

CURRICULUM VITAE

MATTHEW S. FOSTER

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RESEARCH INTERESTS

Theoretical condensed matter physics. The effects of disorder and interactions in low-dimensional systems. Anderson localization and metal-insulator transitions. Transport in Dirac materials including graphene, topological insulators, and topological superconductors. Many-body localization. Hydrodynamics and thermoelectric transport. Non-equilibrium quantum many-body dynamics. Applications of quantum field theory and exact (symmetry-based) methods such as conformal field theory and integrability.

EMPLOYMENT

- 07/2019–Present Associate Professor
Physics and Astronomy Department
Rice University (Houston, TX)
- 07/2012–04/2019 Assistant Professor
Physics and Astronomy Department
Rice University (Houston, TX)
- 09/2009–08/2012 Postdoctoral Research Scientist
Department of Physics and Astronomy
Rutgers, the State University of New Jersey (Piscataway, NJ)
- 12/2008–09/2009 Visiting Scholar
Group of Emil A. Yuzbashyan
Department of Physics and Astronomy
Rutgers, the State University of New Jersey (Piscataway, NJ)
- 11/2006–11/2008 Postdoctoral Research Scientist
Group of Igor L. Aleiner
Physics Department
Columbia Nanoscale Science and Engineering Center
(joint appointment)
Columbia University (New York, NY)

EDUCATION

- 12/2006 Doctor of Philosophy in Physics,
University of California, Santa Barbara (Santa Barbara, CA)
Specialization: Theoretical Condensed Matter Physics
Dissertation title: “Interparticle interaction effects in novel disordered quantum systems”
Thesis advisor: Andreas W. W. Ludwig
- 05/2000 Bachelor of Engineering, Electrical Engineering
(Summa Cum Laude)
The Cooper Union for the Advancement of Science and Art (New York, NY)
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PUBLICATIONS

Preprints

48. “Suppression of Shot Noise in a Dirty Marginal Fermi Liquid,” T. C. Wu and M. S. Foster,
[arXiv:2312.03071](#).
47. “Magnetic instability and spin-glass order beyond the Anderson-Mott transition in interacting power-law random banded matrix fermions,” X. Zhang and M. S. Foster,
[arXiv:2309.13114](#).

Published

46. “Fragility of surface states in non-Wigner Dyson topological insulators,” A. Altland, P. W. Brouwer, J. Dieplinger, M. S. Foster, M. Moreno-Gonzalez, and L. Trifunovic,
[Phys. Rev. X **14**, 011057 \(2024\)](#).
45. “Enhancement of Superconductivity in a Dirty Marginal Fermi Liquid,” T. C. Wu, P. A. Lee, and M. S. Foster,
[Phys. Rev. B **108**, 214506 \(2023\)](#).
44. “Weyl nodal ring states and Landau quantization with very large magnetoresistance in square-net magnet EuGa_4 ,” S. Lei, K. Allen, J. Huang, J. M. Moya, T. C. Wu, B. Casas, Y. Zhang, J. S. Oh, M. Hashimoto, D. Lu, J. Denlinger, C. Jozwiak, A. Bostwick, E. Rotenberg, L. Balicas, R. Birgeneau, M. S. Foster, M. Yi, Y. Sun, and E. Morosan,
[Nat. Commun. **14**, 5812 \(2023\)](#).
43. “Enhanced Amplitude for Superconductivity due to Spectrum-wide Wave Function Criticality in Quasiperiodic and Power-law Random Hopping Models,” X. Zhang and M. S. Foster,
[Phys. Rev. B **106**, L180503 \(2022\)](#).[†]
42. “Dynamical phase transitions in the collisionless pre-thermal states of isolated quantum systems: theory and experiments,” J. Marino, M. Eckstein, M. S. Foster, and A. M. Rey,
[Rep. Prog. Phys. **85**, 116001 \(2022\)](#).
41. “Quantum Interference of Hydrodynamic Modes in a Dirty Marginal Fermi Liquid,” T. C. Wu, Y. Liao, and M. S. Foster,
[Phys. Rev. B **106**, 155108 \(2022\)](#).

[†] Selected as an Editor’s Suggestion.

40. “Geodesic geometry of 2+1-D Dirac materials subject to artificial, quenched gravitational singularities,” S. M. Davis and M. S. Foster, *SciPost Phys.* **12**, 204 (2022).
39. “How spectrum-wide quantum criticality protects surface states of topological superconductors from Anderson localization: Quantum Hall plateau transitions (almost) all the way down,” J. F. Karcher and M. S. Foster, Invited article for the Philip W. Anderson Memorial Special Issue, *Ann. Phys.* **435**, 168439 (2021).
38. “Dissipative Hot-Spot-Enabled Shock and Bounce Dynamics via Terahertz Quantum Quenches in Helical Edge States,” X. Zhang and M. S. Foster, *Phys. Rev. Lett.* **127**, 026801 (2021).
37. “Topological Anomalous Skin Effect in Weyl Superconductors,” T. C. Wu, H. K. Pal, and M. S. Foster, *Phys. Rev. B* **103**, 104517 (2021).[†]
36. “Non-Markovian dephasing of disordered, quasi-one-dimensional fermion systems,” S. M. Davis and M. S. Foster, *Phys. Rev. B* **102**, 155101 (2020).
35. “Criticality across the energy spectrum from random artificial gravitational lensing in two-dimensional Dirac superconductors,” S. A. A. Ghorashi, J. F. Karcher, S. M. Davis, and M. S. Foster, *Phys. Rev. B* **101**, 214521 (2020).
34. “Tunneling spectroscopy of *c*-axis epitaxial cuprate junctions,” P. Zhou, L. Chen, I. Sochnikov, T. C. Wu, M. S. Foster, A. T. Bollinger, X. He, I. Božović, and D. Natelson, *Phys. Rev. B* **101**, 224512 (2020).
33. “Topological quantum control: Edge currents via Floquet depinning of skyrmions in the $\nu = 0$ graphene quantum Hall antiferromagnet,” D. Iyer and M. S. Foster, *Phys. Rev. B* **101**, 241403(R) (2020).
32. “Spectrum-Wide Quantum Criticality at the Surface of Class AIII Topological Phases: An ‘Energy Stack’ of Integer Quantum Hall Plateau Transitions,” B. Sbierski, J. F. Karcher, and M. S. Foster, *Phys. Rev. X* **10**, 021025 (2020).
31. “Power-law Temperature Dependence of the Penetration Depth in a Topological Superconductor due to Surface States,” T. C. Wu, H. K. Pal, P. Hosur, and M. S. Foster, *Phys. Rev. Lett.* **124**, 067001 (2020).
30. “Effect of synthesis conditions on the electrical resistivity of TiSe₂,” J. M. Moya, C.-L. Huang, J. Choe, G. Costin, M. S. Foster, and E. Morosan, *Phys. Rev. Materials* **3**, 084005 (2019).
29. “Fractionalization Waves in Two-dimensional Dirac Fermions: Quantum Imprint from One Dimension,” S. M. Davis and M. S. Foster, *Phys. Rev. Lett.* **122**, 065302 (2019).
28. “Topological superconductivity of spin-3/2 carriers in a three-dimensional doped Luttinger semimetal,” B. Roy, S. A. A. Ghorashi, M. S. Foster, and A. H. Nevidomskyy, *Phys. Rev. B* **99**, 054505 (2019).[†]
27. “Critical Percolation without Fine Tuning on the Surface of a Topological Superconductor,” S. A. A. Ghorashi, Y. Liao, and M. S. Foster, *Phys. Rev. Lett.* **121**, 016802 (2018).

[†] Selected as an Editor’s Suggestion.

26. “Dephasing catastrophe in 4 - ϵ dimensions: A possible instability of the ergodic (many-body-delocalized) phase,” Y. Liao and M. S. Foster,
[Phys. Rev. Lett. **120**, 236601 \(2018\)](#).
25. “Quantum Multicriticality near the Dirac-Semimetal to Band-Insulator Critical Point in Two Dimensions: A Controlled Ascent from One Dimension,” B. Roy and M. S. Foster,
[Phys. Rev. X **8**, 011049 \(2018\)](#).
24. “Response theory of the ergodic many-body delocalized phase: Keldysh Finkel’stein sigma models and the 10-fold way,” Y. Liao, A. Levchenko, and M. S. Foster,
[Ann. Phys. **386**, 97 \(2017\)](#).
23. “Disorder-enhanced topological protection and universal quantum criticality in a spin-3/2 topological superconductor,” S. A. A. Ghorashi, S. Davis, and M. S. Foster,
[Phys. Rev. B **95**, 144503 \(2017\)](#).
22. “Twisting Anderson pseudospins with light: Quench dynamics in terahertz-pumped BCS superconductors,” Y.-Z. Chou, Y. Liao, and M. S. Foster,
[Phys. Rev. B **95**, 104507 \(2017\)](#).[†]
21. “Transport coefficients of graphene: Interplay of impurity scattering, Coulomb interaction, and optical phonons,” H.-Y. Xie and M. S. Foster,
[Phys. Rev. B **93**, 195103 \(2016\)](#).
20. “Enhanced Thermoelectric Power in Graphene: Violation of the Mott Relation By Inelastic Scattering,” F. Ghahari, H.-Y. Xie, T. Taniguchi, K. Watanabe, M. S. Foster, and P. Kim,
[Phys. Rev. Lett. **116**, 136802 \(2016\)](#).[†]
19. “Topological Protection from Random Rashba Spin-orbit Backscattering: Ballistic Transport in a Helical Luttinger Liquid,” H.-Y. Xie, H. Li, Y.-Z. Chou, and M. S. Foster,
[Phys. Rev. Lett. **116**, 086603 \(2016\)](#).
18. “Spectroscopic probes of isolated nonequilibrium quantum matter: Quantum quenches, Floquet states, and distribution functions,” Y. Liao and M. S. Foster,
[Phys. Rev. A **92**, 053620 \(2015\)](#).
17. “Helical Quantum Edge Gears in 2D Topological Insulators,” Y.-Z. Chou, A. Levchenko, and M. S. Foster,
[Phys. Rev. Lett. **115**, 186404 \(2015\)](#).
16. “Quantum quench phase diagrams of an s-wave BCS-BEC condensate,” E. A. Yuzbashyan, V. Gurarie, M. Dzero, and M. S. Foster,
[Phys. Rev. A **91**, 033628 \(2015\)](#).
15. “Surface transport coefficients for three-dimensional topological superconductors,” H.-Y. Xie, Y.-Z. Chou, and M. S. Foster,
[Phys. Rev. B **91**, 024203 \(2015\)](#).
14. “Quench-Induced Floquet Topological p -Wave Superfluids,” M. S. Foster, V. Gurarie, M. Dzero, and E. A. Yuzbashyan,
[Phys. Rev. Lett. **113**, 076403 \(2014\)](#).
13. “Chalker scaling, level repulsion, and conformal invariance in critically delocalized quantum matter: Disordered topological superconductors and artificial graphene,” Y.-Z. Chou and M. S. Foster,
[Phys. Rev. B **89**, 165136 \(2014\)](#).

[†] Selected as an Editor’s Suggestion.

12. “Topological protection, disorder, and interactions: Survival at the surface of 3D topological superconductors,” M. S. Foster, H.-Y. Xie, and Y.-Z. Chou,
[Phys. Rev. B **89**, 155140 \(2014\)](#).[†]
11. “Quantum quench in a $p+ip$ superfluid: Winding numbers and topological states far from equilibrium,” M. S. Foster, M. Dzero, V. Gurarie, and E. A. Yuzbashyan,
[Phys. Rev. B **88**, 104511 \(2013\)](#).[†]
10. “Interaction-mediated surface state instability in disordered three-dimensional topological superconductors with spin SU(2) symmetry,” M. S. Foster and E. A. Yuzbashyan,
[Phys. Rev. Lett. **109**, 246801 \(2012\)](#).
9. “Multifractal nature of the surface local density of states in three-dimensional topological insulators with magnetic and nonmagnetic disorder,” M. S. Foster,
[Phys. Rev. B **85**, 085122 \(2012\)](#).
8. “Quantum quench spectroscopy of a Luttinger liquid: Ultrarelativistic density wave dynamics due to fractionalization in an XXZ chain,” M. S. Foster, T. C. Berkelbach, D. R. Reichman, and E. A. Yuzbashyan,
[Phys. Rev. B **84**, 085146 \(2011\)](#).[†]
7. “Quantum quench in one dimension: Coherent inhomogeneity amplification and ‘supersolitons,’” M. S. Foster, E. A. Yuzbashyan, and B. L. Altshuler,
[Phys. Rev. Lett. **105**, 135701 \(2010\)](#).
6. “Termination of typical wavefunction multifractal spectra at the Anderson metal-insulator transition: Field theory description using the functional renormalization group,” M. S. Foster, S. Ryu, and A. W. W. Ludwig,
[Phys. Rev. B **80**, 075101 \(2009\)](#).[†]
Selected for a “Viewpoint” in Physics, [Physics **2**, 66 \(2009\)](#).
5. “Slow imbalance relaxation and thermoelectric transport in graphene,” M. S. Foster and I. L. Aleiner,
[Phys. Rev. B **79**, 085415 \(2009\)](#).[†]
4. “Graphene via large N: A renormalization group study,” M. S. Foster and I. L. Aleiner,
[Phys. Rev. B **77**, 195413 \(2008\)](#).[†]
3. “Metal-insulator transition from combined disorder and interaction effects in Hubbard-like electronic lattice models with random hopping,” M. S. Foster and A. W. W. Ludwig,
[Phys. Rev. B **77**, 165108 \(2008\)](#).
2. “Metal-insulator transition in Hubbard-like models with random hopping,” M. S. Foster and A. W. W. Ludwig,
[Phys. Rev. B **74**, 241102\(R\) \(2006\)](#).
1. “Interaction effects on 2D fermions with random hopping,” M. S. Foster and A. W. W. Ludwig,
[Phys. Rev. B **73**, 155104 \(2006\)](#).

NEWS ARTICLES

2. “Quantum Hall effect ‘reincarnated’ in 3D topological materials,” Rice press release (2020).
1. “Ultracold atoms could provide 2D window to exotic 1D physics,” Rice press release (2019).

[†] Selected as an Editor’s Suggestion.

INVITED PRESENTATIONS

- 89. (04-11-24) “Anomalous successes and a surprising failure: The Dirac equation and topological materials,” seminar at Harvard University (Cambridge, MA).
- 88. (03-06-24) “Anomalous successes and a surprising failure: The Dirac equation and topological materials,” invited talk at the *2024 APS March Meeting* (Minneapolis, MN).
- 87. (03-02-24) “When is quantum hydrodynamics *Quantum* hydrodynamics?” invited talk at the conference *Fine Theoretical Physics Institute March Meeting*, University of Minnesota, Minneapolis (Minneapolis, MN).
- 86. (12-16-23) “Interference-mediated pairing in dirty marginal Fermi liquids,” invited talk at the conference *Recent Advances in Superconductivity: Theory and Experiment*, University of Florida, Gainesville (Gainesville, FL).
- 85. (12-12-23) “Fragility of spectral flow in topological insulators,” invited talk at the workshop *Disorder and Quantum Phases of Matter*, Aspen Center for Physics (Aspen, CO).
- 84. (11-21-23) “Anomalous successes and a surprising failure: The Dirac equation and topological materials,” seminar given at Rutgers University (New Brunswick, NJ).
- 83. (09-06-23) “Anomalous successes and a surprising failure: The Dirac equation and topological materials,” colloquium given at City College of New York (New York City, NY).
- 82. (07-19-23) “Quantum interference effects in dirty marginal Fermi liquids,” invited talk at the conference *New Directions on Strange Metals in Correlated Systems*, Aspen Center for Physics (Aspen, CO).
- 81. (06-12-23) “Shock and bounce edge-state dynamics, and fractal-mediated superconductivity,” invited talk at the conference *Periodically and quasi-periodically driven complex systems*, International Centre for Theoretical Sciences (Bangalore, India).
- 80. (12-08-22) “Quantum interference of hydrodynamic modes despite Planckian dissipation in a strange metal,” seminar at the University of Maryland, College Park (College Park, MD).
- 79. (12-07-22) “Topological superconductors: Boundary fluids, electromagnetic fingerprints, and spectrum-wide fractality,” seminar at Johns Hopkins University (Baltimore, MD).
- 78. (09-22-22) “Topological superconductors: Boundary fluids and electromagnetic fingerprints,” invited virtual seminar hosted by Ames Lab and Iowa State University (Ames, IA).
- 77. (09-15-22) “Topological superconductors II: Spectrum-wide quantum criticality,” invited lecture lecture for *Elasto-Q TRR288 Summer School*, virtual school hosted by CRC TRR288 (Goethe University Frankfurt, Karlsruhe Institute of Technology, Johannes Gutenberg University Mainz, and Max Planck Institutes, Germany).
- 76. (09-13-22) “Topological superconductors I: Boundary fluids and electromagnetic fingerprints,” invited lecture lecture for *Elasto-Q TRR288 Summer School*, virtual school hosted by CRC TRR288 (Goethe University Frankfurt, Karlsruhe Institute of Technology, Johannes Gutenberg University Mainz, and Max Planck Institutes, Germany).
- 75. (09-08-22) “Spectrum-wide quantum criticality, random color and gravity gauge fields, topological CM systems,” invited talk at the program *Random Geometry in Statistical Physics, Condensed Matter and Quantum Gravity*, Aspen Center for Physics (Aspen, CO).

74. (07-14-22) “Dynamical phase transitions in the collisionless pre-thermal states of isolated quantum systems: theory and experiments,” virtual colloquium hosted by CRC TRR288 (Goethe University Frankfurt, Karlsruhe Institute of Technology, Johannes Gutenberg University Mainz, and Max Planck Institutes, Germany).
73. (02-10-22) “Topological superconductors: Boundary fluids, electromagnetic fingerprints, and spectrum-wide fractality,” virtual colloquium hosted by Lehigh University (Bethlehem, PA).
72. (11-16-21) “[Spectrum-wide quantum criticality in topological, and maybe high-Tc superconductors,](#)” invited talk at the conference *RCQM Workshop on Topological Materials and Electron Correlations*, Rice Center for Quantum Materials (Rice University, Houston, TX).
71. (10-15-21) “[Dynamical phase transitions: what’s quantum about them?](#)” Panel discussion for the program *Non-Equilibrium Universality: From Classical to Quantum and Back*, Kavli Institute for Theoretical Physics (University of California, Santa Barbara, CA).
70. (02-25-21) “[Electromagnetic Properties of Topological Superconductors,](#)” virtual seminar hosted by the University of Maryland (College Park, MD).
69. (12-11-20) “Electromagnetic Properties of Topological Superconductors,” invited talk at the workshop *New Frontiers in Quantum Materials Research* (Virtually hosted by the University of British Columbia and by Rice University, Vancouver, BC and Houston, TX).
68. (11-30-20) “[Dephasing redux: Non-Markovian noise and correlations beyond Born in weakly disordered fermion systems,](#)” virtual seminar for the Localisation 2020 seminar series (Sapporo, Japan).
67. (11-05-20) “[Dephasing redux: Non-Markovian noise and correlations beyond Born in weakly disordered fermion systems,](#)” virtual seminar hosted by Johannes Gutenberg Universität (Mainz, Germany).
66. (10-28-20) “Disordered fermions via Keldysh,” virtual seminar hosted by Johannes Gutenberg Universität (Mainz, Germany).
65. (10-26-20) “[Turtles all the way down: Spectrum-wide quantum criticality in topological, and maybe high-Tc superconductors,](#)” virtual seminar hosted by Washington University (St. Louis, MO).
64. (10-02-20) “[Dephasing redux: Non-Markovian noise and correlations beyond Born in weakly disordered fermion systems,](#)” virtual seminar hosted by Oxford University (Oxford, England).
63. (08-26-20) “[Turtles all the way down: Spectrum-wide quantum criticality in topological, and maybe high-Tc superconductors,](#)” invited talk at the conference *Localisation 2020* (Virtual conference hosted in Sapporo, Japan).
62. (10-18-19) “Topological superconductors and surface Majorana fluids,” invited talk at the workshop *Texas Quantum Institute Kickoff Meeting* (College Station, TX).
61. (09-10-19) “Dephasing in quasi-1D wires redux: Non-Markovian noise and correlations beyond Born due to itinerant spin interactions,” invited talk at the conference *Spins in a quantum 1D multi-particle environment: from exotic phases and non-trivial topology to protected transport*, Arnold Sommerfeld Center for Theoretical Physics, Ludwig-Maximilian University of Munich (Munich, Germany).
60. (07-10-19) “[Critical Anderson delocalization throughout the quasiparticle energy spectrum in superconductors,](#)” invited talk at the conference *Random Geometries and Multifractality in Condensed Matter and Statistical Mechanics*, International Institute of Physics (Natal, Brazil).

59. (06-19-19) “Critical Anderson delocalization throughout the quasiparticle energy spectrum in superconductors,” invited talk at *The 2019 Euler Symposium on Theoretical and Mathematical Physics*, Euler International Mathematical Institute (St. Petersburg, Russia).
58. (05-21-19) “Critical Anderson delocalization throughout the quasiparticle energy spectrum in superconductors,” invited talk at the conference *Quasiperiodicity and Fractality in Quantum Statistical Physics*, Rutgers University (New Brunswick, NJ).
57. (05-09-19) “From surface-enhanced field penetration to robust quantum fractality and artificially curved spacetime: Topological superconductors and surface Majorana fluids,” invited talk at the conference *Quantum Many Body State 2019*, KAIST (Daejeon, Korea).
56. (09-25-18) “Two new applications of geometric critical phenomena for disordered electron systems,” invited talk at the conference *Anderson Localization and Interactions*, Max Planck Institute for the Physics of Complex Systems (Dresden, Germany).
55. (09-12-18) “Quantum critical fluids at the edge: Disorder, interactions, and topological protection,” colloquium at Rice University (Houston, TX).
54. (06-01-18) “Critical percolation without fine-tuning on the surface of a topological superconductor, and Dephasing catastrophe in $4 - \epsilon$: A possible instability of the ergodic phase,” seminar at the University of California, Santa Cruz (Santa Cruz, CA).
53. (05-07-18) “Critical percolation without fine-tuning on the surface of a topological superconductor, and Dephasing catastrophe in $4 - \epsilon$: A possible instability of the ergodic phase,” seminar at Caltech (Pasadena, CA).
52. (04-25-18) “Quantized transport and universal criticality on the surface of a dirty bulk topological superconductor: A 3D analog of the integer quantum hall effect?,” invited talk at the conference *Topological superconductors: Materials, topological order, and quenched disorder*, Rice Center for Quantum Materials (Rice University, Houston, TX).
51. (03-26-18) “Quantum critical fluids at the edge: Disorder, interactions, and topological protection,” colloquium at Iowa State University (Ames, IA).
50. (02-08-18) “Critical percolation without fine-tuning on the surface of a topological superconductor, and Ballistic transport at the edge of a 2D TI with Rashba SOC, disorder, and interactions,” seminar at the University of Texas, Austin (Austin, TX).
49. (02-01-18) “Quantum critical fluids at the edge: Disorder, interactions, and topological protection,” seminar at Stanford University (Palo Alto, CA).
48. (11-13-17) “Two new applications of geometric critical phenomena for disordered electron systems,” invited talk at the workshop *Progress in quantum collective phenomena — from MBL to black holes*, Simons Center for Geometry and Physics (State University of New York, Stony Brook, NY).
47. (09-21-17) “Geometric percolation at the surface of a topological superconductor, and Dephasing catastrophe in $4 - \epsilon$: A toy MBL-ergodic transition,” invited seminar given at Brookhaven National Lab (Brookhaven, NY).
46. (09-21-17) “Geometric percolation at the surface of a topological superconductor, and Dephasing catastrophe in $4 - \epsilon$: A toy MBL-ergodic transition,” invited talk for the program *Hydrodynamics, ergodicity, entanglement and localization in interacting lattice models and field theories*, Simons Center for Geometry and Physics (State University of New York, Stony Brook, NY).

45. (07-03-17) “Informal tutorial: the (Keldysh) Finkel’stein nonlinear sigma model, and possible applications to many-body localization,” invited talk at the program *Correlations and Entanglement in and out of Equilibrium: from Cold Atoms to Electrons*, Aspen Center for Physics (Aspen, CO).
44. (06-26-17) “Perfect adiabatic evolution along the dirty edge of a topological insulator,” invited talk at the program *Correlations and Entanglement in and out of Equilibrium: from Cold Atoms to Electrons*, Aspen Center for Physics (Aspen, CO).
43. (03-30-17) “Universal transport at the edge: Disorder, interactions, and topological protection,” seminar at Yale University (New Haven, CT).
42. (03-20-17) “Many-body Delocalization: Keldysh sigma model approach,” invited talk at the conference *Dynamics and Hydrodynamics of Certain Quantum Matter*, CUNY Graduate Center, (City University of New York, New York, NY).
41. (12-08-16) “Universal transport at the edge: Disorder, interactions, and topological protection,” seminar at the University of Wisconsin (Madison, WI).
40. (06-30-16) “Universal transport at the edge: Disorder, interactions, and topological protection,” invited talk at the conference *Localization, Interactions and Superconductivity*, Landau Institute for Theoretical Physics (Chernogolovka, Russia).
39. (05-06-16) “Quenched BCS superfluids: Topology, spectral probes, and gapless superconductivity by intense THz pumping,” invited talk at the conference *Interacting Quantum Systems Driven Out of Equilibrium*, Rice Center for Quantum Materials (Rice University, Houston, TX).
38. (03-31-16) “Universal transport at the edge: Disorder, interactions, and topological protection,” colloquium given at Texas A&M University (College Station, TX).
37. (10-28-15) “Topological protection, disorder, and interactions: Delocalization and transport at the surface of 3D topological superconductors,” invited talk at the program *Many body localization*, Kavli Institute for Theoretical Physics (University of California, Santa Barbara, CA).
36. (08-06-15) “A 3D integer quantum Hall effect: Universal spin and heat transport at the surface of a topological superconductor, or: 2D Majorana liquid theory,” invited talk at the conference *2015 SPICE Junior Research Leaders* (Mainz, Germany).
35. (04-14-15) “A 3D integer quantum Hall effect: Universal spin and heat transport at the surface of a topological superconductor, or: 2D Majorana liquid theory,” invited talk at the conference *Hangzhou Workshop on Quantum Matter and Asia-Pacific Workshop on Strong Correlated Systems* (Hangzhou, China).
34. (02-03-15) “A 3D integer quantum Hall effect: Universal spin and heat transport at the surface of a topological superconductor, or: 2D Majorana liquid theory,” colloquium at the University of Houston (Houston, TX).
33. (01-31-15) “Conductivity and thermoelectric power in graphene: Coulomb interaction, disorder, and optical phonons,” invited talk at the conference *Two-dimensional van der Waals Materials* (University of Texas, Austin, TX).
32. (03-28-14) “Far from equilibrium topological p-wave superfluids,” invited talk at the workshop *Topological Matter out of Equilibrium*, Max Planck Institute for the Physics of Complex Systems (Dresden, Germany).

31. (03-14-14) “[Topological protection, disorder, and interactions: Life and death at the surface of a topological superconductor](#),” invited talk at the workshop *Recent Progress and Perspectives in Scaling, Multifractality, Interactions, and Topological Effects Near Anderson Transitions*, Max Planck Institute for the Physics of Complex Systems (Dresden, Germany).
30. (02-14-14) “Topological protection, disorder, and interactions: Life and death at the surface of a topological superconductor,” seminar at the University of California, Berkeley (Berkeley, CA).
29. (10-11-13) “Interaction-mediated surface state instability in dirty topological superconductors,” seminar at Texas A & M University (College Station, TX).
28. (05-03-13) “Interaction-mediated surface state instability in dirty topological superconductors,” seminar at National High Magnetic Field Laboratory (Tallahassee, FL).
27. (04-26-13) “[Quantum quench in p+ip superfluids: Winding numbers and topological states far from equilibrium](#),” extended pedagogical lecture given at the Hangzhou Workshop on Quantum Matter (Hangzhou, China).
26. (04-23-13) “Quantum quench in p+ip superfluids: Winding numbers and topological states far from equilibrium,” invited talk given at the Hangzhou Workshop on Quantum Matter (Hangzhou, China).
25. (03-01-13) “Quantum quench in p+ip superfluids: Non-equilibrium ‘topological’ gapless state(s),” seminar at Boston University (Boston, MA).
24. (02-21-13) “Quantum quench in p+ip superfluids: Non-equilibrium ‘topological gapless’ state(s),” seminar at University of Colorado, Boulder (Boulder, CO).
23. (02-04-13) “Interaction-mediated surface state instability in dirty topological superconductors,” invited talk at the workshop *Topological Phenomena in Quantum Dynamics and Disordered Systems*, Banff International Research Station for Mathematical Innovation and Discovery (Banff, Alberta, Canada).
22. (12-12-12) “Interaction-mediated surface state instability in dirty topological superconductors,” seminar at the Niels Bohr Institute (Copenhagen, Denmark).
21. (12-06-12) “Quantum quench in p+ip superfluids: Non-equilibrium ‘topological gapless’ state,” the Abdus Salam International Centre for Theoretical Physics (Trieste, Italy).
20. (11-12-12) “Interaction-mediated surface state instability in dirty topological superconductors,” seminar at the University of Illinois at Urbana-Champaign (Champaign, IL).
19. (09-28-12) “Interaction-mediated surface state instability in dirty topological superconductors,” seminar at the University of Oklahoma (Norman, OK).
18. (08-30-12) “Instability of ‘protected’ surface Andreev states in 3D class CI dirty topological superconductors due to interactions and multifractality,” invited talk at the workshop *Complex Quantum Systems: Non-Ergodicity, Glassiness and Localization*, the Abdus Salam International Centre for Theoretical Physics (Trieste, Italy).
17. (03-06-12) “‘Supersolitons’ in continuum and lattice quenches: Correlated quantum fronts far from equilibrium,” invited talk at the workshop *Frontiers of quantum condensed matter physics: light, matter and unusual devices out of equilibrium*, CUNY Graduate Center, (City University of New York, New York, NY).

16. (02-02-12) [“When Quantum Waves Crash upon Strange Shores: Splash Statistics in Disordered Media, and Correlated Fronts Far from Equilibrium,”](#) colloquium at Rice University (Houston, TX).
15. (01-19-12) “When Quantum Waves Crash upon Strange Shores: Splash Statistics in Disordered Media, and Correlated Fronts Far from Equilibrium,” colloquium at the University of Minnesota (Minneapolis, MN).
14. (01-13-12) “When Quantum Waves Crash upon Strange Shores: Splash Statistics in Disordered Media, and Correlated Fronts Far from Equilibrium,” seminar at the University of Chicago (Chicago, IL).
13. (12-12-11) “When Quantum Waves Crash upon Strange Shores: Splash Statistics in Disordered Media, and Correlated Fronts Far from Equilibrium,” seminar at Rutgers University (Piscataway, NJ).
12. (11-18-10) “Knotted wavefunctions and Dirac surface states: Introducing topological insulators,” seminar at the Cooper Union for the Advancement of Science and Art (New York, NY).
11. (11-12-10) “Quantum quench in 1D: Fractionalization and ‘supersolitons’,” seminar at the Kavli Institute for Theoretical Physics (University of California, Santa Barbara, CA).
10. (11-10-10) “Quantum quench in 1D: Fractionalization and ‘supersolitons’,” seminar at the University of California, Los Angeles (Los Angeles, CA).
9. (06-25-10) “Quantum quench in 1D: Coherent inhomogeneity amplification and ‘supersolitons’,” invited talk at the workshop *Dynamics of Strongly Correlated Quantum Systems*, the Abdus Salam International Centre for Theoretical Physics (Trieste, Italy).
8. (02-16-10) “Emergent ‘super solitons’ following a Luttinger liquid to Mott insulator quantum quench,” seminar at Columbia University (New York, NY).
7. (06-12-09) [“Termination of typical wavefunction multifractal spectra at the Anderson metal-insulator transition,”](#) invited talk at the workshop *“Meso-09”: Mesoscopic and strongly correlated electron systems*, Landau Institute for Theoretical Physics (Chernogolovka, Russia).
6. (06-16-08) “Competing Disorder and Coulomb Interaction Effects in Graphene via Large N,” seminar at Rutgers University (Piscataway, NJ).
5. (04-15-08) “Competing Disorder and Coulomb Interaction Effects in Graphene via Large N,” seminar at Columbia University (New York, NY).
4. (02-28-08) “Competing Disorder and Coulomb Interaction Effects in Graphene via Large N,” seminar at Brookhaven National Laboratory (Brookhaven, NY).
3. (08-10-06) “Interparticle interaction effects in quantum disordered systems with random hopping,” invited talk at the workshop *Dynamics and Relaxation in Complex Quantum and Classical Systems and Nanostructures*, Max Planck Institute for the Physics of Complex Systems (Dresden, Germany).
2. (03-01-06) “Quantum Physics of Disordered and Chaotic Condensed Matter Systems,” seminar at The Cooper Union for the Advancement of Science and Art (New York, NY).
1. (02-28-06) “Interparticle interaction effects in quantum disordered systems with random hopping,” seminar at the University of California, Santa Barbara (Santa Barbara, CA).

POSTERS BY PI AND BY GROUP MEMBERS

19. (06-26-22) (1) “Quantum Interference of Hydrodynamic Modes in a Dirty Marginal Fermi Liquid” (Tsz Chun Wu), (2) “Enhanced Superconductivity due to Spectrum-wide Wavefunction Criticality in Quasiperiodic and Power-law Random Hopping Models” (Xinghai Zhang), (3) “Spectrum-wide quantum criticality (SWQC) in topological, and maybe high-Tc superconductors” (Matthew S. Foster), presented at the 2022 Correlated Electron Systems Gordon Conference *Topology and Correlations: Long-Range Entanglement in Many-Body Systems*, (Mount Holyoke College, South Hadley, MA).
18. (03-25-21) (1) “Shock and soliton dynamics in helical edge states” (Xinghai Zhang), (2) “Topological anomalous skin effect in Weyl superconductors” (Tsz Chun Wu), (3) “Geometry of 2D gravitationally disordered superconductors” (Seth M. Davis), presented at the virtual conference *Correlated phases and hydrodynamics of driven systems*, hosted by City University of New York and Boston University.
17. (04-24-18) (1) “Critical percolation without fine tuning on the surface of a topological superconductor” (Sayed A. A. Ghorashi), (2) “[Incommensurate Floquet Dynamics Induced by Quantum Quench in 1D s-wave BCS Model](#)” (Xinghai Zhang), presented at the conference *Topological superconductors: Materials, topological order, and quenched disorder*, Rice Center for Quantum Materials (Rice University, Houston, TX).
16. (06-28-17) “Spin-3/2 Topological Superconductors: Disorder, Topological Protection and Generalized Surface Theories” (Sayed A. A. Ghorashi), presented at the conference *Frontiers in Emergent Quantum Phenomena Center for Quantum Phenomena Inaugural Symposium*, (New York University, New York, NY).
15. (06-04-17) “Topological superconductors in a three-dimensional doped parabolic semimetal: Possible applications to pyrochlore iridates, half-heusler compounds” (Bitan Roy), presented at the Gordon Conference on Superconductivity (Waterville Valley, NH).
14. (11-04-16) “[Helical Quantum Edge Gears in 2D Topological Insulators, and Transport coefficients of graphene: Interplay of impurity scattering, Coulomb interaction, and optical phonons,](#)” presented at the Kavli Frontiers of Science Conference, National Academy of Sciences (Irvine, CA)
13. (11-04-16) (1) “Surface state BCS instability in a spin-3/2 time-reversal invariant topological superconductor” (Sayed A. A. Ghorashi), (2) “Disorder-enhanced topological protection and universal quantum criticality in a spin-3/2 topological superconductor” (Seth M. Davis), (3) “Many-body delocalization: Keldysh sigma model approach” (Yunxiang Liao), presented at the conference *Workshop on Frontiers of Quantum Materials*, Rice Center for Quantum Materials (Rice University, Houston, TX).
12. (06-13-16) “[Transport coefficients of graphene: Interplay of impurity scattering, Coulomb interaction, and optical phonons](#)” (Hong-Yi Xie), presented at the summer school *Advances in strongly correlated electronic systems (ASCES2016)*, William I. Fine Theoretical Physics Institute (University of Minnesota, Minneapolis, MN).
11. (11-20-15) “[Helical Quantum Edge Gears in 2D Topological Insulators](#)” (Yang-Zhi Chou), presented at the conference *Workshop on Strongly Correlated Electron Materials*, Rice Center for Quantum Materials (Rice University, Houston, TX).

10. (12-15-14) (1) “2D Majorana fluids: Instabilities, universal statistics, and quantized transport at the surface of a topological superconductor,” (2) “[Distribution functions and probes of far-from-equilibrium topological matter](#)” (Yunxiang Liao), (3) “Conductivity and thermoelectric power in graphene: Interplay of disorder, Coulomb interaction, and optical phonons” (Hong-Yi Xie), (4) “Quantum Critical Phenomena in Disordered Topological Superconductors” (Yang-Zhi Chou), presented at the conference *Quantum Materials - Perspectives and Opportunities The Rice Center for Quantum Materials Launch*, Rice Center for Quantum Materials (Rice University, Houston, TX).
9. (11-17-14) “[2D Majorana fluids: Quantized transport, universal statistics, and instabilities at the surface of a topological superconductor](#),” presented at the Kavli Frontiers of Science Conference, National Academy of Sciences (Irvine, CA)
8. (06-22-14) (1) “[Universal Surface Transport Coefficients of 3D Topological Superconductors](#)” (Hong-Yi Xie), (2) “[Quantum Critical Phenomena in Disordered Topological Superconductors](#)” (Yang-Zhi Chou), (3) “Detecting Edge State in Out of Equilibrium System” (Yunxiang Liao), presented at the Gordon Conference on Correlated Electron Systems (South Hadley, MA).
7. (06-24-12) “Interaction-mediated surface state instability in disordered three-dimensional topological superconductors,” presented at the Gordon Conference on Correlated Electron Systems (South Hadley, MA).
6. (04-20-12) “Interaction-mediated surface state instability in disordered 3D topological superconductors with spin SU(2) symmetry,” presented at the Gotham-Metro Condensed Matter Meeting (New York Academy of Sciences, New York, NY).
5. (11-11-11) “[Quench spectroscopy of a Luttinger liquid: Fractionalized density waves in the XXZ chain](#),” presented at the Gotham-Metro Condensed Matter Meeting (New York Academy of Sciences, New York, NY).
4. (06-27-11) “Quench spectroscopy of a Luttinger liquid: Fractionalized density waves in the XXZ chain,” presented at the conference *Workshop and school on topological aspects of condensed matter physics*, the Abdus Salam International Centre for Theoretical Physics (Trieste, Italy).
3. (06-13-10) “Quantum quench in 1D: Coherent inhomogeneity amplification and ‘supersolitons,’” presented at the Gordon Conference on Correlated Electron Systems (South Hadley, MA).
2. (11-21-09) “[Termination of Typical Wavefunction Multifractal Spectra at the Anderson MIT](#),” presented at the Gotham-Metro Condensed Matter Meeting (New York Academy of Sciences, New York, NY).
1. (06-12-07) “Competing Effects of Coulomb Interactions and Quenched Disorder in Graphene,” Columbia Nanoscale Science and Engineering Center Biannual Review (Columbia University, New York, NY).

FELLOWSHIPS AND AWARDS

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| 2023 | Career Champion, Center for Career Development, Rice University (Houston, TX). |
| 2016, 2014 | Kavli Frontiers Fellow, National Academy of Sciences. |
| 2016 | NSF CAREER. |

2014	Alfred P. Sloan Foundation Research Fellowship, the Alfred P. Sloan Foundation.
2004	Graduate Division Fellowship, University of California, Santa Barbara.
2001	John Cardy Award, Physics Department, University of California, Santa Barbara.
2000	National Science Foundation Graduate Research Fellowship.
2000	Broida Fellowship, Physics Department, University of California, Santa Barbara.
2000	Abraham Pletman Memorial Fund Prize for excellence in electrical engineering, Cooper Union (New York, NY).
2000	Harry W. Reddick Fund Prize and Medal for meritorious work in mathematics, Cooper Union (New York, NY).
2000	First Place (with Nader W. Zaki), Region I IEEE Student Paper Competition, for the paper "PsiOptik: an optical image processing system."

GRANTS

14. 09/23–04/24 Conference funding proposal for workshop "Disorder and Quantum Phases of Matter," hosted by the Aspen Center for Physics, 12/2023. Institute for Complex Adaptive Matter (ICAM), \$15,000.
13. 06/22–05/25 "Fractal Mechanisms of Coherent Dynamics in Complex Quantum Materials," Welch Foundation, \$300,000.
12. 04/21–03/22 "Multiscale optimization of electrical and thermal transport in carbon nanotube conductors for power cable applications." (Co-PI with Geoff Wehmeyer and Junichiro Kono). Rice Carbon Hub, \$135,000.
11. 04/20–05/21 Conference funding proposal for workshop "Topological Materials and Electron Correlations," hosted by the Rice Center for Quantum Materials at Rice University, 04/2021. National Science Foundation, \$7,000.
10. 06/19–05/22 "Quantum Criticality and Coherence in Topological and Strongly Correlated Matter: Random Curvature and (Artificial) 2D Quantum Gravity." Welch Foundation, \$240,000.
9. 04/18–05/18 Conference funding proposal for workshop "Topological superconductors: Materials, topological order, and quenched disorder," hosted by the Rice Center for Quantum Materials at Rice University, 04/2018 (Co-PI with Andriy Nevidomskyy). Institute for Complex Adaptive Matter (ICAM), \$10,000.
8. 03/18–02/19 Conference funding proposal for workshop "Topological superconductors: Materials, topological order, and quenched disorder," hosted by the Rice Center for Quantum Materials at Rice University, 04/2018 (Co-PI with Andriy Nevidomskyy). National Science Foundation, \$7,000.
7. 05/17–05/20 "Optical Probes and Electron Correlations in Far-From-Equilibrium Graphene" (Co-PI with Junichiro Kono). Army Research Office, \$240,126.
6. 06/16–05/21 "CAREER: Wave Mechanics of Complex, Correlated, and Driven Quantum Materials." National Science Foundation, \$483,019.
5. 06/16–05/19 "Quantum Coherence in Driven, Disordered, and Topological Many-body Systems." Welch Foundation, \$195,000.

4. 05/16 Conference funding proposal for workshop “Interacting Quantum Systems Out of Equilibrium,” hosted by the Rice Center for Quantum Materials at Rice University, 05/2016. Institute for Complex Adaptive Matter (ICAM), \$10,000.
3. 09/14–09/16 Alfred P. Sloan Fellowship in Physics. Alfred P. Sloan Foundation, \$50,000.
2. 05/14 Conference funding proposal for the 2014 Correlated Electron Systems Gordon Research Seminar, hosted by Mount Holyoke College, 06/2014. Institute for Complex Adaptive Matter (ICAM), \$11,800.
1. 06/13–05/16 “Topological Matter Phases Under Extreme Duress: Dynamics and Disorder,” Welch Foundation, \$180,000.

PROFESSIONAL ACTIVITIES

- 12/2023 Co-organizer, Aspen Center for Physics workshop “[Disorder and Quantum Phases of Matter](#)” (Aspen Center for Physics, Aspen, CO).
- 08–09/2022 Co-organizer, Aspen Center for Physics workshop “Random geometry in statistical physics, condensed matter, and quantum gravity” (Aspen Center for Physics, Aspen, CO).
- 04,11/2021 Co-organizer, Rice Center for Quantum Materials workshop “[Topological Materials and Electron Correlations](#)” (Rice University, Houston, TX).
- 2020–2021 Member, advisory board for the virtual [Localisation Seminar Series](#).
- 04/2018 Co-organizer, Rice Center for Quantum Materials workshop “[Topological superconductors: Materials, topological order, and quenched disorder](#)” (Rice University, Houston, TX).
- 05/2016 Co-organizer, Rice Center for Quantum Materials workshop “[Interacting Quantum Systems Driven Out of Equilibrium](#)” (Rice University, Houston, TX).
- 11/2015 Co-organizer, Kavli Insitute for Theoretical Physics Conference “[Aspects and applications of many-body localization](#)” (University of California, Santa Barbara, CA).
- 06/2014 Organizer and chair, [2014 Correlated Electron Systems Gordon Research Seminar](#) (South Hadley, MA).
- 12/2013 Co-organizer, “[Workshop on Heavy Fermion Materials and Quantum Phase Transitions](#)” (Rice University, Houston, TX).
- Referee for *Physical Review Journals*, *Nature Materials*, *Nature Physics*, *Annalen der Physik*, *Journal of Statistical Mechanics: Theory and Experiment* (IOP), *Nano Letters*, *Journal of High Energy Physics*, *Europhysics Letters* (IOP), *Ann. Phys. (N.Y.)*, *Sci. Post.*, and *Proc. Natl. Acad. Sci. (USA)*.
 - Proposal reviewer for the Army Research Office, the National Science Foundation (DMR), the Israel Science Foundation, the Research Corporation for Science Advancement, the Croucher Foundation, and the Department of Energy (MSE).

POST-DOCS ADVISED

- 5/2023–8/2024 Xinghai Zhang.
- 9/2016–9/2017 Bitan Roy. Currently an assistant professor at Lehigh University.
- 9/2013–8/2016 Hongyi Xie. Currently an assistant professor at the Beijing Academy of Quantum Information Sciences (BAQIS).
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STUDENTS ADVISED

- 04/2024–present Matheus Barbosa (Ph.D. Physics & Astronomy expected).
- 04/2024–present Alexander Canright (Ph.D. Physics & Astronomy expected).
- 04/2022–present Arthur Lee (Ph.D. Physics & Astronomy expected).
- 12/2017–08/2023 Tsz Chun Wu (Ph.D. Physics & Astronomy).
Dissertation: “Electromagnetic Responses in Topological Superconductors, and Transport and Superconductivity in Dirty Quantum Critical Systems.”
Now at Trexquant Investment LP.
- 06/2017–05/2023 Xinghai Zhang (Ph.D. Physics & Astronomy).
Dissertation: “Quantum Dynamics, Localization, and Fractal-mediated Superconductivity and Magnetism.”
Now a Welch Postdoctoral Fellow at Rice University.
- 02/2016–08/2021 Seth M. Davis (Ph.D. Physics & Astronomy).
Dissertation: “Dynamics, disorder, and interactions in low-dimensional quantum matter: Fractionalization waves, non-Markovian dephasing, and quenched gravity.”
Now a Postdoctoral Fellow of the CMTC at the University of Maryland, College Park.
- 09/2013–02/2018 Yunxiang Liao (Ph.D. Applied Physics).
Dissertation: “Probes of nonequilibrium quantum matter and many-body delocalization.”
Now an Assistant Professor in the Department of Physics at KTH Royal Institute of Technology.
- 09/2012–06/2016 Yang-Zhi Chou (Ph.D. Physics & Astronomy).
Dissertation: “Topological Solid State Materials with Quenched Disorder: Transport, Spectral Correlations, and Topological Protection.”
Now a Assistant Research Scientist in the CMTC at the University of Maryland, College Park.
- 09/2012–08/2013 Christopher White (B.S. Physics & Astronomy).
Senior thesis: “Lattice models of topological superconductors.”
Now a Postdoctoral Fellow of the CMTC at the University of Maryland, College Park.
- 09/2012–05/2013 Yinbin Ma (M.S. Physics & Astronomy).
Master’s thesis (obtained with previous advisor Adilet Imambekov): “Magneto-Raman Signatures of Electron-Electron Interactions in Graphite.”

STUDENT ADVISEE AWARDS

- 05/2024 Tsz Chun Wu (Ph.D. Physics & Astronomy). Wilson Award, which recognizes the most outstanding Ph.D. thesis in the department each year. (Physics & Astronomy Dept., Rice University).
- 05/2022 Tsz Chun Wu (Ph.D. Physics & Astronomy). Henry F. and Margaret Dunlap Fellowship, awarded to upper-level graduate students showing exceptional performance in research. (Physics & Astronomy Dept., Rice University).
- 05/2022 Seth M. Davis (Ph.D. Physics & Astronomy). Wilson Award, which recognizes the most outstanding Ph.D. thesis in the department each year. (Physics & Astronomy Dept., Rice University).
- 05/2019 Seth M. Davis (Ph.D. Physics & Astronomy). Henry F. and Margaret Dunlap Fellowship, awarded to upper-level graduate students showing exceptional performance in research. (Physics & Astronomy Dept., Rice University).
- 05/2017 Seth M. Davis (Ph.D. Physics & Astronomy). Chouke Award to recognize the second and third year graduate students who show the greatest promise in physics as evidenced by performance in course work and speedy progress in research. (Physics & Astronomy Dept., Rice University).
- 05/2014 Yang-Zhi Chou (Ph.D. Physics & Astronomy). Henry F. and Margaret Dunlap Fellowship, awarded to upper-level graduate students showing exceptional performance in research. (Physics & Astronomy Dept., Rice University).
- 05/2013 Christopher White (B.S. Physics & Astronomy). Bonner Book Prize, given each year to the most outstanding sophomore, junior, senior, and first year graduate students in physics. (Physics & Astronomy Dept., Rice University).
- 05/2013 Christopher White (B.S. Physics & Astronomy). Heaps Prize for excellence in research (Physics & Astronomy Dept., Rice University).

LECTURES AND COURSES TAUGHT

- F 21–23 [PHYS 311 “Introduction to Quantum Mechanics I,”](#) Rice University (Houston, TX).
- S 17 [“Topological Materials Physics.”](#) Guest lecture for PHYS 412 “Solid State Physics,” Rice University (Houston, TX).
- F 16, 17;
S 19, 21, 23 [PHYS 600 “‘Modern’ mathematical physics I: Mainly Lie algebra representation theory,”](#)
Rice University (Houston, TX).
- S 14–18, 20,
22, 24 [PHYS 664 “Many-body formalism,”](#) Rice University (Houston, TX).
- F 13, 14, 18, 19 [PHYS 301 “Intermediate mechanics,”](#) Rice University (Houston, TX).
- S 13 [PHYS 600 “Fields, disorder, and dynamics in condensed matter physics,”](#) Rice University (Houston, TX).
- 07/2012 “Frontiers in disordered quantum systems: Dirac fermions, random matrix theory, non-linear sigma models,” Yeshiva University (New York, NY).

COURSE MATERIALS DEVELOPED

- Fall 16 [PHYS 600](#) “Modern’ mathematical physics I: Mainly Lie algebra representation theory,” Rice University (Houston, TX). Nine LaTeXed modules covering the basics of Lie algebra representation theory, up through the Weyl character formula. Includes a module on the Cartan classification of Hamiltonians, used in random matrix theory, Anderson localization physics, and the classification of topological insulators and superconductors. All are freely available here online from [my website](#).
Links to individual modules: [\[1\]](#) [\[2\]](#) [\[2A\]](#) [\[3\]](#) [\[4\]](#) [\[5\]](#) [\[6\]](#) [\[7\]](#) [\[8\]](#) [\[9\]](#)
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PH.D. DISSERTATION COMMITTEES

28. Xiaomo Huang (Physics & Astronomy, Rice University). Committee member.
27. FNU Aymen (Physics, University of Houston). Committee member.
26. Yiming Wang (Physics & Astronomy, Rice University). Committee member.
25. Sohail Dasgupta (Physics & Astronomy, Rice University). Committee member.
24. 04/2024 Lei Chen, “Strongly correlated systems: quantum criticality, electronic topology and flatband” (Physics & Astronomy, Rice University). Committee member.
23. 04/2024 Xingya Wang, “Spectral analysis of Schrödinger operators with decaying distributional potentials” (Ph.D., Mathematics, Rice University). Committee member.
22. 08/2023 Tsz Chun Wu, “Electromagnetic Responses in Topological Superconductors, and Transport and Superconductivity in Dirty Quantum Critical Systems” (Physics & Astronomy, Rice University). **Committee chair.**
21. 05/2023 Xinghai Zhang, “Quantum Dynamics, Localization, and Fractal-mediated Superconductivity and Magnetism” (Physics & Astronomy, Rice University). **Committee chair.**
20. 12/2022 Jaime Moya, “Quantum criticality and complex spin textures in the extremes of magnetism: from the itinerant moment to local moment limits” (Ph.D., Applied Physics, Rice University). Committee member.
19. 12/2022 Shuyi Li, “Magnetic Phases and Topological Excitations in Frustrated Magnetic Systems on Honeycomb Lattices” (Ph.D., Physics & Astronomy, Rice University). Committee member.
18. 04/2022 Haoyu Hu, “Strongly correlated electron systems: Quantum criticality, unconventional superconductivity, and topology” (Ph.D., Physics & Astronomy, Rice University). Committee member.
17. 04/2022 Matthew Butcher, “Ground States and Phase Transitions in Frustrated Spin Models: Investigations Using Classical and Quantum Monte Carlo” (Ph.D., Physics & Astronomy, Rice University). Committee member.
16. 06/2021 Seth M. Davis, “Dynamics, disorder, and interactions in low-dimensional quantum matter: Fractionalization waves, non-Markovian dephasing, and quenched gravity” (Ph.D., Physics & Astronomy, Rice University). **Committee chair.**

15. 04/2021 Chengcheng Yang, “Properties of Shortest Length Curves inside Semi-Algebraic Sets and Problems related to an Erdos Conjecture concerning Lattice Cubes” (Ph.D., Mathematics, Rice University). Committee member.
14. 04/2020 Henry Yu, “Electronics in 2D: heterojunction, property modulation, and growth” (Ph.D., Materials Science & Nanoengineering, Rice University). Committee member.
13. 04/2020 Chia-Chuan Liu, “Quantum criticality of strongly correlated systems” (Ph.D., Physics & Astronomy, Rice University). Committee member.
12. 04/2020 Sarah E. Grefe, “Topological metals driven by strong correlations in heavy fermion systems” (Ph.D., Physics & Astronomy, Rice University). Committee member.
11. 01/2019 Li Yang, “Strongly Interacting One-Dimensional Spinor Quantum Gases” (Ph.D., Physics & Astronomy, Rice University). Committee member.
10. 04/2018 Daniel Bernazzani, “Centralizers and Conjugacy Classes in the Group of Interval Exchange Transformations” (Ph.D., Mathematics, Rice University). Committee member.
9. 04/2018 Vitalii Gerbuz, “Transport Properties of One-dimensional Quantum Systems” (Ph.D., Mathematics, Rice University). Committee member.
8. 04/2018 Sayed Ali Akbar Ghorashi, “Phases and Critical Phenomena in 3D Topological Superconductors and Semimetals” (Ph.D., Physics, University of Houston). Committee member.
7. 01/2018 Yunxiang Liao, “Probes of nonequilibrium quantum matter and many-body delocalization” (Ph.D., Applied Physics, Rice University). **Committee chair.**
6. 05/2017 Joseph A. Barchas, “Radiative Transfer of Polarized X-rays: Magnetized Thomson Scattering in Neutron Stars” (Ph.D., Physics & Astronomy, Rice University). Committee member.
5. 10/2016 Lingjie Du, “Experiments on quantum phases in InAs/GaSb bilayers: Topological insulator and exciton condensation” (Ph.D., Physics & Astronomy, Rice University). Committee member.
4. 08/2016 Emilian Nica, “Strongly correlated electron systems: From quantum criticality in heavy-fermion metals to orbital-entangled superconductivity in Fe-based materials” (Ph.D., Physics & Astronomy, Rice University). Committee member.
3. 05/2016 Yang-Zhi Chou, “Topological Solid State Materials with Quenched Disorder: Transport, Spectral Correlations, and Topological Protection” (Ph.D., Physics & Astronomy, Rice University). **Committee chair.**
2. 04/2016 Zhentao Wang, “Frustrated Magnetism in Strongly Correlated Electron Systems” (Ph.D., Physics & Astronomy, Rice University). Committee member.
1. 04/2016 Jedediah Pixley, “Quantum Criticality, Magnetic Frustration, and Unconventional Superconductivity in Heavy Fermion Metals” (Ph.D., Physics & Astronomy, Rice University). Committee member.

DEPARTMENTAL SERVICE, PHYSICS & ASTRONOMY, RICE UNIVERSITY

15. 2023–present Graduate Admissions and Recruitment committee. Committee member.
14. 2023–24 Quantum science and technology faculty search. Committee member.

13. 2022–23 Quantum science and technology faculty search. Committee member.
 12. 2021–22 Quantum science and technology faculty search. Committee member.
 11. 2021 Wilson thesis prize. Committee member.
 10. 2019 Heaps Prize. Committee member.
 9. 2018–19 Atomic, molecular, and optical experiment faculty search. Committee member.
 8. 2014–23 Undergraduate Program Committee, member.
 7. 2013–15, 2018 Wilson thesis prize. Committee member.
 6. 2017–18 Condensed matter experiment faculty search. Committee member.
 5. 2016, 22–24 Strecker Award. Committee member.
 4. 2014–15 Astro-particle/Cosmology theory faculty search. Committee member.
 3. 2014–15, 20, Bonner Book Award. Committee member.
23, 24
 2. 2013–14 Atomic, molecular, and optical theory faculty search. Committee member.
 1. 2012–13 Condensed matter experiment faculty search. Committee member.
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UNIVERSITY SERVICE, RICE UNIVERSITY

5. 2023 Discover Rice Dinner for CBO Advisors and Directors, faculty attendee.
4. 2023–present University committee in teaching. Committee member.
4. 2016, 2022–23 Gulf Coast Undergraduate Research Symposium. Mentor.
3. 2014–2017 Night at the Museum Recruiting Event, faculty attendee.
2. 2019, 2022 Rice VISION dinner, faculty attendee.
2015–2017
1. 2013–2014 Committee on Undergraduate Admission, member.