

CONTACT INFORMATION

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POSITIONS

Jul 2022 - *date* *Assistant Professor in Mathematics*
 at Princeton University
Sep 2021 - Jun 2022 *Lecturer in Physics*
 at Princeton University
Jan 2020 - Aug 2021 *SNSF Postdoctoral Fellow*
 at Princeton University Physics Department,
 mentor: Michael Aizenman
Oct 2018 - Dec 2019 *Postdoctoral Fellow*
 at Columbia University Mathematics Department,
 mentor: Michael I. Weinstein

EDUCATION

2018 *Ph.D. in Mathematical Physics*
 at ETH Zürich, advisor: Gian Michele Graf
 "*Topology and Localization:*
 Mathematical Aspects of Electrons in Strongly Disordered Media"
2015 *M.Sc. in Physics*
 at ETH Zürich, with distinction
2007 - 2012 *Studies towards B.Mus. in classical saxophone performance*
 at Mannes College of Music and Basel Musikhochschule
2007 *B.Sc. in Physics and Psychology*
 at the Hebrew University of Jerusalem
2003 *Israeli Bagrut*
 at Handessaim High School, Tel-Aviv University

RESEARCH INTERESTS

I use *mathematical analysis* to study problems originating from statistical mechanics and quantum physics. I mainly use methods from functional analysis and PDEs, algebraic topology and probability.

Topics I have worked on recently include:

- Continuum Schrödinger operators and PDEs
- Random Schrödinger operators
- Topological insulators and Fredholm theory
- Random matrices
- Classical spin systems

FELLOWSHIPS AND AWARDS

- Swiss National Science Foundation: Early Postdoc.Mobility Fellowship 2020-2021, Won 168,250 CHF.
- Columbia Mathematics Department REU funding, Won approx. 30,000 USD.
- PCTS funds for conference (see below), Won approx. 50,000 USD.
- Pauli center funds for conference, Won approx. 30,000 CHF.

ARTICLES

- [1] Graf, G. M. and Shapiro, J.: The Bulk-Edge Correspondence for Disordered Chiral Chains. *Communications in Mathematical Physics*. **363** (3), 829–846 (2018)
- [2] Shapiro, J. and Tauber, C.: Strongly Disordered Floquet Topological Systems. *Annales Henri Poincaré*. **20** (6), 1837–1875 (2019)
- [3] Fonseca, E., Shapiro, J., Sheta, A., Wang, A., and Yamakawa, K.: Two-Dimensional Time-Reversal-Invariant Topological Insulators via Fredholm Theory. *Mathematical Physics, Analysis and Geometry*. **23** (3), 29 (2020)
- [4] Shapiro, J.: The bulk-edge correspondence in three simple cases. *Reviews in Mathematical Physics*. **32** (03), 2030003 (2020)
- [5] Shapiro, J.: The topology of mobility-gapped insulators. *Letters in Mathematical Physics*. **110** (10), 2703–2723 (2020)
- [6] Aizenman, M., Harel, M., Peled, R., and Shapiro, J.: *Depinning in integer-restricted Gaussian Fields and BKT phases of two-component spin models*. 2022. arXiv: 2110.09498 [math.PR].
- [7] Cipolloni, G., Peled, R., Schenker, J., and Shapiro, J.: *Dynamical Localization for Random Band Matrices up to $W \ll N^{1/4}$* . 2022. arXiv: 2206.05545 [math-ph].
- [8] Fefferman, C., Shapiro, J., and Weinstein, M. I.: Lower Bound on Quantum Tunneling for Strong Magnetic Fields. *SIAM Journal on Mathematical Analysis*. **54** (1), 1105–1130 (2022)
- [9] Shapiro, J. and Weinstein, M. I.: Is the continuum SSH model topological? *Journal of Mathematical Physics*. **63** (11), 111901 (2022)
- [10] Shapiro, J. and Weinstein, M. I.: Tight-binding reduction and topological equivalence in strong magnetic fields. *Advances in Mathematics*. **403**, 108343 (2022)
- [11] Bols, A., Schenker, J., and Shapiro, J.: Fredholm homotopies for strongly-disordered 2D insulators. *Communications in Mathematical Physics*. **397** (3), 1163–1190 (2023)
- [12] Chung, J.-H. and Shapiro, J.: *Topological Classification of Insulators: I. Non-interacting Spectrally-Gapped One-Dimensional Systems*. 2023. arXiv: 2306.00268 [math-ph].

- [13] Shapiro, J.: *Chiral Random Band Matrices at Zero Energy*. 2023. arXiv: 2308.00934 [math-ph].
- [14] Shapiro, J.: Incomplete localization for disordered chiral strips. *Journal of Mathematical Physics*. **64** (8), 081902 (2023)

LECTURE NOTES AND BOOKS

1. J. Shapiro, *Notes on "Topological Aspects in Condensed Matter Physics" following a course taught by Prof. G. M. Graf in the Fall semester of 2015*
2. J. Shapiro, *Lecture Notes on Calculus I* to accompany a course taught in spring 2019
3. J. Shapiro, "Paris lectures on topological insulators", 2022.
4. J. Shapiro and M. Weinstein, upcoming book on *Analytical Aspects in Topological Insulators*.

CONFERENCES ORGANIZED

- Princeton Center for Theoretical Sciences, "Mathematical Challenges in Quantum Physics", March 2023 with Michael Aizenman (Princeton), Giorgio Cipolloni (PCTS), Bruno Nachtergaele (UC Davis) and Simone Warzel (TU Munich).
- Pauli Center in ETH Zürich, "Mathematical Aspects of Condensed Matter Physics", July 2023, with Gian Michele Graf (ETHZ), Amir Sagiv (Technion) and Michael I. Weinstein (Columbia)

CONFERENCE LECTURES

SIAM Conference on Mathematical Aspects of Materials Science, to be held in Pittsburgh, PA, on May 19 - 23, 2024.

Plenary speaker at the Texas Analysis and Mathematical Physics Symposium, Texas A&M, February 2024.

The Statistical Mechanics Meeting organized by Joel Lebowitz in Rutgers University, December 2023.

2023 Winter Meeting of the Canadian Mathematical Society (CMS) in Montreal, December 2023.

"Dynamics, Phase Transitions and Equilibria in Stochastic Systems", SIAM-NNM meeting in October 2023.

Columbia Probability Workshop, April 28th, 2023.

"Mathematical Challenges in Complex Quantum Systems" as part of the upcoming AMS-SMF-EMS joint international meeting to be held in Grenoble (France) - July 2022.

Risorgimento della vita felice – a celebration of Mathematical Physics, Zürich, Switzerland July 2022

"New directions in disordered systems" on the occasion of the 75th birthday of Abel Klein, Paris June 2022

"Challenges in probability and statistical mechanics", Technion, June 2022

Plenary Speaker at the Great Lakes Mathematical Physics Conference June 2022

The 12th IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena, Georgia, Athens, GA, USA, March 2022 (cancelled)
 Solid Math Conference, Paris, France, August 2021
 Topological phases of matter ICMP satellite conference, Leysin Switzerland, July 2021
 Mathematics of topological insulators, online workshop, December 2020
 Abel Klein's 75th Birthday Conference, Cergy, France, July 2020 *postponed*
 Conference on Random Schroedinger Operators, Florence, Italy, February 2020
 JMM (joint Mathematics Meeting) *Spectral and Transport Properties of Disordered Systems, II*, Denver, Colorado, USA, January 2020
 IPAM Conference on Mathematics of 2D Materials at UCLA, Los Angeles, California, USA in January 2020
 SIAM Sectional meeting on 2D Materials in La Quinta, California, USA in December 2019
 AMS Sectional Meeting, Special Session on Recent Trends in Geometrical PDEs and Mathematical Physics, III, at Binghamton University, NY USA, in October 2019
 Mathematical Physics Days in Cergy, France in September 2019
 Quantissima in the Serenissima III in Venice, Italy in August 2019
 QMATH14 in Aarhus University, Denmark in August 2019
 Great Lakes Mathematical Physics Meeting, Oberlin, Ohio, USA in June 2019
 Workshop on Spectral Theory of Quasi-periodic and Random Operators, in Montreal, Canada, November 2018
 AMS Sectional Meeting AMS Special Session on Ergodic and Topological Quantum Systems, IV in University of Michigan, Ann Arbor, MI USA in October 2018
 Recent progress in mathematics of topological insulators, Zurich, Switzerland, September 2018
 YRS of the 19th International Congress of Mathematical Physics (ICMP) in Montreal, Canada, July 2018
 Swiss Physical Society Joint Annual Meeting in Geneva, Switzerland in August 2017
 Summer school on Current Topics in Mathematical Physics, in Zurich Switzerland in July 2017
 Winter School in Mathematical Physics, Les Diablerets, Switzerland January 2017

SEMINAR LECTURES

Rice University Mathematical Physics Seminar, February 13th 2023
 University of Maryland Geometry and Physics seminar, Nov 16th 2023
 ISTA Mathematical Physics Seminar, Oct 17 2023
 ETHZ Mathematical Physics Seminar, July 12th 2023
 Strasbourg Analysis Seminar, June 8th 2023
 Yale Analysis Seminar, April 20th, 2023
 Binghamton Analysis Seminar, March 2nd 2023
 Mathematical Challenges in Quantum Mechanics, Online, January 2023.
 Princeton Analysis Seminar December 2022.

Joint Caltech/UCLA/USC analysis Seminar May 2022
Davis Quantum Seminar May 2022
International Association for Mathematical Physics One World IAMP Seminar April 5th 2022
LU-NU-UMN Joint probability seminar March 2022
One World Probability Seminar February 2022
Texas A&M Mathematical Physics Seminar
Haifa Mathematics Department Colloquium December 2021
Princeton University Math Department November 2021
German Austrian Swiss Seminar on Analysis and PDE November 2021
Tel-Aviv University Math Department October 2021
Hebrew University of Jerusalem Math Department October 2021
Technion Quantum Information Seminar June 2021
Rome Mathematical Physics Seminar June 2021
MSU Mathematical Physics and Geometry Seminar March 2021
ETH Zurich Mathematical Physics Seminar March 2021
Online North East PDE and Analysis Seminar (ONEPAS), March 2021
SISSA Trieste Analysis and Mathematical Physics Seminar, March 2021
Technion PDE Seminar, December 2020
University of Kentucky PDE/Analysis Seminar, November 2020
Columbia University Waves Seminar, October 2020
Harvard University Random Matrix Theory Seminar, April 2020 *postponed*
Binghamton Mathematical Physics Seminar, April 2020 *postponed*
Virginia Tech Mathematical Physics and Analysis Seminar, April 2018
Columbia Waves Seminar, March 2019
Princeton Mathematical Physics Seminar, December 2018
Erlangen University Mathematical Physics Seminar, May 2018
LMU Mathematical Physics Seminar, April 2018
Harvard Mathematical Physics Seminar, February 2018
Hebrew University Analysis Seminar, January 2018
Technion Haifa Mathematical Physics Seminar, January 2018
Princeton University Mathematical Physics Seminar, December 2017
IST Austria Mathematical Physics Seminar, November 2017
Institute for Theoretical Physics PhD Seminar in ETH Zurich, April 2017
Zurich Topological Insulators Seminar, March 2017

TALKS FOR NON-SPECIALISTS

Columbia Mathematics Society invited talk, March 2019

EXTENDED RESEARCH VISITS

Research visit to Prof. Vojkan Jaksic at Cergy, France in June-July 2022 (invited for a semester)

Research visit to Prof. Ron Peled in Tel-Aviv University, Israel in June-July 2021.

Research visit to Prof. Vojkan Jaksic at Cergy, France in September 2019 (invited for a semester)

Research visit to Prof. Joseph Avron at Technion Haifa, Israel in January 2018

TEACHING EXPERIENCE

PRINCETON

MAT595 *Mathematical aspects of condensed matter physics* topics class in spring 2024.

MAT330 *Complex Analysis*, spring 2024.

MAT520 *Functional Analysis* fall 2023.

MAT330 *Complex Analysis*—with lecture notes, spring 2023.

MAT201 *Multivariable Calculus*, fall 2022.

PHY104 *General Physics 2*, spring 2022.

MAT330 substitute for *Complex Analysis* spring 2022.

PHY103 *General Physics 1*, fall 2021.

PHY521 MAT597 substitute for *Mathematical Physics* spring, 2021.

COLUMBIA

Math S4062Q *Intro to Modern Analysis II*, summer term 2020 *invited*

Math UN1101 *Calculus I*—with lecture notes, spring term 2019

ETHZ (AS ASSISTANT)

General Relativity, fall 2017

Mechanics of Continua, spring 2016

Analytical Mechanics, fall 2016

Quantum Field Theory 2, spring 2016

Topological Aspects of Condensed Matter Physic, fall 2015

Analysis II, spring 2015

Analysis I, fall 2014

ADVISING AND MENTORING

PHD STUDENTS

- Jui-Hui Chung, Princeton, 2022-*date*: one preprint (see relevant item in publication list) which is the first installment of three.

UNDERGRADUATE STUDENTS

- Noam Borgnia, Princeton 2023 senior thesis.
- Sreeta Basu, Princeton 2023 senior thesis.
- Beyer White, Princeton, 2023 senior thesis.
- Jonathan Kutasov, Princeton, 2020: Co-advising a numerical project together with Prof. Michael Aizenman.
- Eli Fonseca, Princeton and Columbia 2019-2020: Ongoing summer project on Fredholm theory, held online.
- Eli Fonseca, Ahmed Sheta, Angela Wang, Koh Yamakawa 2019: Directed a summer REU (research undergraduate experience) project on *Topological Insulators and the Bulk-Edge Correspondence using Fredholm theory* in the mathematics department which resulted in a published paper.
- Anton Eder 2018: Proseminar on *The DC conductivity via Kubo, path integrals, and introduction to super-Gaussian integrals*
- Jeremy Mann 2018: Proseminar on *The Saddle-Point Approximation for the DC Conductivity and arrival at a NLSM*
- Tim Fleischmann 2018: Proseminar on *The calculation of the first quantum corrections to the Drude formula using the NLSM formalism*

COMMUNITY SERVICE

- Co-organize the Princeton Mathematical Physics Seminar and the Princeton Probability Seminar in 2023-2024 academic year.
- Referee service for
 - Communications on Pure and Applied Mathematics
 - Combinatorics Probability and Computing
 - Reviews in Mathematical Physics
 - Communications in Mathematical Physics
 - Annales Henri Poincaré
 - Journal of Mathematical Physics
 - Journal of Statistical Physics
 - Journal of High Energy Physics
 - SIAM Journal of Math Analysis
 - SIAM Journal on Scientific Computing
 - Multiscale Modeling and Simulation
 - Advances in Mathematics
 - Pure and Applied Analysis
 - Letters in Mathematical Physics
 - Probability and Mathematical Physics
 - Journal of Fourier Analysis and Applications
- Roma Tre Mathematics Department PhD Committee (2022)
- Princeton Math PhD Committee (2023)
- Princeton Applied Math PhD Committee (2023)
- Princeton Math Department Graduate Admissions Committee (2023)

CONFERENCES, WORKSHOPS, SUMMER SCHOOLS (EXCLUDING THE ONES ALREADY LISTED ABOVE)

International Congress on Mathematical Physics
Geneva Switzerland August 2021

Random Physical Systems
conference in Patagonia, Chile, in December 2018

19th International Congress of Mathematical Physics
conference in Montreal, Canada, July 2018

119th Statistical Mechanics Conference
conference in Rutgers, NJ USA in May 2018

Transport and localization in random media: theory and applications
conference at Columbia University in May 2018

A random event in honour of Ilya Goldsheid's 70th birthday
conference in London, UK in December 2017

Current Topics in Mathematical Physics
conference in Zürich, Switzerland in July 2017

Mathematical Aspects of Disordered Systems
conference in Zürich, Switzerland in May 2017

Mathematical Physics Winter School
winter school in Freudenstadt, Germany in February 2017

Mathematical Physics Winter School
school held in Les Diablerets, Switzerland January 2017

Summer school in Honor of Barry Simon's 70th Birthday
school held in Toronto, Canada in August 2016

Conference in Honor of Barry Simon's 70th Birthday
conference held in Montreal, Canada, in August 2016

Topological Insulators Conference
conference and school in Munich, Germany, September 2015

SwissMAP Annual Meeting
meeting held in Engelberg, Switzerland in September 2015

International Congress on Mathematical Physics
conference held in Santiago, Chile in July 2015

MEMBERSHIPS

International association of mathematical physics (IAMP)
American Mathematical Society (AMS)

LANGUAGES

Hebrew: mother tongue
English: fluent
German: intermediate (B2)