

Dr. Sachin Vaidya

POSTDOCTORAL ASSOCIATE, MIT

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Current Role

Exploring frontiers in topological matter, nanophotonics and AI for physics as a postdoc at MIT.

Experience

Massachusetts Institute of Technology | Postdoctoral Associate 2023 - present

- Research topics: Topological matter, Nanophotonics and AI for physics
- Advisor: Prof. Marin Soljačić

Pennsylvania State University | Graduate Research Assistant 2019 - 2023

- Research topics: Topological photonics
- Advisor: Prof. Mikael C. Rechtsman

Pennsylvania State University | Graduate Teaching Assistant 2017 - 2018

- Teaching assistant for undergraduate courses during three semesters

National Center for Radio Astrophysics, Pune, India | Visiting Student 2016

- Project: Towards understanding radio mode feedback in galaxy clusters

National Physical Laboratory, New Delhi, India | Graduate Teaching Assistant 2015

- Project: Ytterbium atomic oven: designing, modeling, and testing

Education

Ph.D., Physics, Pennsylvania State University 2017 - 2023

- Thesis: Topological photonic crystals in one, two and three dimensions

Integrated M.Sc., Physics, University of Hyderabad 2012 - 2017

- Thesis: A stochastic approach to simulating the complex modulus of viscoelastic fluids

Technical Skills

Computational

- Computational electromagnetics using plane-wave expansion (PWE), finite difference time domain (FDTD), rigorous coupled wave analysis (RCWA) methods
- AI for physics applications using PyTorch

Experimental

- Nanofabrication of photonic structures using plasma-enhanced chemical vapor deposition (PECVD), 3D micro-printing (Nanoscribe Photonic Professional GT2), Au sputtering
- Optical characterization using Ellipsometry, UV-Vis-NIR spectroscopy, FTIR spectroscopy
- X-ray imaging (Zeiss Xradia microCT)

Awards, Honors and Fellowships

Awards and Honors

- David H. Rank Memorial Physics Award, Penn State (2018)
- Graduate Teaching Assistant Award, Penn State (2018)
- University Medal in Physics, University of Hyderabad (2017)

Graduate Fellowships

- David C. Duncan Graduate Fellowship in Physics, Penn State (2022)
- Downsborough Graduate Fellowship in Physics, Penn State (2021 and 2022)
- Troxell Scholarship in Physics, Penn State (2017)
- Homer F. Braddock Fellowship, Penn State (2017)
- Indian Academy of Sciences Summer Research Fellowship (2015)

Teaching and Mentoring

Graduate Teaching Assistant

- Wave Motion and Quantum Mechanics, Penn State, Fall 2018
- Fluids and Thermal Physics, Penn State, Fall 2018
- Mechanics and Intro Physics Laboratory, Penn State, Summer 2018
- Mechanics, Penn State, Spring 2018
- Introductory Physics, Penn State, Fall 2017

Undergraduate Mentoring

- Raafat Salib, MIT, UROP, Spring 2024-present
- Maggie Shi, MIT, UROP, Fall 2023-present
- Kyle Linn, Penn State, REU, Summer 2022
- Megan Goh, Amherst College, REU, Summer 2022
- Alison Weiss, Amherst College, REU, Summer 2020 and 2021

Service and Outreach

Peer Review

- Referee for the following journals: Physical Review Letters (APS), Physical Review X (APS), Physical Review A (APS), Physical Review B (APS), Physical Review Applied (APS), Physical Review Research (APS), Nature Communications (Nature), Communications Physics (Nature), Science Advances (AAAS), National Science Review (Oxford), APL Photonics (AIP), Applied Physics Letters (AIP), Journal of Applied Physics (AIP), Photonics Research (Optica), Optics Express (Optica), Advanced Optical Materials (Wiley), Laser & Photonics Reviews (Wiley)

External Review

- External reviewer for user proposals submitted to CINT at Sandia National Laboratories.

Conference Organization

- APS March Meeting 2024 – session chair

Outreach

- MIT Undergraduate Research Opportunities Program (UROP) mentor (2023 – present)
- Penn State Research Experience for Undergraduates (REU) mentor (2019 – 2022)
- MRSEC outreach team member at Penn State (2019 – 2020)
- Co-founder of the science club ETHER (Engaging Talks on Highly Exciting Research) at the University of Hyderabad (2015 – 2017)

Publications

Links: [Google Scholar](#) | [arXiv](#) | [ORCID](#)

(* denotes equal contribution)

Preprints

- André Grossi e Fonseca*, **Sachin Vaidya***, Thomas Christensen, Mikael C. Rechtsman, Taylor L. Hughes and Marin Soljačić, *Weyl points on non-orientable manifolds*, arXiv:2310.18485 (2023)
- Ali Ghorashi, **Sachin Vaidya**, Mikael Rechtsman, Wladimir Benalcazar, Marin Soljačić and Thomas Christensen, *Prevalence of two-dimensional photonic topology*, arXiv:2307.15701 (2023)
- Maria Barsukova*, Fabien Grisé*, Zeyu Zhang*, **Sachin Vaidya**, Jonathan Guglielmon, Michael I. Weinstein, Li He, Bo Zhen, Randall McEntaffer and Mikael C. Rechtsman, *Direct observation of Landau levels in silicon photonic crystals*, arXiv:2306.04011 (2023) - to appear in Nature photonics

Peer-Reviewed Publications

- **Sachin Vaidya**, Mikael C. Rechtsman and Wladimir A. Benalcazar, *Polarization and weak topology in Chern insulators*, Physical Review Letters 132, 116602 (2024)
- **Sachin Vaidya***, Christina Jörg*, Kyle Linn, Megan Goh and Mikael C. Rechtsman, *Reentrant delocalization transition in one-dimensional photonic quasicrystals*, Physical Review Research 5, 033170 (2023)

- **Sachin Vaidya**, Ali Ghorashi, Thomas Christensen, Mikael C. Rechtsman and Wladimir A. Benalcazar, *Topological phases of photonic crystals under crystalline symmetries*, Physical Review B 108, 085116 (2023)
- Christina Jörg*, **Sachin Vaidya***, Jiho Noh, Alexander Cerjan, Shyam Augustine, Georg von Freymann and Mikael C. Rechtsman, *Observation of quadratic (charge-2) Weyl point splitting in near-infrared photonic crystals*, Laser & Photonics Reviews 16, 2100452 (2022) – featured on the cover.
- Alexander Cerjan*, Christina Jörg*, **Sachin Vaidya**, Shyam Augustine, Wladimir A. Benalcazar, Chia Wei Hsu, Georg von Freymann and Mikael C. Rechtsman, *Observation of bound states in the continuum embedded in symmetry bandgaps*, Science Advances 7, eabk1117 (2021)
- Julian Schulz, **Sachin Vaidya** and Christina Jörg, *Topological photonics in 3D micro-printed systems*, APL Photonics 6, 080901 (2021) – highlighted as editor's pick.
- **Sachin Vaidya**, Wladimir A. Benalcazar, Alexander Cerjan and Mikael C. Rechtsman, *Point-defect-localized bound states in the continuum in photonic crystals and structured fibers*, Physical Review Letters 127, 023605 (2021)
- **Sachin Vaidya***, Jiho Noh*, Alexander Cerjan, Christina, Jörg, Georg von Freymann and Mikael C. Rechtsman, *Observation of a charge-2 photonic Weyl point in the infrared*, Physical Review Letters 125, 253902 (2020) – highlighted as editors' suggestion.

Conference Presentations

Conferences

- *Photonic Weyl points on non-orientable Brillouin zones* – Conference on Lasers and Electro-Optics (CLEO) (2024), Charlotte, NC (upcoming)
- *Localization and reentrant delocalization transitions in one-dimensional photonic quasicrystals* – APS March Meeting (2024), Minneapolis, MN
- *Polarization-induced topological edge and corner states in Chern photonic crystals* – Conference on Lasers and Electro-Optics (CLEO) 2023, San Jose, CA
- *Photonic Chern and Weyl systems in multilayer structures via dimensional extension* – Conference on Lasers and Electro-Optics (CLEO) 2023, San Jose, CA
- *Polarization and corner charge in Chern insulators* – APS March Meeting 2023, Las Vegas, 2023
- *Point-defect localized photonic bound states in the continuum* – APS Division of AMO Physics Meeting (DAMOP) 2021, Virtual
- *Observation of charge-2 photonic Weyl point* – Conference on Lasers and Electro-Optics (CLEO) 2020, Virtual

Other talks and posters

- *Symmetry-indicator invariants: bridging the gap in topological band theory* – MIT CMT Journal Club (2023)
- *Novel topological phases in photonic crystals* – Office of Naval Research (ONR) MURI Review (2023)
- *Topological photonic crystals in one, two and three dimensions* – MIT Seminar (2022)
- *Quantum polarization and fractional corner charge in Chern insulators* – Office of Naval Research (ONR) MURI Seminar (2022)
- *Weyl points and BICs in 3D micro-printed photonic crystals* – Nanoscribe User Meeting (2021)
- *Observation of quadratic Weyl point splitting in 3D micro-printed photonic crystals* – Office of Naval Research (ONR) MURI Review (2021)
- *Point-defect localized photonic bound states in the continuum* – Office of Naval Research (ONR) MURI Poster Session (2021)