. D. Stone, M. A. Choma, and H. Cao, “Low-Spatial Coherence Electrically-Pumped Semiconductor Laser for Speckle-Free Full-Field Imaging,” *Proc. Natl. Acad. Sci. USA* **112**, 1304 (2015).
– Featured in *Optics and Photonics News*
– Selected for a *Microscopy Today Innovation Award*
- [6] S. Esterhazy, D. Liu, M. Liertzer, A. Cerjan, L. Ge, K. G. Makris, A. D. Stone, J. M. Melenk, S. G. Johnson, and S. Rotter, “Scalable numerical approach for the steady-state *ab initio* laser theory,” *Phys. Rev. A* **90**, 023816 (2014).
- [5] A. Cerjan, and A. D. Stone, “Steady-state *ab initio* theory of lasers with injected signals,” *Phys. Rev. A* **90**, 013840 (2014).
- [4] M. Liertzer, L. Ge, A. Cerjan, A. D. Stone, H. E. Türeci, and S. Rotter, “Pump-induced exceptional points in lasers,” *Phys. Rev. Lett.* **108**, 173901 (2012).
- [3] A. Cerjan, Y. D. Chong, L. Ge, and A. D. Stone, “Steady-state *ab-initio* laser theory for N-level lasers,” *Opt. Express* **20**, 474 (2012).
- [2] A. Cerjan and C. Cerjan, “Orbital angular momentum of Laguerre-Gaussian beams beyond the paraxial approximation,” *J. Opt. Soc. Am. A* **28**, 2253 (2011).
- [1] A. Cerjan and C. Cerjan, “Analytic solution of flat-top Gaussian and Laguerre-Gaussian laser field components,” *Opt. Lett.* **35**, 3465 (2010).

AWARDS

- ◇ Best Talk Award, U.S./Middle East Conference on Photonics, New York City, 2019
- ◇ Prize Teaching Fellowship Award, Yale University, 2014
- ◇ Prize Teaching Fellowship Award, Yale University, 2012
- ◇ Karen T. Romer Undergraduate Teaching and Research Award, Brown University, 2008
- ◇ Eagle Scout Award, 2004

GRANTS

- ◇ “The Search for High Redshift Clusters,” Rhode Island Space Grant, \$3000, June 1, 2007 to August 31, 2007.

INVITED TALKS

- [7] A. Cerjan, “Topological photonic systems: from structure to function,” At: Rice University, February 18, 2020.
- [6] A. Cerjan, “Advances in non-Hermitian and topological photonics,” At: *Center for Theoretical Physics of Complex Systems*, Institute for Basic Science, South Korea, October 22, 2019.
- [5] A. Cerjan, “Weyl points and Weyl exceptional rings in helical waveguide arrays,” In: *Weyl Fermions in Condensed Matter*, International Institute of Physics, Brazil, August 7, 2019.
- [4] A. Cerjan, “Exceptional contours formed in non-Hermitian topological photonic systems,” In: *Banff International Research Station Workshop on Photonic Topological Insulators*, Canada, September 14, 2017.
- [3] A. Cerjan, “Photonic systems with patterned gain and loss,” In: *Northrop Grumman Next Workshop on the Physics of Light Matter Interactions and Excited State Dynamics*, October 25–27, 2016.
- [2] A. Cerjan, “Exceptional contours and eigenvalue dynamics in systems with non-uniform gain and loss,” At: *Yale University, Applied Physics, Special SSO Seminar*, August 24, 2016.
- [1] A. Cerjan, “Quantitative test of general theories of the intrinsic laser linewidth,” In: *Texas A&M Physics of Quantum Electronics Follow-on Workshop*, January 12–14, 2015.

CONFERENCE TALKS

- [13] A. Cerjan, M. Jürgensen, W. A. Benalcazar, S. Mukherjee, and M. C. Rechtsman, “Bound States in the Continuum of Higher-Order Topological Photonic Systems,” In: *CLEO 2020*, May 10 – May 15, 2020.
- [12] A. Cerjan, M. Wang, S. Huang, K. P. Chen, and M. C. Rechtsman, “Thouless Pumping in Disordered Photonic Systems,” In: *CLEO 2020*, May 10 – May 15, 2020.
- [11] A. Cerjan, S. Huang, M. Wang, K. P. Chen, Y. D. Chong, and M. C. Rechtsman, “Experimental Realization of a Weyl Exceptional Ring,” In: *U.S./Middle East Conference on Photonics*, New York City, Nov 4 – Nov 6, 2019.
- [10] A. Cerjan, C. W. Hsu, and M. C. Rechtsman, “Bound states in the continuum through environment engineering,” In: *CLEO 2019*, May 5 – May 10, 2019.
- [9] A. Cerjan, S. Huang, K. P. Chen, Y. D. Chong, and M. C. Rechtsman, “Weyl exceptional ring in a helical waveguide array,” In: *CLEO 2018*, May 13 – May 18, 2018.
- [8] A. Cerjan and S. Fan, “Complete photonic bandgaps in supercell photonic crystals,” In: *CLEO 2018*, May 13 – May 18, 2018.
- [7] A. Cerjan, M. Xiao, L. Yuan, and S. Fan, “Effects of non-Hermitian perturbations on Weyl Hamiltonians with arbitrary topological charges,” In: *CLEO 2018*, May 13 – May 18, 2018.
- [6] A. Cerjan and S. Fan, “Eigenvalue dynamics in the presence of non-uniform gain and loss,” In: *CLEO 2017*, May 14 – May 19, 2017.
- [5] A. Cerjan, A. Raman, and S. Fan, “Exceptional Contours and Band Structure Design in Parity-Time Symmetric Photonic Crystals,” In: *Frontiers in Optics 2016*, October 17–21, (2016).
- [4] A. Cerjan, A. Pick, Y. D. Chong, S. G. Johnson, and A. D. Stone, “Quantitative test of general theories of the intrinsic laser linewidth,” In: *CLEO 2015*, May 10 – May 15, 2015.

- [3] A. Cerjan, B. Redding, H. Cao, and A. D. Stone, "Device design using the steady-state *ab initio* laser theory," In: *CLEO 2015*, May 10 – May 15, 2015.
- [2] A. Cerjan, and A. D. Stone, "Ab Initio Theory of Injection Locking of Lasers," In: *CLEO 2013*, June 9 – June 14, 2013.
- [1] A. Cerjan, Y. D. Chong, L. Ge, and A. D. Stone, "Steady-state Ab initio Laser Theory: Generalizations," In: *2012 APS March Meeting*, February 27 – March 2, 2012.

STUDENT
ADVISING

Kanchita Klangboonkrong

Undergraduate student in Physics, Pennsylvania State University. Designed and supervised her project on finding bound states in the continuum in structures with low refractive index contrast. 2019.

Lauren Bittner

Undergraduate student in Physics, Saint Vincent College, doing an REU program at Pennsylvania State University. Supervised her project on setting up and experimental apparatus for measuring the band structure of 3D printed photonic structures. 2018.

Jingjing Pan

Undergraduate student in Physics, Pennsylvania State University. Supervised her project on finding bound states in the continuum in 2D colloidal structures. 2018.

Jason Frost

Undergraduate student in Applied Physics, Stanford University. Supervised his project on exploring the optical properties of meta-materials comprised of eutectic materials with a phonon-polariton response, such as AgCl and KCl. 2016.

Kevin Lai

Undergraduate student in Physics, Yale University. Supervised his project on developing an implementation of SALT using the PETSc and SLEPc libraries. 2012–2013.

TEACHING
EXPERIENCE

Yale University, New Haven, CT

Invited Guest Lecturer

Exploring the Nature of Genius

Invited by professor Craig Wright to discuss the concept of genius as it applies to the scientific and mathematical disciplines. February 3rd, 2015.

Non-linear Optics and Lasers

Invited by professor Hui Cao to give an introduction to the steady-state *ab initio* laser theory. April 21st, 2015.

Teaching Fellow

September 2009 to May 2015

Ordinary and Partial Differential Equations with Applications

- Spring 2015
- Entry-level undergraduate course
- Responsible for weekly homework sessions, holding office hours, and producing homework solutions.
- Created homework and exam questions.

Thermodynamics and Statistical Mechanics

- Fall 2011, Fall 2012, Fall 2013, Fall 2014
- Upper-level undergraduate course
- Responsible for weekly homework sessions, holding office hours, producing homework solutions, and grading problem sets.
- Created homework and exam questions.

Electromagnetic Fields and Optics

- Spring 2014
- Upper-level undergraduate course
- Responsible for holding office hours, producing homework solutions, and grading problem sets.

Solid State Physics II

- Spring 2013
- Graduate level course
- Responsible for weekly homework sessions, holding office hours, producing homework solutions, and grading problem sets.

General Physics Laboratory

- Fall 2009, Spring 2010, Spring 2012
- Entry-level undergraduate level laboratory
- Responsible for a running a weekly section of 12-16 students for 3 hours, including a short lecture at the beginning, and grading the lab reports.

Electromagnetic Theory I

- Spring 2011
- Graduate level course
- Responsible for holding office hours, producing homework solutions, and grading problem sets.

Classical Mechanics (Intensive)

- Fall 2010
- Upper-level undergraduate course
- Responsible for weekly homework sessions, holding office hours, producing homework solutions, and grading problem sets.

(Student evaluations and other materials available upon request, or on my website.)

PROFESSIONAL
SERVICE

Meep Contributor

Validated the saturable multi-level atomic susceptibility and gyrotropic media features in the open-source photonics simulation software package Meep.

Referee Service

APS Journals: Phys. Rev. Letters, Phys. Rev. A, Phys. Rev. B, Phys. Rev. Research

OSA Journals: Optica, Optics Letters, Optics Express, Applied Optics

Nature Journals: Nature Communications, Light: Science & Applications, Scientific Reports

AAAS Journals: Science

AIP Journals: Applied Physics Letters

ACADEMIC
SERVICE

Graduate Student Seminar at Yale University

Organizer, Fall 2011 through Spring 2013.

Davenport College Affiliate

Organize and run events, such as making Liquid Nitrogen ice cream, for members of Davenport College, Fall 2010 to Spring 2015.

Co-coordinator

Facilitated the operation of the Graduate Affiliate program at Davenport, Fall 2011 to Spring 2014.

Mellon Forum Steering Committee Member

Helped seniors in Davenport college prepare and rehearse for Mellon Forum presentations. Fall 2013 to Spring 2015.

PROFESSIONAL
MEMBERSHIPS

American Physical Society, 2011–present
Optical Society of America, 2015–present

REFERENCES
AVAILABLE TO
CONTACT

Prof. Mikael Rechtsman (email: mcr22@psu.edu)

- Professor of Physics, Pennsylvania State University
- ◇ Department of Physics, 104 Davey Lab, University Park, PA 16802
- ★ *Prof. Rechtsman is my postdoctoral advisor at Penn State.*

Prof. Shanhui Fan (email: shanhui@stanford.edu; phone: +1-650-724-4759)

- Professor of Electrical Engineering, Stanford University
- ◇ Department of Electrical Engineering, 348 Via Pueblo Mall, Stanford, CA 94305
- ★ *Prof. Fan was my postdoctoral advisor at Stanford.*

Prof. A. Douglas Stone (email: douglas.stone@yale.edu; phone: +1-203-432-4279)

- Carl A. Morse Professor of Applied Physics & Physics, Yale University
- ◇ Department of Applied Physics, PO Box 208284, New Haven, CT 06520
- ★ *Prof. Stone was my Ph.D. advisor and the instructor for many of the courses I was a Teaching Fellow for.*

Prof. Hui Cao (email: hui.cao@yale.edu; phone: +1-203-432-0683)

- Professor of Applied Physics & Physics, Yale University
- ◇ Department of Applied Physics, PO Box 208284, New Haven, CT 06520
- ★ *Prof. Cao was on my thesis committee and is a close collaborator.*