

CONTACT
INFORMATION

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POSITIONS

Jul 2022 - *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, algebraic topology and probability.

Topics I have worked on recently include:

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

FELLOWSHIPS AND
AWARDS

- Swiss National Science Foundation: Early Postdoc.Mobility Fellowship, 2020-2021
- Columbia Mathematics Department REU funding, Summer of 2019

PAPERS

- peer-reviewed [1] G. M. Graf and J. Shapiro, *The bulk-edge correspondence for disordered chiral chains*, Commun. Math. Phys. **363**, 829–846 (2018)
- [2] C. Tauber and J. Shapiro, *Strongly disordered Floquet topological systems*, Ann. Henri Poincaré **20**, 1837–1875 (2019)
- [3] J. Shapiro, *The bulk-edge correspondence in three simple cases*, Rev. Math. Phys. **32**(3) (2020)
- [4] E. Fonseca, J. Shapiro, A. Sheta, A. Wang and K. Yamakawa, *Two-dimensional time-reversal-invariant topological insulators via Fredholm theory*, Math. Phys. Anal. Geom. **23**, 29 (2020)
- [5] J. Shapiro, *The topology of mobility-gapped insulators*, Lett. Math. Phys. **110**, 2703–2723 (2020)
- [6] C. L. Fefferman, J. Shapiro and M. I. Weinstein, *Lower bound on quantum tunneling for strong magnetic fields*, SIAM J. Math. Anal. 54 (1), 1105-1130 2021
- [7] J. Shapiro and M. I. Weinstein, *Tight-binding reduction and topological equivalence for strong magnetic fields*, arXiv:2010.12097 (2020), to appear in Advances in Mathematics (2022)
- submitted [8] J. Shapiro and M. I. Weinstein, *Is the continuum SSH model topological?*, arXiv:2107.09146 (2021)
- [9] J. Shapiro, *Incomplete Localization for Disordered Chiral Strips*, arXiv:2108.10978 (2021)
- [10] A. Bols, J. Schenker and J. Shapiro *Fredholm Homotopies for Strongly-Disordered 2D Insulators*, arXiv:2110.07068 (2021)
- [11] M. Aizenman, M. Harel, R. Peled and J. Shapiro, *Depinning in the integer-valued Gaussian field and the BKT phase of the 2D Villain model*, arXiv:2110.09498 (2021)
- in preparation [12] M. Aizenman and J. Shapiro *The 2D Poisson-Sigma Model* (2022)

ONGOING PROJECTS

1. M. Aizenman and J. Shapiro, Decay of correlations in the two-dimensional classical $O(N)$ model.
2. A. Cordoba, C. L. Fefferman, J. Shapiro and M. I. Weinstein, Tunneling between non-radial wells in strong magnetic fields.

LECTURE NOTES

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. M. Aizenman and J. Shapiro, upcoming lecture notes on *classical statistical mechanics*.
4. J. Shapiro and M. Weinstein, upcoming lecture notes on *PDEs and topological insulators*.

Conference talks

"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

Great Lakes Mathematical Physics Conference June 2022 - Plenary Speaker

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

TALKS (CONT.)

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 talks

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

At Princeton University

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.

Instructor at Columbia University

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

Math UN1101 *Calculus I*, spring term 2019

Teaching assistant at ETH Zürich

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

At Princeton University

Jonathan Kutasov 2020: Co-advising a numerical project together with Prof. Michael Aizenman.

Eli Fonseca 2020: Ongoing summer project on Fredholm theory, held online.

At Columbia University

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 paper [4]

At ETH Zürich

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*

SERVICE ACTIVITIES

Referee service

Referee service for Communications in Mathematical Physics, Annales Henri Poincaré, Journal of Mathematical Physics, Journal of Statistical Physics, Journal of High Energy Physics, SIAM Journal on Scientific Computing, Multiscale Modeling and Simulation.

PhD committee

Roma Tre Mathematics Department PhD Judge

CONFERENCES,
WORKSHOPS, AND
SUMMER SCHOOLS

(Not including 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)