

Bo Zhen

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EDUCATION

- Ph.D. Physics, *Massachusetts Institute of Technology* (09/2008 – 08/2014)
- B.S. Academic Talent Program, Mathematics and Physics, (ranked 2/55)
Tsinghua University, Beijing, China (09/2004 – 08/2008)

APPOINTMENTS

- Assistant Professor, Department of Physics, *University of Pennsylvania* (Jan 2018 –)
- Joint Postdoc, Prof. Marin Soljačić group, Physics Department, *MIT* (2014 –2017)
- Joint Postdoc, Prof. Moti Segev group, Physics Department, *Technion* (2014 –2017)
- Graduate Student, Prof. Marin Soljačić group, Physics Department, *MIT* (2010 –2014)

HONORS AND AWARDS

- Army Early Career Award for Scientists and Engineers, 2019
(previously known as PECASE)
- Kaufman New Investigator, 2018
- AFOSR Young Investigator Award, 2018
- Elliman Faculty Fellowship, University of Pennsylvania (01/2018-06/2023)
- MIT, Presidential Fellowship (09/2008 – 09/2009)
- Tsinghua University, National Scholarships (09/2005 – 09/2007)

PEER-REVIEWED PUBLICATIONS

- “Quadrupole topological photonic crystals”, L. He, Z. Addison, E. Mele, **B. Zhen**, *Nature Communications*, 11, 1-6 (2020).
- “Observation of topologically enabled unidirectional guided resonances”, X. Yin, J. Jin, M. Soljacic, C. Peng, **B. Zhen**, *Nature* 580, 467-471 (2020).
- “Topologically enabled ultra-high-Q resonances robust to out-of-plane scattering loss”, J. Jin, X. Yin, L. Ni, M. Soljacic, **B. Zhen**, C. Peng, *Nature* 574, 501-504 (2019).
- “Floquet Chern insulators of light”, L. He, Z. Addison, J. Jin, E. Mele, S.G. Johnson, **B. Zhen**, *Nature Communications* 10, 4194 (2019).
- “Synthesis and observation of non-Abelian gauge fields in real space”, Y. Yang, C. Peng, D. Zhu, H. Buljan, J.D. Joannopoulos, **B. Zhen**, M. Soljacic, *Science* 365, 6457 (2019).
- “Exceptional surfaces in PT-symmetric photonic systems”, H. Zhou, J.Y. Lee, S. Liu, **B. Zhen**, *Optica* 6, 2, 190 (2019).
- “Bound states in the continuum in low contrast fiber Bragg gratings”, X. Gao, **B. Zhen**, M. Soljacic, H. Chen, C.W. Hsu, *ACS Photonics* 6, 11, 2996-3002 (2019).
- “Observation of bulk Fermi arc and polarization half charge from paired exceptional points”, H. Zhou*, C. Peng*, Y. Yoon, C. W. Hsu, K. A. Nelson, L. Fu, J. D. Joannopoulos, M. Soljacic, **B. Zhen**, *Science* 359, 1009 (2018).
- “Topological band theory for non-Hermitian Hamiltonians”, H. Shen, **B. Zhen**, L. Fu, *Physical Review Letters* 120(14): 146402 (2018).

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10. “General theory of spontaneous emission at exceptional points” A. Pick*, **B. Zhen***, O. D. Miller, C. W. Hsu, F. Hernandez, A. W. Rodriguez, O. D. Miller, M. Soljačić, and S. G. Johnson, *Optics Express* 25, 11, 12325 (2017). Editor’s Pick
 11. “Topologically-enabled optical nano-motors” O. Ilic, I. Kaminer, **B. Zhen**, O. Miller, H. Buljan, and M. Soljačić, *Science Advances*, 3, 6, e1602738 (2017).
 12. “Dynamically encircling exceptional points: exact evolution and polarization state conversion” A. U. Hassan, **B. Zhen**, M. Soljačić, M. Khajavikhan, and D. Christodoulides, *Physical Review Letters*, 118, 093002 (2017).
 13. “Symmetry, stability, and computation of degenerate lasing modes.” D. Liu, **B. Zhen**, L. Ge, F. Hernandez, A. Pick, S. Burkhardt, M. Liertzer, S. Rotter, and S. G. Johnson, *Physical Review A*, 95, 023835 (2017).
 14. “Spectrally and Spatially Resolved Smith-Purcell Radiation in Plasmonic Crystals with Short-Range Disorder” I. Kaminer, S. E. Kooi, R. Shiloh, **B. Zhen**, Y. Shen, J. J. López, R. Remez, S. A. Skirlo, Y. Yang, J. D. Joannopoulos, A. Arie, and M. Soljačić, *Physical Review X*, 7, 011003 (2017).
 15. “Direct imaging of isofrequency contours in photonic structures” E. C. Regan*, Y. Igarashi*, **B. Zhen***, I. Kaminer, C. W. Hsu, Y. Shen, J.D. Joannopoulos, and M. Soljačić, *Science Advances*, 2, 1601591 (2016).
 16. “Perfect single-sided radiation and absorption without mirrors” H. Zhou, **B. Zhen†**, C. W. Hsu, O. D. Miller, S. G. Johnson, J. D. Joannopoulos, and M. Soljačić, *Optica*, 3, 10, 1079-1086 (2016).
 17. “Bound states in the continuum” C.W. Hsu*, **B. Zhen***, A.D. Stone, J.D. Joannopoulos, and M. Soljačić, *Invited review at Nature Review Material*, 1, 16048 (2016).
 18. “Shrinking light to allow forbidden transitions on the atomic scale”, N. Rivera*, I. Kaminer*, **B. Zhen**, J. D. Joannopoulos, and M. Soljačić, *Science*, 353 (6296), 263-269 (2016).
 19. “Electromagnetic pathway: flexible yet robust”, **B. Zhen** and M. Soljačić, *Nature Materials, Views and News*, 15, 494-495 (2016).
 20. “Optically thin metallic films for high-radiative-efficiency plasmonics”, Y. Yang, **B. Zhen**, C. W. Hsu, O. D. Miller, J. D. Joannopoulos, and M. Soljačić, *Nano Letters*, 16, 4110-4117 (2016).
 21. “Substrate-independent light confinement in bioinspired all-dielectric surface resonators”, E. Regan, Y. Shen, J. Lopez, C. W. Hsu, **B. Zhen**, J. D. Joannopoulos, and M. Soljačić, *ACS Photonics*, 3, 352-356 (2016).
 22. “Controlling directionality and dimensionality of wave propagation through separable bound states in the continuum” N. Rivera, C.W. Hsu, **B. Zhen**, H. Buljan, J. D. Joannopoulos, and M. Soljačić, *Scientific Report*, 6, 33394 (2016).
 23. “Formation Mechanism of Guided Resonance and Bound States in the Continuum in Photonic Crystal Slabs”, X. Gao*, C. W. Hsu*, **B. Zhen**, L. Xiao, J. D. Joannopoulos, and M. Soljačić, *Scientific Report*, 6, 31908 (2016).
 24. “Spawning Rings of Exceptional Points out of Dirac Cones”, **B. Zhen***, C.W. Hsu*, Y. Igarashi*, L. Ling, I. Kaminer, A. Pick, S.-L. Chua, J. D. Joannopoulos, and M. Soljačić, *Nature*, 525, 354, (2015).
 25. “Topological nature of optical bound states in the continuum” **B. Zhen***, C. W. Hsu*, L. Ling, A. D. Stone, and M. Soljačić, *Physical Review Letters* 113, 257401 (2014).

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26. “Fabricating Centimeter-scale High Quality Factor 2D-periodic Photonic Crystal Slabs” J. Lee, **B. Zhen**, S.-L. Chua, O. Shapira, and M. Soljačić, *Optics Express* 22, 3724 (2014).
 27. “Modeling of threshold and dynamics behavior of organic Nanostructured lasers.” S.-L. Chua, **B. Zhen**, J. Lee, J. Bravo, E. Ippen, O. Shapira, and M. Soljačić, *Invited article in Journal of Material Chemistry C* 2, 1463 (2014).
 28. “Transparent Displays Enabled by Resonant Nanoparticle Scattering”, C. W. Hsu, **B. Zhen**, W. Qiu, O. Shapira, B. G. Delacy, J. D. Joannopoulos, and M. Soljačić, *Nature Communications* 7, 3152 (2014).
 29. “Enabling Enhanced Emission and Low-Threshold Lasing of Organic Molecules Using Special Fano Resonances of Macroscopic Photonic Crystals”, **B. Zhen***, S.-L. Chua*, J. Lee, A. W. Rodriguez, X. Laing, S. G. Johnson, J. D. Joannopoulos, M. Soljačić, and O. Shapira, *Proceedings of the National Academy of Sciences* 110 (34) 13711-13716 (2013). [*Featured on the cover*]
 30. “Observation of Trapped Light within the Radiation Continuum” C. W. Hsu*, **B. Zhen***, J. Lee, S.-L. Chua, S. G. Johnson, J. D. Joannopoulos, and M. Soljačić, *Nature* 499 (7457), 188-191 (2013)
 31. “Bloch Surface Eigenstates within the Radiation Continuum” C. W. Hsu, **B. Zhen**, S.-L. Chua, S. G. Johnson, J. D. Joannopoulos, and M. Soljačić, *Invited Article in Light: Science & Applications* 2(7), 84 (2013).
 32. “Topological Dangling Bonds with Large Spin Splitting and Enhanced Spin Polarization on the Surface of Bi₂Te₃.” H. Lin, T. Das, Y. Okada, M. C. Boyer, W. D. Wise, M. Tomasik, **B. Zhen**, E. W. Hudson, W. Zhou, V. Madhavan, C. Ren, H. Ikuta, and A. Bansil, *Nano Letters* 13(5), 1915-1919 (2013).
 33. “Observation and Differentiation of Unique High-Q Optical Resonances Near Zero Wave Vector in Macroscopic Photonic Crystal Slabs.” J. Lee*, **B. Zhen***, S.-L. Chua*, W. Qiu, J. D. Joannopoulos, M. Soljačić, and O. Shapira, *Phys. Rev. Lett.* 109(6), 067401 (2012).

MANUSCRIPTS UNDER REVIEW

1. “Polarization state of radiation from a photonic crystal slab”, C. W. Hsu, **B. Zhen**, M. Soljacic, A. D. Stone, arxiv:1708.02197.
2. “Non-Abelian generalization of the Hofstadter model: spin-orbit coupled butterfly pairs”, Y. Yang, B. Zhen, J.D. Joannopoulos, M. Soljačić, arxiv:2005.10978.

SELECTED NEWS COVERAGE

1. “New design could make fiber communications more energy efficient”, *U.S. Army CCDC Army Research Laboratory* (04/22/2020).
2. “Fixing leaky optical pipes with topological glue”, *Penn Today* (04/20/2020).
3. “Light trapping gets a boost”, *Nature* (10/23/2019).
4. “Researchers create better light-trapping devices”, *Penn Today* (11/15/2019).
5. “Researchers discover new topological phases in a class of optical materials”, *Penn Today* (9/17/2019).
6. “An optical contortionist”, *Science* (9/6/2019).
7. “New topological phenomena could light path toward faster optical communications” *Penn Today* (04/02/2018)
8. “Exceptional crystals” *DOE, Office of Science, front page* (01/23/2018).
9. “How to Spawn an ‘Exceptional Ring?’” *DOE, Office of Science, front page* (09/14/2015).

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10. “Trapped Light Research Reveals ‘Twister’ Behavior”, *Optics and Photonics News*, November Issue 2014.
 11. “Trapping Light with a Twister”, *MIT News*, *front page* (12/22/2014).
 12. “Stick-on Screens Open Up a New Vista for Window Projections”, *BBC News* (01/21/2014).
 13. “A Transparent Display without Limits”, *ABC News* (01/31/2014).
 14. “Plasmons on Screen”, *Nature Materials*, February Issue 2014.
 15. “Turning Your Windows into Movie Screens”, *Science/AAAS* (01/21/2014).
 16. “Trapping the Light Fantastic”, *Nature* (07/11/2013).
 17. “Quantum Physics Leads to Perfect Mirror”, *Scientific American* (07/24//2013).
 18. “A Photonic Crystal Sets a Peculiar Trap”, *Physics Today*, September Issue 2013.

PATENTS

1. “Methods and apparatus for transparent display using up-converting nanoparticles”, U.S. Patent number 9,458,989, issued 10/2016; W.O. Patent pending.
2. “Methods and apparatus for transparent display using scattering nanoparticles”, U.S. Patent number 9,335,027, issued 05/2016; W.O. Patent pending.
3. “Excitation enhancement and extraction enhancement with photonic crystals”, U.S. Patent number 8,969,831, issued 03/2015.
4. “Continuous-wave organic dye lasers and methods”, U.S. Patent number 8,837,550, issued 09/2014.

PRESENTATIONS (CONFERENCES, SEMINARS, AND COLLOQUIA)

1. [Colloquium] “Topological photonics at the nano-scale”, *University of Pennsylvania*, Philadelphia, PA (04/2020).
2. [Invited] “Floquet Chern insulator of lights”, *APS March Meeting*, Boston, MA (03/2019).
3. [Invited] “Topological photonics in open systems”, *Physics of Quantum Electronics*, Snowbird, UT (01/2019).
4. [Invited] “Topological photonics in open systems”, *Emergent order in classical systems*, Santa Fe, NM (08/2018).
5. [Invited] “Topological photonics in open systems”, *33rd Summer conference on topology and its applications*, Bowling Green, KY (07/2018).
6. [Invited] “Non-Hermitian topological photonics”, *CLEO*, San Jose, CA (05/2018).
7. [Invited] “Non-Hermitian topological photonics”, workshop on “Photonic Topological Insulators”, *Banff International Research Station* (09/2017).
8. [Colloquium] “Topological properties of novel resonant states in nanophotonics”, Department of Physics, *University of Washington* (04/2017).
9. [University Seminar] “Nanophotonics in systems of large sizes”, Department of ECEE, *University of Colorado, Boulder*, CO (03/2017).
10. [University Seminar] “Nanophotonics in systems of large sizes”, Department of Electrical Engineering, *University of Washington* (03/2017).
11. [University Seminar] “Nanophotonics in systems of large sizes”, Department of Electrical and Computer Engineering, *UCSD*, CA (02/2017).
12. [University Seminar] “Nanophotonics in systems of large sizes”, Department of Physics, *University of Pennsylvania*, PA (02/2017).
13. [University Seminar] “Nanophotonics in systems of large sizes”, Department of Electrical and System Engineering, *Washington University at St. Louis*, MO (02/2017).

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14. [University Seminar] “Nanophotonics in systems of large sizes”, Department of Electrical Engineering, *Penn. State University*, PA (01/2017).
 15. [University Seminar] “Nanophotonics in systems of large sizes”, Department of Physics, *Virginia Tech*, VA (01/2017).
 16. [University Seminar] “Nanophotonics in systems of large sizes”, Institute of Optics, *University of Rochester*, NY (01/2017).
 17. [University Seminar] “Topological properties of exotic resonances in large-size nanophotonic systems”, Department of Physics, *University of Notre Dame*, IN (12/2016).
 18. [Invited] “Topological theory of disallowed couplings”, *Frontier in Optics/Laser Sciences*, Rochester, NY (10/2016).
 19. “High-Purcell high-quantum-yield gap-plasmon spontaneous emission enhancement based on optically thin metallic substrates”, *CLEO*, San Jose, CA (06/2016).
 20. “Spawning rings of exceptional points out of Dirac cones”, *CLEO*, San Jose, CA (06/2016).
 21. [University seminar] “Nanophotonics in systems of large sizes” *CREOL, University of Central Florida* (03/2016).
 22. [Invited] “Topological nature of exotic resonances in nanophotonic systems of large sizes.” *Physics of Quantum Electronics*, Snowbird, UT (01/2016).
 23. [Invited] “Spawning rings of exceptional points out of Dirac cones” *Frontier in Optics/Laser Sciences*, San Jose, CA (10/2015).
 24. [University seminar] “Nanophotonics in systems of large sizes” *Pennsylvania State University CAMP Seminar* (10/2015).
 25. [Special symposium] “Topological nature of bound states in the continuum and their applications in generating high-order vector beams”, *CLEO*, San Jose, CA (05/2015).
 26. [Post-deadline] “Topological nature of bound states in the continuum”, *Frontier in Optics/Laser Sciences*, Tucson, AZ (10/2014).
 27. “Enabling enhanced emission and low-threshold lasing of organic molecules using special Fano resonances of macroscopic photonic crystals”, *CLEO*, San Jose, CA (06/2014).

PROFESSIONAL ACTIVITIES

1. Subcommittee chair, *Frontier in Optics/Laser Sciences* (2016); Subcommittee member, *CLEO* (2019, 2020, 2021).
2. Reviewer for the U.S. National Science Foundation proposals, and professorship application at Swiss National Science Foundation.
3. Referee for Science, Nature, Nature Materials, Nature Photonics, Nature Physics, Nature Communications, Scientific Reports, Advanced Materials, Advanced Optical Materials, Laser & Photonics Reviews, Physical Review X, Physical Review Letters, Physical Review A, Physical Review B, Optica, Optics Letters, Optics Express, Journal of the Optical Society of America B, Applied Optics, and Chemical Reviews.
4. Presider for the sessions at *CLEO* (2016, 2018) and *Frontier in Optics* (2015, 2016).

TEACHING EXPERIENCE

1. Lecturer, Physics 141/151, Electricity and Magnetism, University of Pennsylvania (Spring 2018, Spring 2019, Spring 2020).
2. Lecturer, Physics 361/561, Intermediate electricity and magnetism, University of Pennsylvania (Fall 2019)
3. Teaching assistant, Junior Labs (8.013), Physics Department, MIT (Fall 2009).