

Joseph Maciejko

CONTACT INFORMATION

Department of Physics
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RESEARCH INTERESTS

Theoretical condensed matter physics: emergent phenomena in quantum many-body systems; topological phases of matter including topological insulators, superfluids, and superconductors and the quantum Hall effect; quantum transport in low-dimensional systems and semiconductor physics; fractionalization and strongly correlated systems; field theories of many-body systems and connections between condensed matter physics and high-energy physics.

EDUCATION

- Doctor of Philosophy (Ph.D.) – Physics** 2006-2011
Department of Physics, Stanford University, Stanford, CA USA
Thesis: Studies on Time-Reversal Invariant Topological Insulators
Advisor: Prof. Shou-Cheng Zhang
- Master of Science (M.Sc.) – Physics** 2004-2006
Department of Physics, McGill University, Montreal, QC Canada
Thesis: Time-Dependent Quantum Transport in Mesoscopic Structures
Advisor: Prof. Hong Guo
- Bachelor of Engineering (B.Eng.) – Engineering Physics** 2000-2004
Department of Engineering Physics, École Polytechnique de Montréal, Montreal, QC Canada
Graduated With Honors.

PROFESSIONAL APPOINTMENTS

Associate Professor <i>Department of Physics, University of Alberta, Edmonton, AB Canada</i>	2020-
Assistant Professor <i>Department of Physics, University of Alberta, Edmonton, AB Canada</i>	2014-2020
Tier-II Canada Research Chair in Condensed Matter Theory <i>Department of Physics, University of Alberta, Edmonton, AB Canada</i>	2014-2024
Director, Theoretical Physics Institute (TPI) <i>Department of Physics, University of Alberta, Edmonton, AB Canada</i>	2020-
Fellow, Quantum Materials Program <i>Canadian Institute for Advanced Research, Toronto, ON Canada</i>	2015-2019
Simons Foundation Postdoctoral Fellow <i>Princeton Center for Theoretical Science, Princeton University, Princeton, NJ USA</i>	2011-2014

FELLOWSHIPS AND AWARDS

Great Supervisor Award, Faculty of Graduate Studies and Research, U. Alberta	2020
Research Award, Faculty of Science, U. Alberta	2020
Student's Choice Award, Faculty of Science, U. Alberta	2018
Affiliate Status, Perimeter Institute for Theoretical Physics	2015-present
Postdoctoral Fellowship, Simons Foundation	2011-2014
Postdoctoral Fellowship, NSERC (declined)	2011
Graduate Fellowship, Kavli Institute for Theoretical Physics	2011
William R. Hewlett Graduate Fellowship, Stanford U.	2008-2011
Doctoral Research Fellowship, Fonds de Recherche du Québec – Nature et Technologies (FRQNT)	2008-2009
Postgraduate Scholarship, NSERC (PGS-D)	2006-2007
Richard H. Tomlinson Fellowship, McGill U.	2004-2005
Canada Graduate Scholarship, NSERC (CGS-M)	2004-2005
Master's Research Fellowship, FRQNT, ranked 1 st of 50 applicants to physics committee throughout province of Quebec (declined)	2004
Undergraduate Research Assistantship, McGill U.	2004
Silver Academic Medal, Governor General of Canada	2004
Roger Lessard Award in Mathematics, École Polytechnique de Montréal	2003
Undergraduate Research Stipend, Thin Film Physics Research Centre (GCM)	2002-2003
Undergraduate Student Research Award, NSERC	2001-2003
Excellence Fellowship, École Polytechnique de Montréal	2000-2002
François Munier Award in Mathematics, École Polytechnique de Montréal	2001

PUBLICATION AWARDS

Publication Statistics

- Total citations: >3700 (Google Scholar Citations)
- h-index: 28

Nature Magazine

- Research Highlight on “Topological quantization in units of the fine structure constant” (2010)

Science Magazine

- Perspective by M. Büttiker on “Nonlocal transport in the quantum spin Hall state” (2009)

Nature Physics Magazine

- News and Views by Y. Zhou and F.-C. Zhang on “Spin polarization of the quantum spin Hall edge states” (2012)

American Physical Society

- Editors’ Suggestion for “Stabilized pair density wave via nanoscale confinement of superfluid ^3He ” (2020)
- Featured in PRB Kaleidoscopes: “Unconventional transport in low-density two-dimensional Rashba systems” (November 2018)
- Editors’ Suggestion for “Universality of low-energy Rashba scattering” (2017)
- Editors’ Suggestion for “Evidence of a fractional quantum Hall nematic phase in a microscopic model” (2017)
- Editors’ Suggestion for “Odd-frequency superconductivity in a nanowire coupled to Majorana zero modes” (2017)
- Physics Focus story for “Time-resolved imaging of negative differential resistance on the atomic scale” (2016)
- Editors’ Suggestion for “Superconducting quantum criticality of topological surface states at three loops” (2016)
- Editors’ Suggestion for “Optical conductivity of topological surface states with emergent supersymmetry” (2016)
- Editors’ Suggestion for “Möbius molecules and fragile Mott insulators” (2014)
- Editors’ Suggestion for “Field theory of the quantum Hall nematic transition” (2013)
- Editors’ Suggestion for “Kondo lattice on the edge of a two-dimensional topological insulator” (2012)

- Editors' Suggestion for "Conductance and noise signatures of Majorana backscattering" (2011)
- Editors' Suggestion and Physics Synopsis for "Topological quantization in units of the fine structure constant" (2010)
- Editors' Suggestion for "Orbital order and spontaneous orthorhombicity in iron pnictides" (2010)

Institute of Physics (physicsworld.com)

- Editor piece in the News section featuring "Topological quantization in units of the fine structure constant" (2010)

Phys.org

- News story on "Stabilized pair density wave via nanoscale confinement of superfluid ^3He " (2020): <https://phys.org/news/2020-01-phase-diagrams-superfluid-helium-varying.html>

RESEARCH GRANTS

Natural Sciences and Engineering Research Council of Canada (NSERC) 2020-2023
Discovery Accelerator Supplement (DAS),
C\$120,000

Natural Sciences and Engineering Research Council of Canada (NSERC) 2020-2025
Discovery Grant: "Topology, Interactions, and Disorder in Exotic Quantum Materials",
C\$305,000

Pacific Institute for the Mathematical Sciences (PIMS) 2020-2023
Collaborative Research Group (CRG) on Quantum Topology and Its Applications,
C\$200,000
(Co-PI with D. Krepski, S. Rayan, A. Sowa, J. Szmigielski, and K. Tanaka)

New Frontiers in Research Fund (NFRF) 2019-2021
Exploration Grant: "Topology and the Next Generation of Quantum Materials",
C\$250,000
(Co-PI with S. Rayan)

Major Innovation Fund (MIF), Government of Alberta 2018-2021
"Quantum Simulation with Cold Atoms",
C\$200,000
(Co-PI with D. Feder, L. LeBlanc, F. Marsiglio, and B. Sanders)

Alberta Innovates Technology Futures (AITF) Quantum Alberta grant: “Topological States with Ultracold Atomic Gases”, C\$5,000 (Co-PI with D. Feder, L. LeBlanc, and F. Marsiglio)	2017
Canadian Institute for Advanced Research (CIFAR) Research support, C\$65,000	2015-2019
Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant: “Correlation Effects in Topological Insulators”, C\$216,000	2014-2020
Natural Sciences and Engineering Research Council of Canada (NSERC) Tier-II Canada Research Chair in Condensed Matter Theory, C\$1,000,000	2014-2024
Faculty of Science, University of Alberta CRC postdoctoral fellow supplement, C\$420,000 Start-up grant, C\$80,000	2014-2024

SUPERVISION

Undergraduate students

- Jinsen Han (2015), MSc student at National University of Defense Technology, Department of Physics
- Rishabh Khare (2015), PhD student at Purdue University, Department of Physics
- Ashlesha Patil (2015), PhD student at University of Arizona, College of Optical Sciences
- Rhine Samajdar (2015), PhD student at Harvard University, Department of Physics
- Jingxiang Wu (2015), PhD student at Perimeter Institute for Theoretical Physics
- MengXing Na (2016), PhD student at University of British Columbia, Department of Physics
- Kameron Palmer (2016), Defence Research and Development Canada
- Christian Prosko (2016), MSc student at TU Delft, QuTech
- Mohsin Muhammad (2018), Morgan Stanley
- Zhi Han (2019)
- Xinyuan Xu (2019)

MSc students

- Drew Shepherd (2015-2017), Energy Profiles Limited
- G. Shankar (2017-2019), PhD student at University of Alberta, Department of Physics

PhD students

- Joel Hutchinson (2015-2019), postdoctoral fellow at l'École Polytechnique, Centre de Physique Théorique
- Hennadi Yerzhakov (2015-)
- Pramodh Senarath Yapa (2019-)
- G. Shankar (2019-)

Postdoctoral fellows

- Isil Ozfidan (2015-2016), D-Wave Systems, Inc.
- Chien-Hung Lin (2015-2017), postdoctoral fellow at University of Minnesota, Department of Physics
- Shu-Ping Lee (2015-2017), Intel Corporation
- Chun Chen (2017-2019), postdoctoral fellow at Max Planck Institute for the Physics of Complex Systems (MPI PKS)
- Rufus Boyack (2017-2020), postdoctoral fellow at l'Université de Montréal, Département de Physique

TEACHING EXPERIENCE

Instructor 2014-

University of Alberta

Courses: 4 terms of Condensed Matter Physics I (PHYS 541, graduate course); 4 terms of Quantum Mechanics B (PHYS 472, 4th year undergraduate course); 1 term of Advanced Statistical Physics (PHYS 699, graduate course).

Reading Course Supervisor Fall 2012

Princeton University

Supervised a reading course in statistical field theory and quantum phase transitions for three senior undergraduates in the physics department.

Teaching Assistant

2007-2010

Stanford University

Courses: Electricity and Magnetism (Physics 43), Theory of Many-Particle Systems (Physics 370), Back of the Envelope Physics (Physics 216). Wrote and taught lectures on nonequilibrium many-body physics (Physics 475).

PUBLICATIONS

59. H. Yerzhakov and J. Maciejko, “Random-mass disorder in the critical Gross-Neveu-Yukawa models”, Nucl. Phys. B 962, 115241 (2021).
58. J. Maciejko and S. Rayan, “Hyperbolic band theory”, arXiv:2008.05489.
57. Y. Huang, H. Guo, J. Maciejko, R. T. Scalettar, and S. Feng, “Antiferromagnetic transitions of Dirac fermions in three dimensions”, Phys. Rev. B 102, 155152 (2020).
56. R. Boyack, H. Yerzhakov, and J. Maciejko, “Quantum phase transitions in Dirac fermion systems”, arXiv:2004.09414.
55. R. Boyack and J. Maciejko, “Critical exponents for the valence-bond-solid transition in lattice quantum electrodynamics”, arXiv:1911.09768, to appear in the proceedings of the 11th International Symposium on Quantum Theory and Symmetries (QTS-XI), Centre de Recherches Mathématiques (CRM).
54. C. Chen and J. Maciejko, “Revisiting the Ramond sector of the $\mathcal{N} = 1$ superconformal minimal models”, arXiv:1905.02297, to appear in Phys. Rev. D, Rapid Communications.
53. N. Zerf, R. Boyack, P. Marquard, J. A. Gracey, and J. Maciejko, “Critical properties of the valence-bond-solid transition in lattice quantum electrodynamics”, Phys. Rev. D 101, 094505 (2020).
52. A. J. Shook, V. Vadakumbatt, P. Senarath Yapa, C. Doolin, R. Boyack, P. H. Kim, G. G. Popowich, F. Souris, H. Christiani, J. Maciejko, and J. P. Davis, “Stabilized pair density wave via nanoscale confinement of superfluid ^3He ”, Phys. Rev. Lett. 124, 015301 (2020).
51. N. Zerf, R. Boyack, P. Marquard, J. A. Gracey, and J. Maciejko, “Critical properties of the Néel–algebraic-spin-liquid transition”, Phys. Rev. B 100, 235130 (2019).
50. G. Shankar and J. Maciejko, “Exactly solvable Majorana-Anderson impurity models”, Phys. Rev. B 100, 241105(R) (2019).
49. R. Boyack, A. Rayyan, and J. Maciejko, “Deconfined criticality in the QED₃-Gross-Neveu-Yukawa model: the $1/N$ expansion revisited”, Phys. Rev. B 99, 195135 (2019).

48. T. Graß, P. Bienias, M. J. Gullans, R. Lundgren, J. Maciejko, and A. V. Gorshkov, “Fractional quantum Hall phases of bosons with tunable interactions: From the Laughlin liquid to a fractional Wigner crystal”, *Phys. Rev. Lett.* 121, 253403 (2018).
47. H. Yerzhakov and J. Maciejko, “Disordered fermionic quantum critical points”, *Phys. Rev. B* 98, 195142 (2018).
46. J. Hutchinson and J. Maciejko, “Unconventional transport in low-density two-dimensional Rashba systems”, *Phys. Rev. B* 98, 195305 (2018).
45. N. Zerf, P. Marquard, R. Boyack, and J. Maciejko, “Critical behavior of the QED₃-Gross-Neveu-Yukawa model at four loops”, *Phys. Rev. B* 98, 165125 (2018).
44. R. Boyack, C.-H. Lin, N. Zerf, A. Rayyan, and J. Maciejko, “Transition between algebraic and \mathbf{Z}_2 quantum spin liquids at large N ”, *Phys. Rev. B* 98, 035137 (2018).
43. R. Lundgren, H. Yerzhakov, and J. Maciejko, “Nematic order on the surface of a three-dimensional topological insulator”, *Phys. Rev. B* 96, 235140 (2017).
42. C. Prosko, S.-P. Lee, and J. Maciejko, “Simple \mathbf{Z}_2 lattice gauge theories at finite fermion density”, *Phys. Rev. B* 96, 205104 (2017).
41. J. Hutchinson and J. Maciejko, “Universality of low-energy Rashba scattering”, *Phys. Rev. B* 96, 125304 (2017).
40. N. Regnault, J. Maciejko, S. A. Kivelson, and S. L. Sondhi, “Evidence of a fractional quantum Hall nematic phase in a microscopic model”, *Phys. Rev. B* 96, 035150 (2017).
39. S.-P. Lee, D. Nandi, F. Marsiglio, and J. Maciejko, “Fractional Josephson effect in nonuniformly strained graphene”, *Phys. Rev. B* 95, 174517 (2017).
38. S.-P. Lee, R. M. Lutchyn, and J. Maciejko, “Odd-frequency superconductivity in a nanowire coupled to Majorana zero modes”, *Phys. Rev. B* 95, 184506 (2017).
37. S.-K. Jian, C.-H. Lin, J. Maciejko, and H. Yao, “Emergence of supersymmetric quantum electrodynamics”, *Phys. Rev. Lett.* 118, 166802 (2017).
36. M. Rashidi, M. Taucer, I. Ozfidan, E. Lloyd, H. Labidi, J. L. Pitters, J. Maciejko, and R. A. Wolkow, “Time-resolved imaging of negative differential resistance on the atomic scale”, *Phys. Rev. Lett.* 117, 276805 (2016).
35. I. Ozfidan, J. Han, and J. Maciejko, “Gapless helical superconductivity on the surface of a three-dimensional topological insulator”, *Phys. Rev. B* 94, 214510 (2016).

34. N. Zerf, C.-H. Lin, and J. Maciejko, “Superconducting quantum criticality of topological surface states at three loops”, Phys. Rev. B 94, 205106 (2016).
33. P. Ye, T. L. Hughes, J. Maciejko, and E. Fradkin, “Composite particle theory of three-dimensional gapped fermionic phases: Fractional topological insulators and charge-loop excitation symmetry”, Phys. Rev. B 94, 115104 (2016).
32. C.-C. Chen, L. Muechler, R. Car, T. Neupert, and J. Maciejko, “Fermionic symmetry-protected topological phase in a two-dimensional Hubbard model”, Phys. Rev. Lett. 117, 096405 (2016).
31. J. Hutchinson and J. Maciejko, “Rashba scattering in the low-energy limit”, Phys. Rev. B 93, 245309 (2016).
30. W. Witczak-Krempa and J. Maciejko, “Optical conductivity of topological surface states with emergent supersymmetry”, Phys. Rev. Lett. 116, 100402 (2016).
29. J. Wu, J. P. L. Faye, D. Sénéchal, and J. Maciejko, “Quantum cluster approach to the spinful Haldane-Hubbard model”, Phys. Rev. B 93, 075131 (2016).
28. R. Lundgren and J. Maciejko, “Landau theory of helical Fermi liquids”, Phys. Rev. Lett. 115, 066401 (2015).
27. B. D. Hauer, J. Maciejko, and J. P. Davis, “Nonlinear power spectral densities for the harmonic oscillator”, Ann. Phys. (N.Y.) 361, 148 (2015).
26. J. Maciejko and G. A. Fiete, “Fractionalized topological insulators”, Nature Phys. 11, 385 (2015).
25. Y. J. Park, S. B. Chung, and J. Maciejko, “Surface Majorana fermions and bulk collective modes in superfluid $^3\text{He-B}$ ”, Phys. Rev. B 91, 054507 (2015).
24. L. Muechler, J. Maciejko, T. Neupert, and R. Car, “Möbius molecules and fragile Mott insulators”, Phys. Rev. B 90, 245142 (2014).
23. I. D. Potirniche, J. Maciejko, R. Nandkishore, and S. L. Sondhi, “Superconductivity of disordered Dirac fermions in graphene”, Phys. Rev. B 90, 094516 (2014).
22. J. Maciejko and R. Nandkishore, “Weyl semimetals with short-range interactions”, Phys. Rev. B 90, 035126 (2014).
21. J. Maciejko, V. Chua, and G. A. Fiete, “Topological order in a correlated three-dimensional topological insulator”, Phys. Rev. Lett. 112, 016404 (2014).

20. J. Maciejko and A. Rüegg, “Topological order in a correlated Chern insulator”, Phys. Rev. B 88, 241101(R) (2013).
19. J. Maciejko, B. Hsu, S. A. Kivelson, Y. J. Park, and S. L. Sondhi, “Field theory of the quantum Hall nematic transition”, Phys. Rev. B 88, 125137 (2013).
18. R. Nandkishore, J. Maciejko, D. A. Huse, and S. L. Sondhi, “Superconductivity of disordered Dirac fermions”, Phys. Rev. B 87, 174511 (2013).
17. J. Maciejko, X. L. Qi, A. Karch, and S. C. Zhang, “Models of three-dimensional fractional topological insulators”, Phys. Rev. B 86, 235128 (2012).
16. J. Maciejko, “Kondo lattice on the edge of a two-dimensional topological insulator”, Phys. Rev. B 85, 245108 (2012).
15. C. Brüne, A. Roth, H. Buhmann, E. M. Hankiewicz, L. W. Molenkamp, J. Maciejko, X. L. Qi, and S. C. Zhang, “Spin polarization of the quantum spin Hall edge states”, Nature Phys. 8, 486 (2012).
14. S. B. Chung, X. L. Qi, J. Maciejko, and S. C. Zhang, “Conductance and noise signatures of Majorana backscattering”, Phys. Rev. B 83, 100512(R) (2011).
13. J. Maciejko, T. L. Hughes, and S. C. Zhang, “The quantum spin Hall effect”, Annu. Rev. Condens. Matter Phys. 2, 31 (2011).
12. A. Karch, J. Maciejko, and T. Takayanagi, “Holographic fractional topological insulators in 2+1 and 1+1 dimensions”, Phys. Rev. D 82, 126003 (2010).
11. J. Maciejko, X. L. Qi, A. Karch, and S. C. Zhang, “Fractional topological insulators in three dimensions”, Phys. Rev. Lett. 105, 246809 (2010).
10. J. Maciejko, E.-A. Kim, and X. L. Qi, “Spin Aharonov-Bohm effect and topological spin transistor”, Phys. Rev. B 82, 195409 (2010).
9. J. Maciejko, X. L. Qi, H. D. Drew, and S. C. Zhang, “Topological quantization in units of the fine structure constant”, Phys. Rev. Lett. 105, 166803 (2010).
8. J. Maciejko, X. L. Qi, and S. C. Zhang, “Magnetoelectricity of the quantum spin Hall state”, Phys. Rev. B 82, 155310 (2010).
7. C.-C. Chen, J. Maciejko, A. P. Sorini, B. Moritz, R. R. P. Singh, and T. P. Devereaux, “Orbital order and spontaneous orthorhombicity in iron pnictides”, Phys. Rev. B 82, 100504(R) (2010).

6. J. Maciejko, C. X. Liu, Y. Oreg, X. L. Qi, C. Wu, and S. C. Zhang, “Kondo effect in the helical edge liquid of the quantum spin Hall state”, Phys. Rev. Lett. 102, 256803 (2009).
5. A. Roth, C. Brüne, H. Buhmann, L. W. Molenkamp, J. Maciejko, X. L. Qi, and S. C. Zhang, “Nonlocal transport in the quantum spin Hall state”, Science 325, 294 (2009).
4. Z. Feng, J. Maciejko, J. Wang, and H. Guo, “Current fluctuations in the transient regime: An exact formulation for mesoscopic systems”, Phys. Rev. B 77, 075302 (2008).
3. J. Maciejko, Y. Zhu, J. Wang, and H. Guo, “Theory of nonequilibrium transient transport in nanostructures”, Int. J. Nanotechnol. 5, 1094 (2008).
2. J. Maciejko, J. Wang, and H. Guo, “Time-dependent quantum transport far from equilibrium: An exact nonlinear response theory”, Phys. Rev. B 74, 085324 (2006).
1. Y. Zhu, J. Maciejko, T. Ji, H. Guo, and J. Wang, “Time-dependent quantum transport: direct analysis in the time domain”, Phys. Rev. B 71, 075317 (2005).

PRESENTATIONS

Invited talks at workshops/conferences

- Invited talk at the conference “Frontiers of Quantum and Mesoscopic Thermodynamics” (FQMT ’21), Prague, Czech Republic, Jul. 18-24, 2021 (upcoming).
- Invited talk at the conference “Topological Matter and Duality”, Galileo Galilei Institute for Theoretical Physics, Florence, Italy, Sep. 7-11, 2020 (cancelled because of Covid-19).
- Invited talk at the workshop “Relativistic Fermions in Flatland: Theory and Applications”, European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT*), Trento, Italy, Jun. 8-12, 2020 (cancelled because of Covid-19).
- Invited talk at the Canadian Mathematical Society (CMS) 75th Anniversary Summer Meeting, Ottawa, ON, Jun. 5-8, 2020 (cancelled because of Covid-19).
- Invited talk at the conference “Frontiers of Quantum and Mesoscopic Thermodynamics”, Prague, Czech Republic, Jul. 19, 2019.
- Invited talk at the XIth International Symposium on Quantum Theory and Symmetries, Centre de recherches mathématiques (CRM), Montreal, QC, Jul. 5, 2019.
- Invited talk at the 2019 Summer Meeting of the Canadian Mathematical Society (CMS), Regina, SK, Jun. 8, 2019.
- Invited talk at the program on Effective Theories of Quantum Phases of Matter, Nordic Institute for Theoretical Physics (NORDITA), Stockholm, Sweden, May 14, 2019.
- Invited talk at the Shoucheng Zhang Memorial Workshop, Stanford University, Stanford, CA, May 4, 2019.
- Invited talk at the 49th Winter Colloquium on the Physics of Quantum Electronics, Snowbird, UT, Jan. 9, 2019.

- Invited talk at the Canadian Institute for Advanced Research (CIFAR) Quantum Materials Program Meeting, Toronto, ON, Nov. 19, 2018.
- Invited talk at the Workshop on Advances in Non-Fermi Liquids, University of California, Berkeley, CA, Aug. 15, 2018.
- Invited talk at the program on Topological Matter Beyond the Ten-Fold Way, Nordic Institute for Theoretical Physics (NORDITA), Stockholm, Sweden, Jul. 17, 2018.
- Invited talk at the 2nd Workshop on Complex Quantum Materials, Fudan University, Shanghai, China, Apr. 20, 2018.
- Invited talk at the March Meeting of the American Physical Society (APS), Los Angeles, CA, Mar. 8, 2018.
- Invited keynote talk at the 2018 Lake Louise Winter Institute, Lake Louise, AB, Feb. 22, 2018.
- Invited talk at the workshop “Relativistic Fermions and Nodal Semimetals from Topology”, Banff International Research Station (BIRS), Banff, AB, Feb. 13, 2018.
- Invited talk at the workshop “Chaos, Duality, and Topology in Condensed Matter Theory”, University of Illinois Urbana-Champaign, Urbana, IL, Nov. 4, 2017.
- Invited talk at the workshop “Contemporary Topics in Mathematical Physics”, Banff International Research Station (BIRS), Banff, AB, Oct. 28, 2017.
- Invited talk at the Spin Phenomena Interdisciplinary Center (SPICE) workshop on “Spin Dynamics in Dirac Systems”, Mainz, Germany, Jun. 7, 2017.
- Invited plenary talk at the 18th Annual Meeting of the APS Northwest Section, Pacific University, Forest Grove, OR, Jun. 3, 2017.
- Invited talk at the workshop “Landau Fermi liquid theory in nuclear and many-body systems”, European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT*), Trento, Italy, May 25, 2017.
- Invited talk at the conference “Topological States of Matter”, International Institute of Physics, Natal, Brazil, Mar. 21, 2017.
- Invited talk at the Canadian Institute for Advanced Research (CIFAR) Quantum Materials Program Meeting, Collège de France, Paris, France, Oct. 7, 2016.
- Invited talk at the conference “Low Energy Challenges for High Energy Physicists II”, Perimeter Institute, Waterloo, ON, Aug. 24, 2016.
- Invited review talk at the conference “Quantum Criticality and Topology in Itinerant Electron Systems”, Albuquerque, NM, Aug. 19, 2016.
- Invited talk at the workshop “Connecting Few-Body and Many-Body Pictures of Fractional Quantum Hall Physics”, Institute for Theoretical Atomic, Molecular, and Optical Physics (ITAMP), Harvard University, Cambridge, MA, Jul. 12, 2016.
- Invited talk at the workshop “Majorana 2016” (DFG priority program SPP 1666 “Topological Insulators”), Schloß Waldthausen, Mainz, Germany, Feb. 25, 2016.
- Invited talk at the workshop “New Phases and Emergent Phenomena in Correlated Materials with Strong Spin-Orbit Coupling”, Kavli Institute for Theoretical Physics (KITP), Santa Barbara, CA, Oct. 8, 2015.

- Invited talk at the 2015 Congress of the Canadian Association of Physicists (CAP), Edmonton, AB, Jun. 15, 2015.
- Invited talk at the Theory Canada 10 meeting of the CAP Division of Theoretical Physics, Calgary, AB, Jun. 13, 2015.
- Invited talk at the March Meeting of the American Physical Society (APS), San Antonio, TX, Mar. 6, 2015.
- Invited talk at the 2014 CAP Congress, Sudbury, ON, Jun. 16-20, 2014.
- Invited talk at the International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, Okinawa, Japan, Oct. 22-26, 2013.
- Invited talk at the 7th International Workshop on Emergent Quantum Phases in Condensed Matter, Institute for Solid State Physics (ISSP), University of Tokyo, Kashiwa, Japan, Jun. 3-21, 2013.
- Invited talk at the Canadian Institute for Advanced Research (CIFAR) Quantum Materials Program Meeting, Vancouver, BC, May 8-11, 2013.
- Invited talk at the Workshop on Frontiers of Condensed Matter Physics, Pajaro Dunes, CA, Mar. 23-25, 2013.
- Invited talk at the 2013 Aspen Winter Conference on Topological States of Matter, Aspen Center for Physics, Aspen, CO, Jan. 13-19, 2013.
- Invited talk at the 2012 International Workshop on Topological Order and Quantum Computation, Richard B. Gump South Pacific Research Station, Moorea, French Polynesia, Sep. 9-15, 2012.
- Invited talk at the Simons Postdoctoral Fellows Meeting, Simons Center for Geometry and Physics, SUNY Stony Brook, Stony Brook, NY, Apr. 11-13, 2012.
- Invited talk at the Program on Topological Insulators and Superconductors, KITP, Santa Barbara, CA, Sep. 19-Dec. 16, 2011.

Invited seminars/colloquia

- Speaker for the Quantum Matter Meets Maths (QM³) Seminar, Instituto Superior Técnico, Universidade de Lisboa, Lisbon, Portugal, Oct. 26, 2020.
- Speaker for the Institute for Condensed Matter Theory (ICMT) Seminar, University of Illinois Urbana-Champaign, Urbana, IL, Sep. 28, 2020.
- Speaker for the Condensed Matter & Biophysics Seminar, Brown University, Providence, RI, Sep. 17, 2020.
- Speaker for the Physics Colloquium, University of Alabama at Birmingham, Birmingham, AL, Apr. 10, 2020 (cancelled because of Covid-19).
- Speaker for the Physics Seminar, University of Saskatchewan, Saskatoon, SK, Jan. 14, 2020.
- Speaker for the quanTA Seminar, University of Saskatchewan, Saskatoon, SK, Jan. 13, 2020.

- Speaker for the High-Energy Theory Seminar, Princeton University, Princeton, NJ, May 6, 2019.
- Speaker for the Condensed Matter Seminar, Purdue University, West Lafayette, IN, Apr. 12, 2019.
- Speaker for the Department of Physics & Astronomy Colloquium, University of Calgary, Calgary, AB, Oct. 19, 2018.
- Speaker for the Department of Mathematical & Statistical Sciences Colloquium, University of Alberta, AB, Apr. 20, 2017.
- Speaker for the Condensed Matter Seminar, Purdue University, West Lafayette, IN, Mar. 31, 2017.
- Speaker for the Condensed Matter Seminar, University of Florida, Gainesville, FL, Feb. 20, 2017.
- Seminar speaker at the National High Magnetic Field Laboratory, Tallahassee, FL, Feb. 17, 2017.
- Speaker for the Kadanoff Center Seminar, Kadanoff Center for Theoretical Physics, University of Chicago, Chicago, IL, Jan. 23, 2017.
- Speaker for the Department of Physics Colloquium, Simon Fraser University, Burnaby, BC, Nov. 18, 2016.
- Speaker for the Department of Physics & Astronomy Colloquium, University of British Columbia, Vancouver, BC, Nov. 17, 2016.
- Speaker for the Department of Physics Colloquium, University of Ottawa, Ottawa, ON, Jan. 14, 2016.
- Speaker for the Physics Seminar of the Institute for Advanced Study, Tsinghua University, Beijing, China, Jan. 6, 2016.
- Speaker for the Centre for the Physics of Materials (CPM) Seminar, McGill University, Montreal, QC, Nov. 19, 2015.
- Speaker for the RQMP seminar, École Polytechnique de Montréal, Montreal, QC, Nov. 9, 2015.
- Seminar speaker at the Perimeter Institute for Theoretical Physics, Waterloo, ON, Apr. 28, 2015.
- Speaker for the Prairie Universities Physics Seminar Series, University of Lethbridge, Lethbridge, AB, Mar. 26, 2015.
- Speaker for the Theoretical Physics Institute Colloquium, University of Alberta, Edmonton, AB, Feb. 12, 2015.
- Speaker for the Quantum Matters seminar, University of Waterloo, Waterloo, ON, Dec. 16, 2014.
- Speaker at the Brockhouse Institute for Materials Research, McMaster University, Hamilton, ON, Dec. 15, 2014.
- Speaker for the Theory Seminar at the University of British Columbia, Vancouver, BC, Sep. 29, 2014.
- Seminar speaker at Microsoft Station Q, Santa Barbara, CA, Aug. 5, 2014.

- Seminar speaker at the Perimeter Institute for Theoretical Physics, Waterloo, ON, Jul. 8, 2014.
- Talk at the Princeton Center for Theoretical Science, Princeton University, Princeton, NJ, May 8, 2014.
- Speaker for the Physics Seminar, Université de Sherbrooke, Sherbrooke, QC, Apr. 22, 2014.
- Speaker for the Condensed Matter Physics Seminar, University of Connecticut, Storrs, CT, Apr. 23, 2013.
- Speaker for the Complex Quantum Systems / Condensed Matter Seminar, UT Austin, Austin, TX, Mar. 26, 2013.
- Speaker for the Physics Colloquium, University of Alberta, Edmonton, AB, Jan. 23, 2013.
- Speaker for the High Energy and Gravity Seminar, UC Santa Barbara, Santa Barbara, CA, Feb. 3, 2011.
- Speaker for the Condensed Matter Seminar, UC Riverside, Riverside, CA, Jan. 19, 2011.
- Speaker for the Station Q Seminar, Microsoft Station Q, Santa Barbara, CA, Dec. 6, 2010.
- Speaker for the Condensed Matter Seminar, Harvard University, Cambridge, MA, Nov. 30, 2010.

Contributed talks

- Contributed talk at the APS March Meeting, Denver, CO, Mar. 2-6, 2020 (cancelled because of Covid-19).
- Contributed talk at the APS March Meeting, San Antonio, TX, Mar. 4, 2015.
- Contributed talk at the APS March Meeting, Denver, CO, Mar. 3-7, 2014.
- Contributed talk at the APS March Meeting, Baltimore, MD, Mar. 18-22, 2013.
- Contributed talk at the APS March Meeting, Boston, MA, Feb. 27-Mar. 2, 2012.
- Contributed talk at the APS March Meeting, Dallas, TX, Mar. 21-25, 2011.
- Contributed talk at the APS March Meeting, Portland, OR, Mar. 15-20, 2010.
- Contributed talk at the APS March Meeting, Pittsburgh, PA, Mar. 16-20, 2009.
- Jam session speaker at the CIAR Nanoelectronics Program Meeting, Banff, AB, Mar. 17-20, 2005.

Lectures

- Invited keynote lecturer at the RQÉMP Summer School, Bishop's University, Sherbrooke, QC, Aug. 8, 2018.
- Invited lecturer at the CIFAR Quantum Materials Summer School 2018, Montreal, QC, May 30, 2018.
- Invited lecturer at the Croucher Summer Course “Quantum Entanglement and Topological Order”, Chinese University of Hong Kong, Hong Kong, Jun. 21-22, 2017.

- Invited lecturer at the International Summer School on Quantum Materials, Jouvence, QC, May 15-17, 2017.
- Invited lecturer at the CIFAR Quantum Materials Summer School 2015, Vancouver, BC, May 6, 2015.

PROFESSIONAL ACTIVITIES

- Member of local scientific committee, International Conference on Quantum Fluids and Solids (QFS 2019), University of Alberta, Edmonton, AB, Aug. 7-13, 2019.
- Contact organizer and co-organizer (with E. Fradkin and S. Parameswaran) of the workshop “Geometrical Degrees of Freedom in Topological Phases” at the Banff International Research Station (BIRS), Banff, AB, Aug. 21-26, 2016.
- Invited participation in the 2015 International Workshop on Topological Order and Quantum Computation, Richard B. Gump South Pacific Research Station, Moorea, French Polynesia, May 25-30, 2015.
- Invited participation in the 2014 International Workshop on Topological Order and Quantum Computation, Richard B. Gump South Pacific Research Station, Moorea, French Polynesia, May 26-Jun. 1, 2014.
- Co-organizer (with R. Nandkishore, T. Neupert, and S. L. Sondhi) of the workshop “Symmetry in Topological Phases” at the Princeton Center for Theoretical Science, Princeton University, Princeton, NJ, Mar. 17-21, 2014.
- Co-organizer (with B. A. Bernevig, F. D. M. Haldane, I. R. Klebanov, T. Nishioka, and M. Yamazaki) of the joint condensed matter/high-energy physics workshop “Entanglement in Discrete and Continuous Quantum Systems” at the Princeton Center for Theoretical Science, Princeton University, Princeton, NJ, Oct. 25-26, 2012.
- Participant of “Spin Age”, the IBM-Stanford SpinAps 2010 International Workshop and Retreat on Emerging Materials for Spintronics, Watsonville, CA, Aug. 27-31, 2010.
- Participant of the CIFAR-Pacific Institute for Theoretical Physics (PITP) International Summer School on Numerical Methods for Correlated Systems in Condensed Matter, Orford, QC, May 25-Jun. 6, 2008.
- Participant of the IBM-Stanford SpinAps Retreat “Quantum Nanoscience with Spins”, Asilomar, CA, Jun. 3-5, 2007.
- Referee for Nature Communications, Physical Review Letters, Physical Review X, Physical Review B, Physical Review Research, SciPost, Scientific Reports, Science Advances, New Journal of Physics, Journal of High Energy Physics, Nuclear Physics B, Europhysics Letters, Journal of Physics: Condensed Matter, Physica B, Physica C, and Journal of Low Temperature Physics.
- External grant reviewer for the Natural Sciences and Engineering Research Council (NSERC) of Canada, U.S. Department of Energy (DoE), U.S. National Science Foundation (NSF), the French National Research Agency (ANR), the German Research Foundation (DFG), and the Polish National Science Centre (NCN).