Alexander Cerjan, PhD

CINT Scientist, Sandia National Laboratories

Albuquerque, NM 87122 • (925) 683-6454 • awcerja@sandia.gov • Google Scholar

EDUCATION

PhD, **Physics**, Yale University, New Haven, CT 2015
BS, **Physics**, **Philosophy**, Brown University, Providence, RI 2009

RESEARCH FUNDING (total funding as PI: $7.5M, total funding as PI or Co-PI: $12.0M)

Laboratory Directed Research and Development (LDRD), Sandia National Labs

PI, "Structured light from superstructured photonics," $1,711k 2025-2027
- Includes START HBCU University Partnership award, $213k

PI, "Mesoscopic modelling of nonlinear materials in structured optical systems," $623k 2025-2026

PI, "From geometry to interface states without a band structure: Developing a real-space approach to material topology," $1,927k 2024-2026

PI, "Identifying and classifying localized states in gapless systems using pseudospectral methods," $1,789k 2023-2025
- Includes START HBCU University Partnership award, $258k

PI, "Novel transport states in phonon-polariton systems," $284k 2022

PI, "Enhancing photonic systems using topology and non-Hermiticity," $1,185k 2021-2023

Department of Energy, Office of Science, Basic Energy Sciences (DOE BES)

Co-PI, "Light-matter interaction phenomena using subwavelength engineering of material properties," $4,500k 2024-2026

PROFESSIONAL EXPERIENCE

Principal Member of the Technical Staff 2024-Present
Sandia National Laboratories, Albuquerque, NM
Scientist at the Center for Integrated Nanotechnologies (CINT)

Senior Member of the Technical Staff 2021-2024
Sandia National Laboratories, Albuquerque, NM
Scientist at the Center for Integrated Nanotechnologies (CINT)

Research Professor (via Letter of Academic Title) 2021-Present
University of New Mexico, Albuquerque, NM
Department of Mathematics and Statistics

Postdoctoral Scholar 2017-2021
Pennsylvania State University, University Park, PA
Department of Physics
Advisor: Mikael C. Rechtsman

Postdoctoral Scholar 2015-2017
Stanford University, Stanford, CA
Department of Electrical and Computer Engineering
Advisor: Shanhui Fan

Graduate Research Assistant 2009-2015
Yale University, New Haven, CT
Department of Physics
Advisor: A. Douglas Stone

HONORS & AWARDS

APS Outstanding Referee	2023
Light: Science & Applications Outstanding Reviewer	2021
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 Univ.	2008
Eagle Scout Award	2004

TEACHING & MENTORING

Postdoctoral Advisees

- Dr. Justin Schirmann, Sandia National Labs, 2026-present
- Dr. Hyosim Yang, Sandia National Labs, 2025-present
- Dr. Ki Young Lee, Sandia National Labs, 2024-present
- Dr. Stephan Manua Wong, Sandia National Labs, 2022-2026
- Dr. Kahlil Yusef Dixon-Whyte, Sandia National Labs, 2021-2023

Graduate Students Mentored

- Sounak Sinha, University of Illinois Urbana-Champaign, 2026-present
- Chris Bairnsfather, Purdue University, 2024-present
- José Garcia, University of New Mexico, 2022-present
- Xingwei Gao, University of Southern California, 2024-2025
- Hao He, University of Southern California, 2024-2025

Undergraduates Mentored

- Olivia Hilton, Florida A&M University, 2025-present
- Sarah Dubuisson, Florida A&M University, 2025
- Louis Shogo Hight, University of New Mexico, 2023-2025
- Ajani Roberts, Florida A&M University, 2023-2025
- Dominic Cordova, University of New Mexico, 2023
- Kanchita Klangboonkrong, Pennsylvania State University, 2019
- Lauren Bittner, Pennsylvania State University, 2018
- Jingjing Pan, Pennsylvania State University, 2017-2018
- Jason Frost, Stanford University, 2016
- Kevin Lai, Yale University, 2012-2013

Teaching

"Band theory and Nanophotonics for Mathematicians" (500-level, Mathematics and Statistics), University of New Mexico	2022

Teaching Assistant

"Ordinary and Partial Differential Equations with Applications" (100-level, Applied Physics), Yale University	2015
"Thermodynamics and Statistical Mechanics" (400-level, Physics), Yale University	2011-2014
"Electromagnetic Fields and Optics" (400-level, Physics), Yale University	2014
"Solid State Physics II" (500-level, Physics), Yale University	2013
"General Physics Laboratory" (100-level, Physics), Yale University	2009,2010,2012
"Electromagnetic Theory I" (500-level, Physics), Yale University	2011
"Classical Mechanics (Intensive)" (400-level, Physics), Yale University	2010

PROFESSIONAL ACTIVITIES & AFFILIATIONS

Society Affiliations

Member, American Physical Society	2011-Present
Member, Optica (formerly the Optical Society of America)	2015-Present
Member, Materials Research Society	2022-Present
Member, SPIE, the International Society for Optics and Photonics	2023-Present
Member, Institute of Electrical and Electronics Engineers	2023-Present
Member, American Mathematical Society	2024-Present
Member, Society for Industrial and Applied Mathematics	2026-Present

Editorial Service

Editorial Board Member, *Physical Review A*	2023-2028

Conference Organization

Organizer, Workshop on "Applications of Operator Algebras and Noncommutative Geometry to Quantum Materials," Banff International Research Station	2027
Organizer, Symposium on "Topology Beyond Periodicity: From Aperiodic to Interacting Systems," MRS Fall 2026	2026
Organizer, Workshop on "Noncommutative Topology and Quantum Materials," University of New Mexico	2026
Subcommittee Member, FS 5: Nonlinear Optics and Novel Phenomena, CLEO	2023-2025

Subcommittee Member, 4: Nonlinear Optics, Optica Latin America Optics and Photonics (LAOP) 2024

Organizer, Session on "Nanophotonics Enabled Advances in Energy and Environmental Sustainability Applications," CINT Annual User Meeting 2022

Institutional Service

Organizer of the CINT Colloquium Series 2024-2026

Journals Reviewed

APS Journals: *Physical Review Letters*, *Physical Review X*, *Physical Review A*, *Physical Review B*, *Physical Review Research*, *Physical Review Applied*, *Physical Review Materials*

Nature Journals: *Nature*, *Nature Physics*, *Nature Photonics*, *Nature Materials*, *Nature Nanotechnology*, *Nature Communications*, *Communications Physics*, *Scientific Reports*

AAAS Journals: *Science, Science Advances*

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

CIOMP Journals: *Light: Science & Applications*, *eLight*

AIP Journals: *Applied Physics Letters*

Cell Journals: *Newton*

Wiley Journals: *Laser & Photonics Reviews*, *Advanced Optical Materials*

Granting Organizations Reviewed

Laboratory Directed Research and Development (LDRD), Sandia National Laboratories, USA
European Research Council (ERC), European Union
Deutsche Forschungsgemeinschaft (DFG), Germany
Agence Nationale de la Recherche (ANR), France
Croatian Science Foundation (HRZZ), Croatia
National Research and Development Agency (ANID), Chile

COLLABORATORS

- Terry A. Loring, Univ. New Mexico
- Wladimir A. Benalcazar, Emory Univ.
- Vasile Lauric, Florida A&M Univ.
- Wei Pan, Sandia National Labs
- Ralph Kaufmann, Purdue Univ.
- Justin Cole, UC Colorado Springs
- Igal Brener, Sandia National Labs
- Hermann Schulz-Baldes, FAU Erlangen
- Shoufeng Lan, Texas A&M Univ.
- Sven Höfling, JMU Würzburg
- Chloe Doiron, Sandia National Labs

TECHNICAL EXPERTISE

MEEP Contributor

Led the effort to complete and validate the saturable multi-level atomic susceptibility feature and validated the gyrotropic media feature in the open-source photonics simulation software package MEEP. (A detailed technical note for the first feature is available in arXiv:2007.09329)

Computer Languages

- Python
- Matlab
- C++
- Perl
- Scheme
- Mathematica
- Bash

PUBLICATIONS (total publications: 72, h-index: 31, total citations ~4000, Google Scholar Link, ORCID 0000-0002-4362-7300)

(Articles marked with a † follow the mathematics convention of listing authors alphabetically.)

Peer-Reviewed Journal Articles

[72] C. A. Bairnsfather, R. M. Kaufmann, T. A. Loring, and A. Cerjan, "Band Unfolding via the Quadratic Pseudospectrum," arXiv:2605.05423. (in press at *Physical Review B*)

[71] H. Yang*, K. Y. Lee*, S. Park, J. Noh, K. Musick, J. Yu, T. Santiago-Cruz, C. F. Doiron, and A. Cerjan, "Polarization-dependent angularly selective dielectric reflector." (in press at *Nature Communications*)

[70]† A. Cerjan and H. Schulz-Baldes, "Detecting local topology with the spectral localizer," arXiv:2506.14174. (in press at *ESAIM: Mathematical Modelling and Numerical Analysis*)

[69] S. Wong, I. Yamazaki, C. Siefert, I. Duff, T. A. Loring, and A. Cerjan, "Efficient local classification of parity-based material topology," *Physical Review B* **114**, 084201 (2026).

[68] C. H. Moore, W. W. Chow, A. S. Fierro, and A. Cerjan, "Integrated Laser-Material Interaction and PIC-DSMC Simulation of Laser-Triggered Vacuum Switches," *IEEE Transactions on Plasma Science* **54**, 3578 (2026).

[67] B. Martinez de Aguirre Jokisch, A. Cerjan, R. E. Christiansen, J. Mørk, O. Sigmund, and S. G. Johnson "Efficient first-principles inverse-design of nanolasers," *Laser & Photonics Reviews* **20**, e01614 (2026).

[66] B. Cerjan and A. Cerjan, "Lines of Bound States in the Continuum in Monodisperse Microsphere Structures," *Laser & Photonics Reviews* **20**, e02179 (2026).

[65] P. Pai, A. W. Cummings, A. Cerjan, W. Pan, F. Zhang, and C. D. Spataru, "Semiconductor Meta-Graphene and Valleytronics," *ACS Applied Materials & Interfaces* **18**, 6111 (2026).

[64] S. Wong, S. Betzold, S. Höfling, and A. Cerjan, "Dynamically reconfigurable topological routing in nonlinear photonic systems," *Light: Science & Applications* **15**, 46 (2026).

[63] S. Wong, A. Cerjan, and J. T. Cole, "Quantitative measure of topological protection in Floquet systems through the spectral localizer," *Physical Review B* **112**, 224306 (2025).

[62] M. Rodriguez-Vega, T. A. Loring, and A. Cerjan, "Dimensional crossover of class D real-space topological invariants," *Communications Physics* **8**, 480 (2025).

[61] B. Zhu, K. Hean, S. Wong, Y. Wang, R. Banerjee, H. Xue, Q. Wang, A. Cerjan, Q. J. Wang, W. Chang, and Y. D. Chong, "Topological photonic crystal fiber," *Science Advances* **11**, ady1476 (2025).

[60] S. C. Malek, T. Norden, C. F. Doiron, T. Santiago-Cruz, J. Yu, A. Cerjan, P. Padmanabhan, and I. Brener, "Giant Enhancement of Four-Wave Mixing by Doubly Zone-Folded Nonlocal Metasurfaces," *ACS Nano* **19**, 35609 (2025).

[59] K. Y. Lee, S. Wong, S. Vaidya, T. A. Loring, and A. Cerjan, "Classification of fragile topology enabled by matrix homotopy," *Physical Review Research* **7**, 033235 (2025).

[58] H. He, X. Gao, A. Cerjan, and C. W. Hsu, "Quasinormal coupled-mode analysis of dynamic gain in exceptional-point lasers," *ACS Photonics* **12**, 4150 (2025).

[57] X. Gao, H. He, W. W. Chow, A. Cerjan, and C. W. Hsu, "Bi-stability and period-doubling cascade of frequency combs in exceptional-point lasers," *Nanophotonics* **14**, 2259 (2025).
❖ Featured on the Journal's Cover

[56] S. Wong, A. Cerjan, K. G. Makris, M. Khajavikhan, D. Christodoulides, and S. S. Oh, "Nonlinear topological photonics: capturing nonlinear dynamics and optical thermodynamics," *ACS Photonics* **12**, 2291 (2025).

[55] C. D. Spataru, W. Pan, and A. Cerjan, "Topological Phenomena in Artificial Quantum Materials Revealed by Local Chern Markers," *Physical Review Letters* **134**, 126601 (2025).
APS Editors' Suggestion

[54] A. R. Kim, C. F. Doiron, F. J. Vega, J. Yu, A. M. Boehm, J. P. Klesko, I. Brener, R. Sarma, A. Cerjan, and T. Ohta, "Imaging Photonic Resonances within an All-Dielectric Metasurface via Photoelectron Emission Microscopy," *Advanced Photonics Research* **6**, 2400223 (2025).
❖ Featured on the Journal's Cover

[53] S. Malek, C. Doiron, I. Brener, and A. Cerjan, "Advanced Symmetry Design for Robust Multi-Resonant Nonlocal Metasurfaces," *Nanophotonics* **14**, 449 (2025).
❖ Featured on the Journal's Cover

[52]† A. Cerjan, V. Lauric, and T. A. Loring, "Multivariable pseudospectrum in C* algebras," *Journal of Mathematical Analysis and Applications* **547**, 129241 (2025).

[51] A. Cerjan and T. A. Loring, "Classifying photonic topology using the spectral localizer and numerical *K*-theory," *APL Photonics* **9**, 111102 (2024).
Selected as a Featured Article

[50] C. Doiron, I. Brener, and A. Cerjan, "Dual-Band Polarization Control with Pairwise Positioning of Polarization Singularities in Metasurfaces," *Physical Review Letters* **133**, 213802 (2024).

[49] X. Gao, H. He, S. Sobolewski, A. Cerjan, and C. W. Hsu, "Dynamic gain and frequency comb formation in exceptional-point lasers," *Nature Communications* **15**, 8618 (2024).

[48] S. Wong, T. A. Loring, and A. Cerjan, "Classifying topology in photonic crystal slabs with radiative environments," *npj Nanophotonics* **1**, 19 (2024).

[47] A. Cerjan, T. A. Loring, and H. Schulz-Baldes, "Local Markers for Crystalline Topology," *Physical Review Letters* **132**, 073803 (2024).

[46] A. Farhi, A. Cerjan, and A. D. Stone, "Generating and processing optical waveforms using spectral singularities," *Physical Review A* **109**, 013512 (2024).

[45]† A. Cerjan and T. A. Loring, "Even spheres as joint spectra of matrix models," *Journal of Mathematical Analysis and Applications* **531**, 127892 (2024).

[44] K. Y. Dixon, T. A. Loring, and A. Cerjan, "Classifying Topology in Photonic Heterostructures with Gapless Environments," *Physical Review Letters* **131**, 213801 (2023).

[43] S. Wong, T. A. Loring, and A. Cerjan, "Probing topology in nonlinear topological materials using numerical K-theory," *Physical Review B* **108**, 195142 (2023).

[42]† A. Cerjan, L. Koekenbier, and H. Schulz-Baldes, "Spectral localizer for line-gapped non-Hermitian systems," *Journal of Mathematical Physics* **64**, 082102 (2023).

[41] W. Cheng*, A. Cerjan*, S.-Y. Chen, E. Prodan, T. A. Loring, and C. Prodan, "Revealing topology in metals using experimental protocols inspired by K-theory," *Nature Communications* **14**, 3071 (2023).
- ❖ Highlighted through a News & Views in Nature Physics

[40]† A. Cerjan, T. A. Loring, and F. Vides, "Quadratic pseudospectrum for identifying localized states," *Journal of Mathematical Physics* **64**, 023501 (2023).

[39] C. F. Doiron, I. Brener, and A. Cerjan, "Realizing symmetry-guaranteed pairs of bound states in the continuum in metasurfaces," *Nature Communications* **13**, 7534 (2022).

[38] A. Cerjan and T. A. Loring, "An operator-based approach to topological photonics," *Nanophotonics* **11**, 4765 (2022).

[37] A. Cerjan and T. A. Loring, "Local invariants identify topology in metals and gapless systems," *Physical Review B* **106**, 064109 (2022).

[36] J. Murray, A. Cerjan, and B. Redding, "Massively distributed fiber strain sensing using Brillouin lasing," *Optics Express* **30**, 25765 (2022).

[35] W. A. Benalcazar and A. Cerjan, "Chiral-Symmetric Higher-Order Topological Phases of Matter," *Physical Review Letters* **128**, 127601 (2022).

[34] J. Murray, A. Cerjan, and B. Redding, "Distributed Brillouin fiber laser sensor," *Optica* **9**, 80 (2022).
- ❖ Featured in Optics and Photonics News Year in Review

[33] C. Jörg*, S. Vaidya*, J. Noh, A. Cerjan, S. Augustine, G. von Freymann, and M. C. Rechtsman, "Observation of Quadratic (Charge-2) Weyl Point Splitting in Near-Infrared Photonic Crystals," *Laser & Photonics Reviews* **16**, 2100452 (2022).
- ❖ Featured on the Journal's Cover

[32] A. Cerjan*, C. Jörg*, S. Vaidya, S. Augustine, W. A. Benalcazar, C. W. Hsu, G. von Freymann, and M. C. Rechtsman, "Observation of bound states in the continuum embedded in symmetry bandgaps," *Science Advances* **7**, eabk1117 (2021).

[31] S. Vaidya, W. A. Benalcazar, A. Cerjan, and M. C. Rechtsman, "Point-defect-localized bound states in the continuum in photonic crystals and structured fibers," *Physical Review Letters* **127**, 023605 (2021).

[30] 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," *Physical Review Letters* **125**, 253902 (2020).
- APS Editors' Suggestion

[29] A. Cerjan, M. Jürgensen, W. A. Benalcazar, S. Mukherjee, and M. C. Rechtsman, "Observation of a higher-order topological bound state in the continuum," *Physical Review Letters* **125**, 213901 (2020).
- APS Editors' Suggestion

[28] A. Cerjan, M. Wang, S. Huang, K. P. Chen, and M. C. Rechtsman, "Thouless pumping in disordered photonic systems," *Light: Science & Applications* **9**, 178 (2020).

[27] M. Benzaouia, A. Cerjan, and S. G. Johnson, "Is single-mode lasing possible in an infinite periodic system?" *Applied Physics Letters* **117**, 051102 (2020).
- Editor's Pick

[26] W. A. Benalcazar and A. Cerjan, "Bound states in the continuum of higher-order topological insulators," *Physical Review B* **101**, 161116(R) (2020).

[25] 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," *Physical Review A* **100**, 063814 (2019).

[24] A. Cerjan, C. W. Hsu, and M. C. Rechtsman, "Bound states in the continuum through environmental design," *Physical Review Letters* **123**, 023902 (2019).

[23] A. Cerjan, S. Huang, M. Wang, K. P. Chen, Y. D. Chong, and M. C. Rechtsman, "Experimental realization of a Weyl exceptional ring," *Nature Photonics* **13**, 623 (2019).
- "Highly Cited Paper," in the top 1% of all papers in physics (Web of Science)

[22] A. Pick, A. Cerjan, and S. G. Johnson, "Ab initio theory of quantum fluctuations and relaxation oscillations in multimode lasers," *Journal of the Optical Society of America B* **36**, C22 (2019).

[21] A. Cerjan, M. Xiao, L. Yuan, and S. Fan, "Effects of non-Hermitian perturbations on Weyl Hamiltonians with arbitrary topological charges," *Physical Review B* **97**, 075128 (2018).

[20] A. Cerjan and S. Fan, "Complete photonic bandgaps in supercell photonic crystals," *Physical Review A* **96**, 051802(R) (2017).

[19] A. Cerjan and S. Fan, "Achieving arbitrary control over pairs of polarization states using complex birefringent metamaterials," *Physical Review Letters* **118**, 253902 (2017).

[18] 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).

[17] A. Cerjan and S. Fan, "Effects of non-uniform distributions of gain and loss in photonic crystals," *New Journal of Physics* **18**, 125007 (2016).

[16] 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," *Optics Express* **24**, 26006 (2016).

[15] A. Cerjan and S. Fan, "Eigenvalue dynamics in the presence of non-uniform gain and loss," *Physical Review A* **94**, 033857 (2016).

[14] 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).

[13] A. Cerjan, A. Raman, and S. Fan, "Exceptional contours and band structure design in parity-time symmetric photonic crystals," *Physical Review Letters* **116**, 203902 (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," *Optics Express* **24**, 41 (2016).

[11] A. Cerjan and A. D. Stone, "Why the laser linewidth is so narrow: A modern perspective," *Physica Scripta* **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," *Optics 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," *Physical Review A* **91**, 063806 (2015).
- APS Editors' Suggestion

[8] A. Cerjan, Y. D. Chong, and A. D. Stone, "Steady-state *ab initio* laser theory for complex gain media," *Optics Express* **23**, 6455 (2015).

[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," *Proceedings of the National Academy of Sciences 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," *Physical Review A* **90**, 023816 (2014).

[5] A. Cerjan, and A. D. Stone, "Steady-state *ab initio* theory of lasers with injected signals," *Physical Review 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," *Physical Review Letters* **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," *Optics Express* **20**, 474 (2012).

[2] A. Cerjan and C. Cerjan, "Orbital angular momentum of Laguerre-Gaussian beams beyond the paraxial approximation," *Journal of the Optical Society of America A* **28**, 2253 (2011).

[1] A. Cerjan and C. Cerjan, "Analytic solution of flat-top Gaussian and Laguerre-Gaussian laser field components," *Optics Letters* **35**, 3465 (2010).

Perspectives

[2] A. Cerjan, "A Compact Topological Microwave Isolator," *Nature Photonics* **19**, 1035 (2025).

[1] A. Cerjan, "A whole surface of exceptional points," *Physics* **12**, 138 (2019).

Technical Notes

[1] 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.

Conference Proceedings

[1] 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," *Proceedings of SPIE* **9731**, 973110 (2016).

Work-in-Progress (manuscripts available upon request)

[13] K. M. Azizur-Rahman, W. J. Smith, A. Belyanin, J. J. Mah, J. J. Fonseca, J. T. Robinson, B. Redding, T. S. Luk, M. X. de Jesus Lopez, S. Wong, T. Norden, K. Y. Lee, A. R. Kim, P. Padmanabhan, A. Cerjan, T. Beechem, T. Ohta, W. W. Chow, and R. Sarma, "When Heat Enhances Gain: Phonon-Assisted Indirect Bandgap Lasing in WS_2 Microcavities." (in submission)

[12] C. D. Spataru, H. Gerhard, W. Pan, A. G. Grushin, W. A. Benalcazar, and A. Cerjan, "Semiconductor Moiré Artificial Graphene as a Platform for Topological Flat Bands." (in submission)

[11] W. N. Faugno, F. Barrows, T. A. Loring, N. Goldman, and A. Cerjan, "Generating quantum error correcting codes from topological pre-thermal scars," arXiv:2609.05699. (in submission)

[10] J. T. Cole, C. Jörg, T. A. Loring, and A. Cerjan, "Time-resolved topology of aperiodically driven systems," arXiv:2609.19348. (in submission)

[9] K. Y. Lee, C. F. Doiron, and A. Cerjan, "Meta-Environments for Structured Lasing." (in submission)

[8] W. W. Chow, S. Peana, D. I. Herman, K. Y. Lee, A. Cerjan, C. Shang, G. Moody, J. E. Bowers and F. Jahnke, "Cavity-QED analysis of InAs quantum-dot single photon production," arXiv:2609.22025. (in submission)

[7] K. Kudtarkar, X. Wang, Y. Jeong, C. F. Doiron, A. Cerjan, and S. Lan, "Doubly Topological Harmonic Generation," arXiv:2605.11349. (in submission)

[6] A. D. Santhosh, A. Cerjan, A. Alù, and A. B. Khanikaev, "Emergent Chiral Symmetry, Dualities, and Topological Phases in Orbital lattices." (in submission)

[5]† A. Cerjan, V. Lauric, and T. A. Loring, "Clifford spectrum of three 2 by 2 matrices," arXiv:2602.15302. (in submission)

[4] H. Gerhard, Y. Wang, A. Cerjan, and W. Benalcazar, "A Spatial Localizer for Electrons in Insulators," arXiv:2603.13206. (in submission)

[3] J. Düreth, S. Widmann, P. Gagel, S. Dam, S. Betzold, M. Emmerling, C. G. Mayer, D. Laibacher, M. Kamp, O. A. Egorov, U. Peschel, T. Hofmann, R. Thomale, A. Cerjan, S. Höfling, and S. Klembt "Probing Local Topology in a Disordered Higher-Order Topological Insulator," arXiv:2511.13958. (in submission)

[2] P. P. Iyer, L. M. Martinez, C. F. Doiron, T. Sentz, J. Noh, T. S. Santiago-Cruz, W. K. Mills, C. Boyd, T. S. Luk, M. B. Sinclair, Z. Jacob, P. Padmanabhan, A. Cerjan, and I. Brener, "Ultrafast steering of circularly polarized light using chiral bound states-in-the-continuum metasurfaces." (in submission)

[1] K. Y. Lee, W. W. Chow, and A. Cerjan, "Superstructured-cavity surface-emitting lasers for intrinsic beam-steering." (in submission)

PROFESSIONAL PRESENTATIONS (69 total presentations + 1 upcoming)

(Presentations marked with a ‡ are for accepted invitations at upcoming events.)

Invited Tutorials and Keynotes

[1] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," International workshop on Quantum Materials and Structured Light 2024, Ettore Majorana Foundation, Erice, Italy. July 9th, 2024.

Invited Talks and Colloquia

[49]‡ "TBD," ETOPIM 14 (the International Conference on Elastic, Electrical, Transport and Optical Properties of Inhomogeneous Media), London, United Kingdom. June 28-July 2, 2027.

[48] "Using Matrix Homotopy to Classify Material Topology, and the Ongoing Need for Sparse Pfaffian Algorithms," SIAM Conference on Nonlinear Waves and Coherent Structures, Montréal, Canada. May 29th, 2026.

[47] "Classifying material topology in real space using matrix homotopy," Workshop on Mathematical Aspects of Topological Insulators, Institute for the Mathematical Sciences of the Americas (IMSA), Miami, FL. April 22th, 2026.

[46] “Steerable surface emitting laser design based on a line of bound states in the continuum,” SPIE Photonics Europe, Strasbourg, France. April 13th, 2026.

[45] “Classifying material topology in real space using matrix homotopy,” CREOL, University of Central Florida, Orlando, FL. February 27th, 2026.

[44] “Classifying material topology in real space using matrix homotopy,” Applied Mathematics Seminar, Florida State University, Tallahassee, FL. February 25th, 2026.

[43] “Classifying material topology in real space using matrix homotopy,” Materials Science and Engineering Department, Texas A&M University, College Station, TX. February 3rd, 2026.

[42] “Classifying reconfigurable photonic topology using matrix homotopy,” SPIE Photonics West, San Francisco, CA. January 21st, 2026.

[41] “Surface emitting laser design based on a line of bound states in the continuum,” SPIE Photonics West, San Francisco, CA. January 20th, 2026.

[40] “Classifying material topology in real space using matrix homotopy,” BLABS Seminar, Los Alamos National Laboratory, Los Alamos, NM. January 12th, 2026.

[39] “Classifying topology in nonlinear photonic systems,” Physics of Quantum Electronics (PQE), Snowbird, UT. January 9th, 2026.

[38] “An operator-based approach to classifying topology in open and nonlinear systems,” Topology and Disorder in Wave Physics, Cargèse Institute of Scientific Studies, Corsica, France. November 21st, 2025.

[37] “Classifying topology in open and nonlinear photonic systems,” PIERS 2025, Chiba, Japan. November 7th, 2025.

[36] “Classifying material topology using matrix homotopy,” Center for Nanoscale Materials, Argonne National Laboratory, Lemont, IL. September 10th, 2025.

[35] “Classifying topology in open and nonlinear photonic systems,” SPIE Optics and Photonics, San Diego, CA. August 7th, 2025.

[34] “Classifying Fragile Topology Using Matrix Homotopy,” META 2025, Malaga, Spain. July 25th, 2025.

[33] “Local topological classification of open and nonlinear photonic systems,” TopoPhoto 2025, Donostia-San Sebastian, Spain. July 2nd, 2025.

[32] “An operator-based approach to classifying topology in open and nonlinear systems,” ETOPIM 13 (the International Conference on Elastic, Electrical, Transport and Optical Properties of Inhomogeneous Media), New York, NY. June 19th, 2025.

[31] “Classifying material topology using matrix homotopy,” Topology and Geometry Beyond Perfect Crystals, Nordita, Stockholm, Sweden, May 27th, 2025.

[30] “Classifying topology in open and nonlinear photonic systems,” Waves 2025, Athens, GA. April 15th, 2025.

[29] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," Julius-Maximilians-Universität Würzburg, Würzburg, Germany. February 26th, 2025.

[28] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," IFW Dresden, Dresden, Germany. February 25th, 2025.

[27] "Local topological classification of open and nonlinear materials," AMS Special Session on Mathematics of Topological Insulators, JMM 2025, Seattle, WA. January 10th, 2025.

[26] "Understanding defects, unfolding bands, and classifying topology using multi-operator pseudospectra," Sandia National Laboratories, Albuquerque, NM. January 8th, 2025.

[25] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," Duke Advanced Multifunctional Metamaterials (AMM) Workshop, Durham, NC. November 18th, 2024.

[24] "Classifying Topology in Open and Nonlinear Photonic Systems," 21st International Workshop on Pseudo-Hermitian Hamiltonians in Quantum Physics (PHHQP-XXI), Chania, Greece. September 24th, 2024.

[23] "Creating Controllable Sets of Bound States in the Continuum," SPIE Optics and Photonics, San Diego, CA. August 22nd, 2024.

[22] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," Physics of Excitons and Polaritons in Semiconductors 2024, Reykjavík, Iceland. August 9th, 2024.

[21] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," CUNY, New York, NY. July 25th, 2024. (Virtual)

[20] "Classifying Topology in Open Photonic Systems," META 2024, Toyama, Japan. July 18th, 2024.

[19] "An operator-based approach to topological physics, and creating controllable sets of bound states in the continuum," Laboratory for Ultrafast Materials and Optical Science (LUMOS), Los Alamos National Laboratory, Los Alamos, NM. November 2nd, 2023.

[18] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," Max Planck Institute for the Science of Light, Erlangen, Germany. October 27th, 2023.

[17] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," RPTU Kaiserslautern-Landau, Kaiserslautern, Germany. October 23rd, 2023.

[16] "An operator-based approach to topological photonics: Band structures and Bloch eigenstates not required," International Workshop on Polaritons in Emerging Materials, IBS: PCS, Daejeon, South Korea. September 14th, 2023.

[15] "Identifying topology directly from Maxwell's equations: Band structures and Bloch eigenstates not required," META 2023, Paris, France. July 18th, 2023.

[14] "An operator-based approach to topological physics: Band structures and Bloch eigenstates not required," Emory University, Atlanta, GA. April 13th, 2023.

[13] "Identifying topology directly from Maxwell's equations: Band structures and Bloch eigenstates not required," Florida A&M University, Tallahassee, FL. February 27th, 2023.

[12] "Creating Controllable Sets of Bound States in the Continuum," Physics of Quantum Electronics (PQE), Snowbird, UT. January 10th, 2023.

[11] "Creating Bound States in the Continuum Using Superstructure Photonics," MRS Fall Meeting, Boston, MA. November 28th, 2022.

[10] "Identifying topology directly from Maxwell's equations: Band structures and Bloch eigenstates not required," International Conference of Quantum, Nonlinear and Nanophotonics, Jena, Germany. September 7th, 2022.

[9] "Using symmetry and topology to confine and control light," University of New Mexico, Albuquerque, NM. September 2nd, 2021.

[8] "Topological photonic systems: from structure to function," Sandia National Laboratories, Albuquerque, NM. September 1st, 2020.

[7] "Topological photonic systems: from structure to function," Rice University, Houston, TX. February 18th, 2020.

[6] "Advances in non-Hermitian and topological photonics," Institute for Basic Science: Center for Theoretical Physics of Complex Systems, Daejeon, South Korea. October 22nd, 2019.

[5] "Weyl points and Weyl exceptional rings in helical waveguide arrays," International Institute of Physics: Weyl Fermions in Condensed Matter, Natal, Brazil. August 7th, 2019.

[4] "Exceptional contours formed in non-Hermitian topological photonic systems," Banff International Research Station Workshop on Photonic Topological Insulators, Banff, Canada. September 14th, 2017.

[3] "Photonic systems with patterned gain and loss," Northrop Grumman Next Workshop on the Physics of Light Matter Interactions and Excited State Dynamics, Redondo Beach, CA. October 27th, 2016.

[2] "Exceptional contours and eigenvalue dynamics in systems with non-uniform gain and loss," Yale University: Applied Physics Seminar, New Haven, CT. August 24th, 2016.

[1] "Quantitative test of general theories of the intrinsic laser linewidth," Texas A&M Physics of Quantum Electronics Follow-on Workshop, College Station, TX. January 12th, 2015.

Invited Guest Lectures

[2] "Introduction to the steady-state ab initio laser theory," Yale University, New Haven, CT. April 21st, 2015.

[1] "Exploring the nature of genius in science and mathematics," Yale University, New Haven, CT. February 3rd, 2015.

Contributed

[18] A. Cerjan and T. A. Loring, "An Operator-Based Approach to Topological Photonics," CLEO, San Jose, CA. May 11th, 2023.

[17] A. Cerjan and T. A. Loring, "Local markers identify topology in metals and gapless systems," APS March Meeting, Las Vegas, NV. March 8th, 2023.

[16] W. A. Benalcazar and A. Cerjan, "Chiral-Symmetric Higher-Order Topological Phases Protected by Multipole Chiral Number Invariants," CLEO, San Jose, CA. May 20th, 2022.

[15] A. Cerjan, C. Jörg, S. Vaidya, S. Augustine, W. A. Benalcazar, C. W. Hsu, G. von Freymann, and M. C. Rechtsman, "Using symmetry bandgaps to create bound states in the continuum in photonic crystals," CLEO, Virtual. May 13th, 2021.

[14] A. Cerjan, M. Jürgensen, W. A. Benalcazar, S. Mukherjee, and M. C. Rechtsman, "Observation of a higher-order topological bound states in the continuum," APS March Meeting, Virtual. March 17th, 2021.

[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," CLEO, Virtual. May 11th, 2020.

[12] A. Cerjan, M. Wang, S. Huang, K. P. Chen, and M. C. Rechtsman, "Thouless pumping in disordered photonic systems," CLEO, Virtual. May 11th, 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," U.S./Middle East Conference on Photonics, New York City, NY. Nov 4th, 2019.

[10] A. Cerjan, C. W. Hsu, and M. C. Rechtsman, "Bound states in the continuum through environment engineering," CLEO, San Jose, CA. May 7th, 2019.

[9] A. Cerjan and S. Fan, "Complete photonic bandgaps in supercell photonic crystals," CLEO, San Jose, CA. May 17th, 2018.

[8] A. Cerjan, S. Huang, K. P. Chen, Y. D. Chong, and M. C. Rechtsman, "Weyl exceptional ring in a helical waveguide array," CLEO, San Jose, CA. May 14th, 2018.

[7] A. Cerjan, M. Xiao, L. Yuan, and S. Fan, "Effects of non-Hermitian perturbations on Weyl Hamiltonians with arbitrary topological charges," CLEO, San Jose, CA. May 14th, 2018.

[6] A. Cerjan and S. Fan, "Eigenvalue dynamics in the presence of non-uniform gain and loss," CLEO, San Jose, CA. May 15th, 2017.

[5] A. Cerjan, A. Raman, and S. Fan, "Exceptional contours and band structure design in parity-time symmetric photonic crystals," Frontiers in Optics, Washington, DC. October 21st, 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," CLEO, San Jose, CA. May 13th, 2015.

[3] A. Cerjan, B. Redding, H. Cao, and A. D. Stone, "Device design using the steady-state *ab initio* laser theory," CLEO, San Jose, CA. May 13th, 2015.

[2] A. Cerjan, and A. D. Stone, "Ab initio theory of injection locking of lasers," CLEO, San Jose, CA. June 10th, 2013.

[1] A. Cerjan, Y. D. Chong, L. Ge, and A. D. Stone, "Steady-state ab initio laser theory: generalizations," APS March Meeting, Boston, MA. March 2nd, 2012.