Mikael C. Rechtsman

Contact Information

The Pennsylvania State University
Davey Laboratories, Department of Physics
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Personal

Born: March 17, 1980, Toronto, Canada.
Native language: English, some French.
Canadian citizenship.

Employment

Assistant Professor of Physics, The Pennsylvania State University (July 2015-current)
Azrieli Postdoctoral fellow, Technion - Israel Institute of Technology, May, 2010 - June 2015
Postdoctoral fellow, Courant Institute of Mathematical Sciences, NYU, September 2008 - May, 2010

Education

Princeton University, *Department of Physics*

Ph.D., Physics, September 2003 - May 2008
Thesis: Optimization and inverse problems in statistical mechanics and electromagnetism
Advisors: Salvatore Torquato, Frank H. Stillinger, Paul J. Steinhardt

Massachusetts Institute of Technology, *Physics major*

September 2000 - June 2003, S.B., June 2003
G.P.A. 5.0/5.0
Senior thesis title: Stacking faults on FCC (111) metal surfaces: a first-principles study
Senior thesis advisor: Prof. Nicola Marzari

McGill University, *Physics and Mathematics major*

September 1999 - May 2000
G.P.A. 3.87/4.0

Teaching experience

Introduction to Mechanics (8.012) (x2), M.I.T.

Introduction to Electricity and Magnetism (8.022) (x2), M.I.T.

Computational Physics (PHY209) (x2), Princeton University

Mechanics for Engineers (PHY103) (x3), Princeton University

Electromagnetism for Engineers (PHY104) (x2), Princeton University

Algebra and Calculus (x2), Courant Institute

Mathematical Patterns in Nature, Courant Institute

Quantum Physics II (PHY411), Penn State

Honors and Awards

J.W.B. McConnell Scholarship, McGill University (full tuition award) (1999)

University of Toronto Summer Studentship Award (2000)

Todd Anderson E.S.G. Teaching Award, M.I.T. (2003)

Burchard Scholarship in the Humanities, M.I.T. (2003)

National Science and Engineering Research Council of Canada (NSERC) foreign fellowship (2005)
(Roughly 100 awarded annually, CAN$63,000 for 3 years.)

Ray Grimm Award for Computational Physics, Princeton University (2007)
(Distinguished thesis work in computational physics, 1 awarded per year)

Courant Postdoctoral Instructorship, Courant Institute, NYU (2008)
($56,000/year)

Azrieli Fellowship (2010)
($35,000/year towards postdoctoral research in Israel)

Fine Fellowship - Technion (2012)
($12,000/year towards postdoctoral research at Technion)

Sloan Research Fellowship - Alfred P. Sloan Foundation (2016)
($55,000 towards research program)

Kavli fellowship (2016)
(Awarded by the National Academy of Sciences)

Publications as first or co-first author: **Nature** (1), **Science** (1), **Nature Materials** (1), **Nature Photonics** (1), **Physical Review Letters** (7), **Optics Letters** (2), **Physical Review A - Rapid Comm.** (1), **Physical Review B** (1), **Physical Review E** (3), **Journal of Chemical Physics** (1), **Journal of Optics** (1), **Journal of Physical Chemistry A** (1), and the **Journal of Applied Physics** (1).

Publications

39. *Parity-time symmetric photonic topological insulators*, MC Rechtsman, K Makris, Y Plotnik, Y Lumer, A Szameit, M Segev (submited).
38. *The optical Rashba effect*, Y Plotnik, MC Rechtsman, Y Lumer, S Stutzer, A Szameit and M Segev (submitted).
37. *Topological Optical Waveguiding in Silicon and the Transition between Topological and Trivial Defect States*, A Blanco-Redondo, I Andonegui, MJ Collins, G Harari, Y Lumer, MC Rechtsman, BJ Eggleton, and M Segev, **Phys. Rev. Lett.** 116, 163901 (2016).
36. *Tachyonic dispersion in coherent networks*, MC Rechtsman, Y Chong, **Journal of Optics** 18, 014001 (2015).
35. *Viewpoint: High Chern Numbers in Photonic Crystals*, MC Rechtsman, **Physics** 8, 122 (2015).
34. *Anomalous Topological Phases and Unpaired Dirac Cones in Photonic Floquet Topological Insulators*, D Leykam, MC Rechtsman, YD Chong, **arXiv**:1601.01764 (2015).
33. *Topological crystalline protection in a photonic system*, JX Zhang, MC Rechtsman, CX Liu, **arXiv**:1512.02763 (2015).
32. *Topological transport in photonic quasicrystals*, M Bandres, MC Rechtsman, M Segev (**PRX**, in press).
31. *Disorder-induced Floquet topological insulators*, P Titum, N Lindner, MC Rechtsman, G Refael, **Phys. Rev. Lett.** 114, 056801 (2015).
30. *Self-Accelerating Dirac Particles and Prolonging the Lifetime of Relativistic Fermions*, I Kaminer, J Nemirovsky, MC Rechtsman, R Bekenstein, M Segev, **Nature Physics** 11, 261267 (2015).
29. *Probing topological invariants in the bulk of a non-Hermitian optical system*, JM Zeuner, MC Rechtsman, Y Plotnik, Y Lumer, MS Rudner, M Segev, A Szameit, **Phys. Rev. Lett.** 115, 040402 (2015).

28. *Enhancement of the ensemble-averaged coupling between defects in random environments*, M Heinrich, MC Rechtsman, F Dreisow, S Nolte, M Segev, and A Szameit, **Opt. Lett.** 39, 12, 3599-3602 (2014).

27. *Experimental observation of bulk and edge transport in photonic Lieb lattices*, D Guzman-Silva, C Mejia-Cortes, MA Bandres, MC Rechtsman, S Weimann, S Nolte, M Segev, A Szameit, RA Vicencio, **New J. Phys.** 16, 063061 (2014).

26. *Edge states in disordered photonic graphene*, J Zeuner, MC Rechtsman, A Szameit, **Opt. Lett.** 39, 602-605 (2014).

25. *Self-Localized States in Photonic Topological Insulators*, Y Lumer, Y Plotnik, MC Rechtsman, M Segev, **Phys. Rev. Lett** 111, 243905 (2013).

24. *Nonlinearly Induced PT Transition in Photonic Systems*, Y Lumer, Y Plotnik, MC Rechtsman, M Segev, **Phys. Rev. Lett** 111, 263901 (2013).

23. *Observation of novel edge states in photonic graphene*, Y Plotnik, MC Rechtsman, D Song, M Heinrich, JM Zeuner, S Nolte, Y Lumer, N Malkova, J Xu, A Szameit, Z Chen and M Segev **Nature Materials**, 13, 5762 (2014).

22. *Topological creation and destruction of edge states in photonic graphene*, MC Rechtsman, Y Plotnik, A Szameit, Z Chen, M Heinrich, M Segev, **Phys. Rev. Lett.**, 111, 103901 (2013).

21. *Photonic topological insulators*, MC Rechtsman, JM Zeuner, Y Plotnik, Y Lumer, M Segev and A Szameit, **Optics and Photonics News**, Special Issue: Optics in 2013, 24 (12), 42, (2013).

20. *Photonic Floquet topological insulators*, MC Rechtsman, JM Zeuner, Y Plotnik, S Nolte, Y Lumer, D Podolsky, F Dreisow, M Segev, A Szameit **Nature**, 496, 196-200 (2013).

19. *Strain-induced pseudomagnetic field and Landau levels in photonic structures*, MC Rechtsman, J Zeuner, A Tunnerman, S Nolte, M Segev, A Szameit, **Nature Photonics 7**, 153-158 (2013).

18. Book chapter, *"Wave dynamics and nonlinear photonics in amorphous photonic lattices" in "Nonlinear Photonics and Novel Optical Phenomena" Springer, Z Chen and R Morandotti, eds, (2012)*, MC Rechtsman, A Szameit, M Segev.

17. *Negative radiation pressure via dielectric birefringence*, J Nemirovsky, MC Rechtsman, M Segev, **Opt. Exp.**, 20, 8, 8907-8914 (2012).

16. *Negative coupling between defects in waveguide arrays*, JM Zeuner, MC Rechtsman, R Keil, F Dreisow, A Tunnerman, S Nolte and A Szameit **Opt. Lett.**, 37, 4, 533-535 (2012).

15. *Negative Goos-Hänchen shift in periodic media*, MC Rechtsman, YV Kartashov, F Setzpfandt, H Trompeter, L Torner, T Pertsch, U Peschel, A Szameit, **Opt. Lett.**, 36, 22, 4446-4448 (2011).

14. *Optical tachyons in PT-symmetric complex photonic graphene*, A Szameit, MC Rechtsman, M Segev, **Phys. Rev. A** (rapid comm) 84, 021806 (2011).

13. *Amorphous photonic lattices: band gaps, effective mass, and suppressed transport*, MC Rechtsman, A Szameit, M Segev, **Phys. Rev. Lett.**, 106, 193904 (2011).

12. *Disorder enhanced transport in photonic quasicrystals* M. Rechtsman, L. Levi, B. Freedman, T. Schwartz, O. Manela and M. Segev, **Optics and Photonics News**, Special Issue: Optics in 2011, 22 (12), 33, (2011).

11. *Disorder-enhanced transport in photonic quasicrystals*, L Levi, MC Rechtsman, T Schwartz, O Manela, B Freedman, M Segev, **Science**, 332, 1541 (2011).

10. *Method for obtaining upper bounds on photonic band gaps*, MC Rechtsman, S Torquato, **Phys. Rev. B** 80, 155126 (2009).

9. *Negative Poisson's Ratio Materials via Isotropic Interactions*, MC Rechtsman, FH Stillinger, S Torquato, **Phys. Rev. Lett.** 101, 085501 (2008).
8. *Effective dielectric tensor for electromagnetic wave propagation in random media*, MC Rechtsman, S Torquato, **J. Appl. Phys.** 103, 084901 (2008)
7. *Optimized Structures for Photonic Quasicrystals*, MC Rechtsman, HC Jeong, S Torquato, P Chaikin, PJ Steinhardt, **Phys. Rev. Lett.** 101, 073902 (2008)
6. *Anomalous negative thermal expansion behavior in isotropic systems*, MC Rechtsman, FH Stillinger, S Torquato, **J. Phys. Chem. A** 111, 12816-12821 (2007)
5. *Global phase diagram for the honeycomb potential*, AP Hynninen, AZ Panagiotopoulos, MC Rechtsman, FH Stillinger, S Torquato, **J. Chem. Phys.** 125, 024505 (2006)
4. *Synthetic diamond and wurtzite structures self-assemble with isotropic pair interactions*, MC Rechtsman, FH Stillinger, S Torquato, **Phys. Rev. E** 75, 031403 (2007)
3. *Self-assembly of the simple cubic lattice with an isotropic potential*, MC Rechtsman, FH Stillinger, S Torquato, **Phys. Rev. E** 74, 021404 (2006)
2. *Designed interaction potentials via inverse methods for self-assembly*, M Rechtsman, F Stillinger, S Torquato, **Phys. Rev. E** 73, 011406 (2006)
1. *Optimized interactions for targeted self-assembly: application to a honeycomb lattice*, MC Rechtsman, FH Stillinger, S Torquato, **Phys. Rev. Lett.** 95, 228301 (2005)

Grant writing experience

Assisted Prof. Mordechai Segev with successful Israeli Science Foundation grant proposal "Dynamics of Light Waves" (2010). (Funded, $480k).

Co-applicant of the US-Israel Binational Science Foundation Transformative grant, with M. Segev, M. Soljacic and Y. Lahini on the topic of "Topological photonics." (Funded, $300k)

Principal investigator of NSF proposal, "Nonlinear optics of photonic topological insulators" (Funded, $285k)

Sloan foundation fellowship (Funded, $55k)

Professional service

Journal referee for Nature, Nature Photonics, Nature Physics, Nature Communications, Science, Science Advances, Physical Review Letters, Physical Review X, Annals of Physics, Optics Letters, Optical Materials, Journal of the Optical Society of America B, Physical Review B, and the Journal of Chemcial Physics.

Guest editor for New Journal of Physics' special edition on Topological Insulator physics
Served on numerous candidacy examination committees at Penn State University; doctoral committee of Grazia Salerno at the University of Trento, Italy (2016).

Invited Talks

State University of New York - Stony Brook AMO seminar, Stony Brook, NY, May 2016 (invited talk) - Aspects of topological photonics

'Topolight' conference, Trento, Italy, April 2016 (invited talk) - Exotic states in topological photonics

Kavli Frontiers of Science Meeting: Alexander von Humboldt Foundation/US National Academy of Sciences German-American Symposium, Potsdam, Germany, March 2016 (invited talk) - Protecting transport with topological insulators

University at Buffalo Electrical Engineering Seminar, Buffalo, NY, March 2016 (invited talk) - Aspects of topological photonics

Case Western Reserve University condensed matter seminar, Cleveland, OH, February 2016 (invited talk) - Aspects of topological photonics

University of Maryland Condensed Matter Physics Colloquium, College Park, MD, February 2016 (invited talk) - Aspects of topological photonics

Quantum Simulation with Cold Atoms and Photons, Solvay, Belgium, February 2016 (invited talk) - Exotic states of photonic topological insulators

PQE conference: Progress in Quantum Electronics, Snowbird, Utah, January 2016 (invited talk) - Exotic states of photonic topological insulators

META conference: Metamaterials, Photonic Crystals, Plasmonics, August 2015 (keynote talk) - Topological Anderson Insulators

Quantum Correlated Matter and Chaos, Dresden, Germany, June 2015 (invited talk) - Aspects of photonic topological insulators

Workshop on Quantum Science and Technology, Ascona, Switzerland, June 2015 (invited talk) - Aspects of photonic topological insulators

Ecole Centrale Lyon Physics Department seminar, Lyon, France, June 2015 (invited talk) - - Aspects of photonic topological insulators

CLEO conference 2015, San Jose, CA, May 2015 - Topological protection of path entanglement in a photonic quantum walk.

Materials Research Society Meeting, San Francisco, California, April 2015 (invited talk) - Disordered photonic graphene to topological insulators.

"Topolight" Photonics Winter School, Fai Della Paganella, Italy, March 2015 (invited talk) - Photonic topological insulators in propagating geometries.

APS March meeting, San Antonio, Texas, March 2015 (invited talk) - Aspects of photonic topological insulators.

SPIE Photonics West, San Francisco, California, February 2015 (invited talk) - Photonic Topological Anderson Insulators.

University of Vienna Physics Department Colloquium, Vienna, Austria, January 2015 (invited talk) - Artificial gauge fields in optics: topological protection and pseudomagnetism.

Physics of Quantum Electronics, Snowbird, Utah, January 2015 (invited talk) - Photonic Floquet topological insulators.

University of Stuttgart Physics Department Colloquium, Stuttgart, Germany, November 2014 (invited talk) - Artificial gauge fields in optics: topological protection and pseudomagnetism.

Quantum Correlations Out of Equilibrium conference, ETH, Zurich, Switzerland, November 2014 (invited talk) - Aspects of photonic topological insulators (Hermitian to non-Hermitian).

IPS IEEE conference, La Jolla, CA, October 2014 (invited talk) - Aspects of photonic topo-

logical insulators.

National Technical University of Singapore, Physics department seminar, Singapore, July 2014.

CLEO conference 2014, San Jose, CA, June 2014 - Measuring topological invariants in optical systems from bulk quantities.

Photonics North 2014, Montreal, Canada, May 2014 (invited talk) - Aspects of photonic topological insulators.

SPIE Photonics Europe, Brussels, Belgium, April 2014 (invited talk) - Photonic topological insulators.

University of Cambridge, Department of Physics, Cavendish Laboratory seminar, Cambridge, UK, April 2014.

University of Michigan, Electrical and Computer Engineering seminar, Ann Arbor, MI, April 2014.

University of Illinois at Urbana-Champaign, Electrical and Computer Engineering seminar, Urbana, IL, April 2014.

Purdue University, Electrical and Computer Engineering seminar, West Lafayette, IN, April 2014.

OSA Incubator Meeting on Topological Order with Photons, Washington, DC, April 2014 (invited talk) - Aspects of photonic Floquet topological insulators

Massachusetts Institute of Technology, Electrical Engineering and Computer Science special seminar, Cambridge, MA, March 2014.

University of Wisconsin at Madison, Department of Physics seminar, Madison, WI, March 2014.

Georgia Institute of Technology, Department of Physics colloquium, Atlanta, GA, March 2014.

Brown University, Department of Physics colloquium, Providence, RI, February 2014.

The Pennsylvania State University, Department of Physics seminar, State College, PA, February 2014.

California Institute of Technology, Department of Applied Physics and Materials Science seminar, Pasadena, CA, February 2014.

University of Washington - Seattle, Department of Physics colloquium, Seattle, WA, February 2014.

Emory University, Department of Physics colloquium, Atlanta, GA, February 2014.

Princeton University, Electrical Engineering departmental seminar, Princeton, NJ, January 2014.

The Pennsylvania State University, condensed matter seminar series, State College, PA, September 2013 (invited talk) - Fictitious fields in photonics.

University of British Columbia, condensed matter seminar, Vancouver, BC, September 2013 - Photonic Floquet topological insulators.

SPIE Active Photonic Materials V, San Diego, CA, August 2013: *Photonic Floquet topological insulators*

Synethetic Gauge Fields conference, Trento, Italy (BEC Center), July 2013: *Artificial gauge fields in photonics*

Nonlinear Schrdinger equation: theory and applications, Heraklion, Crete, May 2013: *Photonic Floquet topological insulators*

Workshop on Quantum Simulations on the occasion of the award of the Wolf prize to Peter Zoller and Ignacio Cirac, Haifa, Israel, May 2013: *Photonic Floquet topological insulators*

ISF / Batsheva workshop on light-matter interaction, Ein Gedi, Israel, April 2013: *Photonic Floquet topological insulators*

Cornell University, Department of Applied and Engineering Physics, departmental seminar, Ithaca, NY, March 2013: *Fictitious fields in photonics and their applications*

University of California, San Diego, Department of Electrical and Computer Engineering, departmental seminar, San Diego, CA, March 2013: *Fictitious fields in photonics and their applications*

Meeting on Topological Phenomena in Quantum Dynamics and Disordered Systems, Banff, February 2013: *Photonic Floquet topological insulators*

Crystal and Graphene Science Symposium, Boston, September 2012: *Strain-induced magnetism and novel edge states in optical graphene*

SIAM conference on nonlinear waves, San Jose, June 2012: *Strain-induced Landau levels in photonic crystal slabs: linear and nonlinear properties*

Conference on Lasers and Electro Optics (CLEO), San Jose, May, 2012: *Strain-induced Band Gap and Effective Magnetic Field in Photonic Crystals*

Yale University Applied Physics Department seminar, New Haven, February 2012: *Disorder-enhanced transport in photonics quasicrystals*

University of Quebec (INRS Varennes) colloquium, October 2011: *Disorder-enhanced transport in photonic quasicrystals and band gaps in amorphous photonic lattices*

University of Toronto, ECTI Lectureship, October 2011: *Disorder-enhanced transport in photonic quasicrystals and band gaps in amorphous photonic lattices*

University of North Carolina, Chapel Hill, applied mathematics colloqium, September 2011: *Nonlinear optics of microstructures: recent results and open problems*

Information Photonics 2011, Ottawa, May, 2011: *Magnetic field effects and solitons in strained photonic graphene*

IMACS Conference on Nonlinear Evolution Equations and Wave Phenomena, Athens, GA, April, 2011: *Disorder-enhanced transport in photonic quasicrystals: Anderson localization and delocalization*

SIAM Conference on Nonlinear Waves and Coherent Structures, Philadelphia, August, 2010: *Band gaps in amorphous photonic lattices*

Conference on Lasers and Electro Optics (CLEO), San Jose, May, 2010: *Band gaps in amorphous photonic lattices*

Dartmouth University Applied Math Seminar, November, 2009: *Upper bounds on photonic bandgaps*

Applied mathematics colloquium, Columbia University, April 2009: *Upper bounds on photonic bandgaps*

Wave propagation seminar, New Jersey Institute of Technology, April 2009: *Upper bounds on photonic bandgaps*

Soft matter seminar series, NYU Center for Soft Matter Research, March 2009: *Upper bounds on photonic bandgaps*

Applied math days workshop, Rensselaer Polytechnic Institute, November 2008: *Optimizing photonic quasicrystals*

Solid state physics seminar, Brooklyn College, November 2008: *Optimizing photonic quasicrystals*

Applied Mathematics Seminar, Courant Institute, September 2008: *A few inverse problems in statistical mechanics and photonics*

Princeton Center for Theoretical Science, June 2008: *Upper bounds on photonic bandgaps*

"Dynarum" (DARPA collaboration on robust uncertainty management) Kickoff Meeting, January, 2007, Caltech, Pasadena, CA: *Inverse Problems and Optimization Techniques for Designed Materials*

References

Prof. Mordechai Segev, Technion - Israel Institute of Technology, msegev@techunix.technion.ac.il (postdoctoral advisor)

Prof. Salvatore Torquato, Princeton University, torquato@electron.princeton.edu (doctoral advisor)

Prof. Marin Soljačić, Massachusetts Institute of Technology, soljacic@mit.edu

Prof. Douglas Stone, Yale University, douglas.stone@yale.edu

Prof. Michal Lipson, Cornell University, kec36@cornell.edu

Prof. Demetrios Christodoulides, CREOL, University of Central Florida, demetri@creol.ucf.edu

Prof. Immanuel Bloch, Max-Planck-Institut für Quantenoptik, immanuel.bloch@mpq.mpg.de

Prof. Nicola Marzari, École Polytechnique Fédérale de Lausanne (EPFL), nicola.marzari@epfl.ch