Leyna Shackleton

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Research Positions

07/2024 - Present **Pappalardo Postdoctoral Fellow**, *Massachusetts Institute of Technology*, Cambridge

01/2023 - 05/2023 **Pre-Doctoral Researcher**, *Flatiron Institute, Center for Computational Quantum Physics*, New York
Supervisor: Shiwei Zhang

Education

09/2018 - 05/2024 **PhD in Physics**, *Harvard University*, Cambridge
Thesis: *Fractionalization and disorder in strongly correlated systems*
Advisor: Subir Sachdev

09/2014 - 06/2018 **B.S's in Physics and Philosophy**, *Massachusetts Institute of Technology*, Cambridge
Thesis: *Diffusional Instabilities on Curved Manifolds*
Advisor: Mehran Kardar

Publications and Preprints

Preprints:

Y. Zhang, **L. Shackleton**, and T. Senthil, "Pathways from a chiral superconductor to a composite fermi liquid," (2025), arXiv:2509.21591 .

L. Shackleton, "Twisted quantum doubles are sign problem-free," (2025), arXiv:2509.03708 .

A. Wietek, L. Staszewski, M. Ulaga, P. L. Ebert, H. Karlsson, S. Sarkar, **L. Shackleton**, A. Sinha, and R. D. Soares, "Xdiag: Exact diagonalization for quantum many-body systems," (2025), arXiv:2505.02901 .

G. Gyawali, **L. Shackleton**, Z.-X. Luo, and M. Lawler, "Emergent coding phases and hardware-tailored quantum codes," (2025), arXiv:2503.15483 .

L. Shackleton and S. Zhang, "Emergent polaronic correlations in doped spin liquids," (2024), arXiv:2408.02190 .

Published:

L. Shackleton and S. Sachdev, "Sign-problem-free effective models of triangular lattice quantum antiferromagnets," Phys. Rev. B **111**, 075101 (2025).

M. Christos, **L. Shackleton**, S. Sachdev, and Z.-X. Luo, "Deconfined quantum criticality of nodal d-wave superconductivity, néel order, and charge order on the square lattice at half-filling," Phys. Rev. Res. **6**, 033018 (2024).

L. E. Anderson, A. Laitinen, A. Zimmerman, T. Werkmeister, **L. Shackleton**, A. Kruchkov, T. Taniguchi, K. Watanabe, S. Sachdev, and P. Kim, "Magneto-thermoelectric transport in graphene quantum dot with strong correlations," Phys. Rev. Lett. **132**, 246502 (2024), (*Editor's Suggestion*).

L. Shackleton, L. E. Anderson, P. Kim, and S. Sachdev, "Conductance and thermopower fluctuations in interacting quantum dots," Phys. Rev. B **109**, 235109 (2024).

L. Shackleton and M. S. Scheurer, "Exactly solvable dissipative spin liquid," Phys. Rev. B **109**, 085115 (2024).

M. Christos, Z.-X. Luo, **L. Shackleton**, Y.-H. Zhang, M. S. Scheurer, and S. Sachdev, "A model of d-wave superconductivity, antiferromagnetism, and charge order on the square lattice," Proceedings of the National Academy of Sciences **120**, e2302701120 (2023), arXiv:2302.07885 .

L. Shackleton and S. Sachdev, "Anisotropic deconfined criticality in Dirac spin liquids," Journal of High Energy Physics **2022**, 141 (2022), arXiv:2203.01962 .

L. Shackleton, A. Thomson, and S. Sachdev, "Deconfined criticality and a gapless $\mathbb{Z}_2$ spin liquid in the square-lattice antiferromagnet," Phys. Rev. B **104**, 045110 (2021), arXiv:2104.09537 .

L. Shackleton, A. Wietek, A. Georges, and S. Sachdev, "Quantum phase transition at nonzero doping in a random t-J model," Phys. Rev. Lett. **126**, 136602 (2021), arXiv:2012.06589 .

L. Shackleton and M. S. Scheurer, "Protection of parity-time symmetry in topological many-body systems: Non-Hermitian toric code and fracton models," Phys. Rev. Research **2**, 033022 (2020), arXiv:2005.09668 .

Nivedita, **L. Shackleton**, and S. Sachdev, "Spectral form factors of clean and random quantum Ising chains," Phys. Rev. E **101**, 042136 (2020), arXiv:2001.06732 .

J. R. Frank, J. Guven, M. Kardar, and **L. Shackleton**, "Pinning of diffusional patterns by non-uniform curvature," Europhysics Letters **127**, 48001 (2019), arXiv:1901.09900 .

Presentations

12/04/2023 "Models of deconfined criticality on square and triangular lattice antiferromagnets," Perimeter Institute seminar

11/29/2023 "Models of deconfined criticality on square and triangular lattice antiferromagnets," University of Illinois Urbana-Champaign seminar

11/28/2023 "Models of deconfined criticality on square and triangular lattice antiferromagnets," Harvard Kids seminar

11/15/2023 "Sign-problem-free effective models for triangular lattice antiferromagnets," Flatiron Institute seminar

06/12/2023 "An exactly solvable dissipative spin liquid," University of Innsbruck, group seminar

05/23/2023 "Variational wavefunctions for the pseudogap metal," Flatiron Institute, predoctoral presentation

03/10/2023 "Sign-problem-free effective models of triangular lattice antiferromagnetism," APS March Meeting 2023, contributed talk

02/08/2023 "Paramagnon fractionalization theory of the cuprate pseudogap," Flatiron Institute, Quantum Monte Carlo seminar

11/06/2022 "Sign-problem-free effective models of triangular lattice antiferromagnetism," Harvard University, group seminar

03/17/2022 "Deconfined criticality and gapless $\mathbb{Z}_2$ spin liquids in the square lattice antiferromagnet," APS March Meeting 2022, contributed talk

03/19/2021 "Protection of parity-time symmetry in topological many-body systems," APS March Meeting 2021, contributed talk

09/21/2020 "Numerical study of the random t-J model with all-to-all interactions," Harvard University, group seminar

06/15/2020 "Protection of parity-time symmetry in topological many-body systems," Harvard University, group seminar

06/16/2018 "Turing patterns on deformed surfaces," Kardar-Fest, in celebration of Prof. Mehran Kardar's 60th birthday, contributed talk

Posters

06/25/2022 "Deconfined criticality and a gapless $\mathbb{Z}_2$ spin liquid in the square-lattice antiferromagnet", Correlated Electron Systems Gordon Research Conference

05/05/2022 "Deconfined criticality and a gapless $\mathbb{Z}_2$ spin liquid in the square-lattice antiferromagnet", CIFAR Quantum Materials Summer School

07/08/2021 "Deconfined criticality and a gapless $\mathbb{Z}_2$ spin liquid in the square-lattice antiferromagnet", IMPRS-MPHQ-BeyondC Summer School

Teaching experience

Teaching fellow at Harvard University for:

09/2022 - 12/2022 Physics 195A (Introduction to Solid State Physics)

01/2022 - 05/2022 Physics 153 (Electrodynamics)

01/2021 - 05/2021 Physics 153 (Electrodynamics)

Responsibilities: Recitation and review sessions (2 hours per week), office hours (2 hours per week)

Head teaching assistant at Massachusetts Institute of Technology for:

09/2017 - 12/2017 8.13 (Experimental Physics 1)

Responsibilities: Assisted students in conducting experiments (4 hours per week)