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James R. Garrison

Education

Ph.D., Physics, University of California, Santa Barbara, 2016.
Dissertation: *Thermalization and its breakdown in isolated quantum systems.*
Advisor: Matthew P. A. Fisher

M.A., Physics, University of California, Santa Barbara, 2012.

B.S., Mathematics and Physics, Case Western Reserve University, 2006.
B.A., History and Psychology, Case Western Reserve University, 2006.
magna cum laude
Minors: Chemistry and Artificial Intelligence.

Experience

Assistant Research Scientist, Joint Quantum Institute (JQI) and Joint Center for Quantum Information and Computer Science (QuICS), NIST/Univ. of Maryland (College Park, MD), 2019 – Present.
Postdoctoral Researcher, JQI and QuICS, NIST/Univ. of Maryland (College Park, MD), 2016 – 2019.
Graduate Student Researcher, University of California (Santa Barbara, CA), 2012 – 2016.
Teaching Assistant, University of California (Santa Barbara, CA), 2009 – 2011.
Software Engineer, The Robotics Institute at Carnegie Mellon University (Pittsburgh, PA), 2009 – 2016.
Public Relations Coordinator, Software Freedom Law Center (New York, NY), 2006 – 2008.

Honors & awards

NIST National Research Council (NRC) Postdoctoral Research Fellowship (2016 – 2018).
KIC/Bethe Postdoctoral Fellowship, Cornell University (2016, declined).
The History Department Award (CWRU), "for outstanding achievement in history" (2006).
The B. S. Chandrasekhar Prize in Physics (CWRU), "awarded upon completion of the junior year to a physics major who has demonstrated superior performance" (2005).
Case Alumni Association Award (2004).
Trustees Scholarship, Case Western Reserve University (2002 – 2006).

Teaching experience

Grader/Teaching Assistant: Field Theory in Condensed Matter Physics (second quarter, graduate-level), UCSB PHYS 217B, Winter 2014.
Teaching Assistant: Basic Physics Lab (first quarter), UCSB PHYS 3L, Fall 2011.
Teaching Assistant: Condensed Matter Physics (first quarter, graduate-level), UCSB PHYS 223A, Fall 2011.
Teaching Assistant: Full two-year introductory sequence for physics majors in UCSB's College of Creative Studies, UCSB PHYS CS 31–36, Fall 2009 – Spring 2011.
Teaching Assistant: Basic Physics (second quarter), UCSB PHYS 2, Summer 2010.
Teaching Assistant: Introductory Physics Lab (third quarter), UCSB PHYS 6CL, Summer 2010.
Teaching Assistant: Mathematical Methods in Physics, UCSB PHYS 100A, Summer 2010.
Supplemental Instructor: Introductory Mechanics (non-calculus based), CWRU PHYS 115, Fall 2004.

<table>
<tr><td>Student advised</td><td>Kevin Wang, Stanford undergraduate, performed summer research at the University of Maryland (June – August 2018).</td></tr>
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Publications & preprints

1. "A novel hybrid simulation for study of multiscale phenomena," P. E. Krouskop, J. Garrison, P. C. Gedeon, and J. D. Madura, *Molecular Simulation* **32**, 825 (2006).

2. "Non-Fermi-liquid d-wave metal phase of strongly interacting electrons," H.-C. Jiang, M. S. Block, R. V. Mishmash, J. R. Garrison, D. N. Sheng, O. I. Motrunich, and M. P. A. Fisher, *Nature* **493**, 39 (2013) [arXiv:1207.6608].

3. "Theory of a Competitive Spin Liquid State for Weak Mott Insulators on the Triangular Lattice," Ryan V. Mishmash, James R. Garrison, Samuel Bieri, and Cenke Xu, *Phys. Rev. Lett.* **111**, 157203 (2013) [arXiv:1307.0829].

4. "Does a single eigenstate encode the full Hamiltonian?" James R. Garrison and Tarun Grover, *Phys. Rev. X* **8**, 021026 (2018) [arXiv:1503.00729].

5. "Many-body localization in the presence of a small bath," Katharine Hyatt, James R. Garrison, Andrew C. Potter, and Bela Bauer, *Phys. Rev. B* **95**, 035132 (2017) [arXiv:1601.07184].

6. "Partial breakdown of quantum thermalization in a Hubbard-like model," James R. Garrison, Ryan V. Mishmash, and Matthew P. A. Fisher, *Phys. Rev. B* **95**, 054204 (2017) [arXiv:1606.05650].

7. "Extracting entanglement geometry from quantum states," Katharine Hyatt, James R. Garrison, and Bela Bauer, *Phys. Rev. Lett.* **119**, 140502 (2017) [arXiv:1704.01974].

8. "Lieb-Robinson bounds on n-partite connected correlation functions," Minh Cong Tran, James R. Garrison, Zhe-Xuan Gong, and Alexey V. Gorshkov, *Phys. Rev. A* **96**, 052334 (2017) [arXiv:1705.04355].

9. "Scale-Invariant Continuous Entanglement Renormalization of a Chern Insulator," Su-Kuan Chu, Guanyu Zhu, James R. Garrison, Zachary Eldredge, Ana Valdés Curiel, Przemyslaw Bienias, I. B. Spielman, and Alexey V. Gorshkov, *Phys. Rev. Lett.* **122**, 120502 (2019) [arXiv:1807.11486].

10. "Locality and digital quantum simulation of power-law interactions," Minh C. Tran, Andrew Y. Guo, Yuan Su, James R. Garrison, Zachary Eldredge, Michael Foss-Feig, Andrew M. Childs, and Alexey V. Gorshkov, *Phys. Rev. X* **9**, 031006 (2019) [arXiv:1808.05225].

11. "Unitary entanglement construction in hierarchical networks," Aniruddha Bapat, Zachary Eldredge, James R. Garrison, Abhinav Desphande, Frederic T. Chong, and Alexey V. Gorshkov, *Phys. Rev. A* **98**, 062328 (2018) [arXiv:1808.07876].

12. "Asymmetric Particle Transport and Light-Cone Dynamics Induced by Anyonic Statistics," Fangli Liu, James R. Garrison, Dong-Ling Deng, Zhe-Xuan Gong, and Alexey V. Gorshkov, *Phys. Rev. Lett.* **121**, 250404 (2018) [arXiv:1809.02614].

13. "Probing Ground-State Phase Transitions through Quench Dynamics," Paraj Titum, Joseph T. Iosue, James R. Garrison, Alexey V. Gorshkov, and Zhe-Xuan Gong, *Phys. Rev. Lett.* **123**, 115701 (2019) [arXiv:1809.06377].

14. "Circuit complexity across a topological phase transition," Fangli Liu, Seth Whitsitt, Jonathan B. Curtis, Rex Lundgren, Paraj Titum, Zhi-Cheng Yang, James R. Garrison, and Alexey V. Gorshkov, *Phys. Rev. Research* **2**, 013323 (2020) [arXiv:1902.10720].

15. "Entanglement bounds on the performance of quantum computing architectures," Zachary Eldredge, Leo Zhou, Aniruddha Bapat, James R. Garrison, Abhinav Deshpande, Frederic T. Chong, and Alexey V. Gorshkov, *Phys. Rev. Research* **2**, 033316 (2020) [arXiv:1908.04802].

16. "Site-by-site quantum state preparation algorithm for preparing vacua of fermionic lattice field theories," Ali Hamed Moosavian, James R. Garrison, and Stephen P. Jordan [arXiv:1911.03505].

Invited talks & tutorials	"Macroscopic structures formed by quantum dot interactions," Duquesne University Summer Research Symposium (Pittsburgh, PA), July 2005.

Invited talks & tutorials

"Macroscopic structures formed by quantum dot interactions," Duquesne University Summer Research Symposium (Pittsburgh, PA), July 2005.

"A simple tutorial on the density matrix renormalization group" (with R. V. Mishmash), Quantum spin liquids summer school (Trieste, Italy), September 2013.

Physics department colloquium: "Modeling strongly correlated quantum phases using numerical methods: insights and progress," California State University, Los Angeles, November 2013.

"Universal aspects of quantum thermalization," Cornell University (Ithaca, NY), November 2015.

"Universal aspects of quantum thermalization," Perimeter Institute for Theoretical Physics (Waterloo, Ontario), November 2015.

"Universal aspects of quantum thermalization," University of Toronto, November 2015.

"Universal aspects of quantum thermalization," Caltech (Pasadena, CA), December 2015.

"Universal aspects of quantum thermalization," QuICS Seminar, University of Maryland (College Park, MD), June 2016.

"Quantum Many-Body Entanglement and Simulation: Insights, Challenges and Opportunities," New York University, February 2019.

"Quantum Many-Body Entanglement and Simulation: Insights, Challenges and Opportunities," Flatiron Institute, February 2019.

"Quantum Many-Body Entanglement and Simulation: Insights, Challenges and Opportunities," University of Notre Dame, February 2019.

Contributed talks

"Rényi entropy of d-wave Bose metal phases on multi-leg ladders," APS March Meeting, 2012.

"Moving toward two dimensions in a t-J-K model with frustrating ring exchange: the quest to stabilize a non-Fermi liquid d-wave metal phase," APS March Meeting, 2013.

"Entanglement properties after a partial measurement: a numerical study of excited states in Hubbard-like models," APS March Meeting, 2014.

"Does the eigenstate thermalization hypothesis hold for non-local operators?" APS March Meeting, 2015.

"Universal aspects of thermalization after a quantum quench," APS March Meeting, 2016.

"Partial breakdown of quantum thermalization in a Hubbard-like model," APS March Meeting, 2017.

"Partial breakdown of quantum thermalization in a Hubbard-like model," DAMOP, June 2017.

"Zero-temperature properties of the long-range transverse-field Ising model on the triangular lattice," APS March Meeting, 2019.

Poster presentations

"Seeking a non-Fermi liquid phase of strongly interacting electrons in two dimensions," Quantum spin liquids summer school (Trieste, Italy), September 2013.

"Theory of a competitive spin liquid state for weak Mott insulators on the triangular lattice," Beyond Quasiparticles: New Paradigms for Quantum Fluids conference (Aspen, CO), January 2014.

"Entanglement properties after a partial measurement: a numerical study of excited states in Hubbard-like models," Boulder Summer School, July 2014.

"Entanglement properties after a partial measurement: a numerical study of excited states in Hubbard-like models," Non-Equilibrium Quantum Matter conference (Aspen, CO), March 2015.

"Entanglement properties after a partial measurement: a numerical study of excited states in Hubbard-like models," Southern California Simulations in Science conference (Santa Barbara, CA), October 2015.

"Partial breakdown of quantum thermalization in a Hubbard-like model," Designer Quantum Systems Out of Equilibrium conference (Santa Barbara, CA), November 2016.

"Partial breakdown of quantum thermalization in a Hubbard-like model," Non-equilibrium Quantum Matter workshop (Mainz, Germany), May – June 2017.

"Extracting entanglement geometry from quantum states," Frontiers of Quantum Information Physics conference (Santa Barbara, CA), October 2017.

"Unitary entanglement generation in hierarchical networks," Advances in Quantum Algorithms and Computation conference (Aspen, CO), March 2018.

"Zero-temperature properties of the long-range transverse-field Ising model," Software-Tailored Architecture for Quantum co-design (STAQ) Kickoff Meeting (Durham, NC), December 2018.

Schools & workshops

Theory Winter School: "Computational Approaches for Electronic/Magnetic Materials," National High Magnetic Field Laboratory (Tallahassee, FL), January 2012.

Summer school: "International summer school on new trends in computational approaches for many-body systems," Sherbrooke, Canada, May – June 2012.

Summer school: "Quantum spin liquids: from theory to numerical simulations," Trieste, Italy, September 2013.

Boulder Summer School: "Modern Aspects of Superconductivity," July 2014.

Aspen Summer Workshop: "From Physics to Applications of Quantum Computers," May – June 2018.

Funding awarded

XSEDE Startup Allocation: 50 000 supercomputing units (SUs) with 10 000 GB of storage, April 2018 – April 2019. Value: $1,157.50 USD.

XSEDE Startup Allocation: 50 000 supercomputing units (SUs) with 1 000 GB of storage, October 2019 – October 2020. Value: $1,157.50 USD.

XSEDE Research Allocation: 411 247 supercomputing units (SUs) with 5 000 GB of storage, July 2020 – June 2021 (Co-PI: Mathias Van Regemortel). Value: $9,520.37 USD.

Outreach and engagement

Classroom guest speaker, Marianapolis Preparatory School (Thompson, CT, via internet), February 7, 2011.

Classroom guest speaker, Marianapolis Preparatory School (Thompson, CT, via internet), January 27, 2012.

"Quantum Computing Explained," Los Angeles Hacker News Meetup, September 29, 2012.

"Quantum Computing Explained," Los Angeles Future Salon, January 13, 2013.

Classroom guest speaker, Marianapolis Preparatory School (Thompson, CT, via internet), January 18, 2013.

"Quantum Computing Explained," Santa Barbara Linux User Group, January 31, 2013.

Panelist, "What is Research?" event, UCSB Women in Physics, December 4, 2014.

Classroom guest speaker, Santa Barbara High School, May 20, 2015.

Classroom guest speaker, Gilmour Academy (Gates Mills, OH, via internet), September 21, 2015.

Volunteer, AAUW Tech Savvy event, UCSB, February 14, 2016.

Classroom guest speaker, Gilmour Academy (Gates Mills, OH, via internet), August 31, 2016.

Service

University Student Advisory Committee on Information Technology Services (CWRU), 2003 – 2004.

Committee on Educational Programs of the College of Arts and Sciences (CWRU), Undergraduate Representative, 2004 – 2005.

Graduate Life Committee (UCSB Physics Department), 2011 – 2013.

Colloquium Committee (UCSB Physics Department), Spring 2014.

Colloquium Committee (UCSB Physics Department), Fall 2014.

Referee for *New Journal of Physics*, *Physical Review Letters*, *Physical Review B*, *Physical Review E*, and *Scientific Reports*, 2014 – Present.

Contributor to the Julia programming language (83 commits to core language; many others to packages), 2014 – Present.

Association memberships American Physical Society, 2005 – Present.
Association for Computing Machinery, 2012 – Present.