Hilary M. Hurst, Ph.D.

Department of Physics & Astronomy
San José State University
One Washington Square
San José, CA 95192 U.S.A.

Office Phone: 408-924-5284
Cell Phone: 970-371-9286

Email: hilary.hurst@sjsu.edu
Website: hhurst.github.io
ORCiD: 0000-0002-7197-7615

CURRENT POSITION

Assistant Professor, Department of Physics & Astronomy, San José State University, San José, California

AREAS OF SPECIALIZATION

Physics; quantum information science: many-body quantum systems, quantum feedback control, weak measurement, cold atomic gases, spin-orbit coupling, solitons.
Dissertation Title: Dynamics of Topological Defects in Hybrid Quantum Systems
Dissertation Advisor: Professor Victor Galitski

APPOINTMENTS HELD

2023 - *Program Director*, Master of Science in Quantum Technology, San José State University, San José, California
2020 - *Assistant Professor*, San José State University, San José, California
2018-20 *NRC Postdoctoral Fellow*, National Institutes of Standards and Technology and Joint Quantum Institute, Gaithersburg, Maryland

EDUCATION

2018 PhD, Physics, University of Maryland
2013 MASt, Applied Mathematics and Theoretical Physics, University of Cambridge
2012 BSc, Engineering Physics, Minor: Public Affairs, Colorado School of Mines

GRANTS, HONORS, & AWARDS

2024 Early Career Investigator Award, San José State University
2023 NSF Facilitating Research at Primarily Undergraduate Institutions "RUI: Quantum

State Control for Ultracold Atoms", NSF Award No. 2309331 PI: **H. M. Hurst**, $180,000.

2021 National Research Traineeship "Collaborative Research: NRT-QL: A Program for Training a Quantum Workforce", NSF Award No. 2125906 PI: **H. M. Hurst**, Co-PI: E. Khatami, H. Wong, $739,029

2020 Quantum Leap Challenge Institutes - Conceptualization Grant, NSF Award No. 1936835, PI: L. D. Carr, Co-PI: **H. M. Hurst**, T. Lynn, S. Eley, M. Beck, $150,000

2018 National Research Council Postdoctoral Fellowship, NIST

2017 Outstanding Graduate Assistant, University of Maryland

2014 National Physical Sciences Consortium Graduate Research Fellowship, NSA/NPSC

2012 Physics Faculty Distinguished Graduate Award, Colorado School of Mines

2012 President's Senior Scholar-Athlete Award, Colorado School of Mines

2012 Summa Cum Laude, Colorado School of Mines

2010 Division II All-American, Track and Field, NCAA

PUBLICATIONS & TALKS

Refereed Journal articles

2023 Yamaguchi, E. P, **Hurst, H. M.**, & Spielman, I. B. (2023). "Feedback cooled Bose-Einstein condensation: near and far from equilibrium." *Physical Review A*, 107, 063306. [4]

2022 **Hurst, H. M.** and Flebus, B. (2022). "Non-Hermitian Physics in magnetic systems." *Journal of Applied Physics*, 132, 220902. [32]

2022 Gunnink, P. M., Flebus, B., **Hurst, H. M.**, & Duine, R. A. (2022). "Nonlinear dynamics of the non-Hermitian Su-Schrieffer-Heeger model." *Physical Review B*, 105, 104433. [15]

2022 Asfaw, A., Blais, A., Brown, K. R., Candelaria, J., ...Ho, A. **Hurst, H. M.**, Jacob, Z. ...& Singh, C. (2022). "Building a quantum engineering undergraduate program". *IEEE Transactions on Education*, 65(2), 220-242. [59]

2020 **Hurst, H. M.**, Guo, S., & Spielman, I. B. (2020). "Feedback Induced Magnetic Phases in Binary Bose-Einstein Condensates." *Physical Review Research*, 2, 043325. [15]

2020 Flebus, B., Duine, R. A. & **Hurst, H. M.** (2020). "Non-Hermitian topology of one-dimensional spin-torque oscillator arrays." *Physical Review B* 102, 180408(R). [28]

2020 **Hurst, H. M.**, Galitski, V. & Heikkilä, T. T. (2020). "Electron Induced Massive Dynamics of Magnetic Domain Walls." *Physical Review B*, 101(5), 054407. [12]

2019 **Hurst, H. M.** & Spielman, I. B. (2019). "Measurement-induced dynamics and stabilization of spinor-condensate domain walls." *Physical Review A*, 99(5), 053612. [17]

2019 Shim, Y.-P., Ruskov, R., **Hurst, H. M.**, Tahan, C. (2019). "Induced quantum dot probe for material characterization." *Applied Physics Letters* 114, 152105. [12]

2017 **Hurst, H. M.**, Efimkin, D. K., Spielman, I. B., & Galitski, V. (2017). "Kinetic theory of dark solitons with tunable friction." *Physical Review A*, 95(5), 053604. [15]

2017 Aycock, L. M., **Hurst, H. M.**, Efimkin, D. K., Genkina, D., Lu, H. I., Galitski, V. , & Spielman, I. B. (2017). "Brownian motion of solitons in a Bose–Einstein condensate." *Proceedings of the National Academy of Sciences*, 114(10), 2503-2508. [58]

2016 **Hurst, H. M.**, Wilson, J. H., Pixley, J. H., Spielman, I. B., & Natu, S. S. (2016). "Real-

space mean-field theory of a spin-1 Bose gas in synthetic dimensions." *Physical Review A*, 94(6), 063613. [15]

2016 **Hurst, H. M.**, Efimkin, D. K., & Galitski, V. (2016). "Transport of Dirac electrons in a random magnetic field in topological heterostructures." *Physical Review B*, 93(24), 245111. [4]

2015 **Hurst, H. M.**, Efimkin, D. K., Zang, J., & Galitski, V. (2015). "Charged skyrmions on the surface of a topological insulator." *Physical Review B*, 91(6), 060401(R). [45]

*[–] Indicates number of citations on Google Scholar

Preprints

2023 Shivam Kamboj, Rembert A. Duine, Benedetta Flebus, and **Hilary M. Hurst** (2023). "Oscillatory Edge Modes in Two Dimensional Spin-Torque Oscillator Arrays" arXiv:2307.13876 *In press at Physical Review B.*

Non-Refereed Articles

2015 Hurst, H. M. (2015). "Women in Physics Hosts Career Panel." *APS Gazette*, 34(2), 3.

2013 Hurst, H. M. (2013). "New Perspectives on the Aharonov-Bohm Effect." *Part III Essay*. University of Cambridge.

Invited Presentations (Selected)

2023 *Quantum State Engineering through Weak Measurement*, Louisiana State University Department of Physics Colloquium. Baton Rouge, LA.

2023 *Quantum Education in the California State University: Launching a Master's Program at San José State University*, NSF Workshop: Supporting Minority Serving Institutions in the Creation of a Diverse, Quantum-Ready Workforce. Washington, DC.

2023 *Quantum State Engineering through Weak Measurement*, ASME/Caltech Quantum Engineering Workshop (Virtual).

2023 *Quantum State Engineering through Weak Measurement*, Colorado School of Mines Physics Colloquium, Golden, CO.

2022 *Exploring Non-Hermitian Topology with Spin Torque Oscillator Arrays*, UC Santa Cruz Condensed Matter Seminar, Santa Cruz, CA.

2021 *Quantum Control with Spinor Bose-Einstein Condensates*, University of Oklahoma Center for Quantum Research & Technology Seminar. (Virtual)

2019 *Transport signatures of Dirac states in topological insulator - ferromagnet heterostructures*, KITP Seminar, Santa Barbara, CA.

2018 *What can weak measurements tell us about Bose-Einstein condensates?*, APS Mid-Atlantic Section Meeting, College Park, MD.

2017 *Understanding dissipative dynamics of dark solitons: results from experiment and theory*, Gordon Research Seminar. Salve Regina University, Newport, RI.

2015 *Charged skyrmions on the surface of a topological insulator*, Workshop on Topological Spintronics and Skyrmionics. Institut Néel, Grenoble, France.

Contributed Presentations (Selected)

2023 *Fermionic State Engineering Through Weak Measurement*, APS DAMOP Division Meeting. Spokane, WA.
2022 *Exploring Non-Hermitian Topology with Spin Torque Oscillator Arrays*, APS March Meeting Chicago, IL.
2020 *Quantum Control with Spinor Bose-Einstein Condensates*, APS DAMOP (Online).
2019 *Measurement induced dynamics and defect stabilization in spinor condensates*, APS March Meeting. Boston, MA.
2018 *Magnetic phases in a spinor Bose-Einstein condensate subject to weak measurement*, APS DAMOP Division Meeting. Ft. Lauderdale, FL.
2017 *Controllable friction of dark solitons in Bose-Fermi mixtures*, APS March Meeting. New Orleans, LA.
2016 *Transport signatures of Dirac electrons in a random magnetic field*, APS March Meeting. Baltimore, MD.

CONFERENCE & WORKSHOP ATTENDANCE (Selected)

2023 June APS DAMOP Division Meeting, Spokane, WA.
2023 Feb Quantum Simulation with Quantum Hardware, Aspen Center for Physics, Aspen, CO.
2022 Jun Real-World Quantum Computing with QuDIT at LLNL (Organizer), Livermore, CA.
2022 Mar APS March Meeting, Chicago, IL.
2021 Jun Quantum Undergraduate Education & Scientific Training Workshop, Virtual, Hosted by CSU San Marcos.
2021 Feb NSF Workshop on Quantum Engineering Education, Virtual, NSF.
2021 Jan AIP TEAM-UP Implementation Workshop, Virtual, Hosted by AIP.
2020 Dec National Quantum Initiative Community Meeting, Virtual, Hosted by DOE, NSF, & NIST.
2020 Feb Open Quantum Frontiers Institute Workshop, Golden, CO.
2019 Nov KITP Program: Spin and Heat Transport in Quantum and Topological Materials, Santa Barbara, CA.
2019 Apr KITP Program: Open Quantum System Dynamics; Quantum Simulators and Simulations Far From Equilibrium, Santa Barbara, CA.
2018 May APS DAMOP Division Meeting, Ft. Lauderdale, FL.
2017 June NYU Center for Quantum Phenomena Inaugural Symposium, New York, NY.
2017 May SPICE Workshop: Non-Equilibrium Quantum Matter, Mainz, Germany.
2016 Oct KITP Program: Synthetic Quantum Matter, Santa Barbara, CA.
2015 Oct Workshop on Topological Spintronics and Skyrmionics, Grenoble, France.
2015 Aug Cargése Summer School: Strongly Correlated Materials with Spin-Orbit Coupling, Corsica, France.

TEACHING

San José State University

2024 Sp	General Physics II: Electricity & Magnetism (PHYS 50) - Primary Instructor
2023 Fall	Fundamentals of Quantum Information (PHYS 161) - Primary Instructor
2023 Fall	Invitation to Physics & Astronomy (PHYS 20) - Primary Instructor
2023 Sp	General Physics II: Electricity & Magnetism (PHYS 50) - Primary Instructor
2023 Sp	Computational Physics (PHYS 240) - Primary Instructor
2022 Fall	Quantum Mechanics (PHYS 163) - Primary Instructor
2022 Fall	Invitation to Physics & Astronomy (PHYS 20) - Primary Instructor
2022 Fall	General Physics - Mechanics (PHYS 50) - Lab Instructor
2022 Sp	Topics in Physics & Astronomy (PHYS 155): Fundamentals of Quantum Information - Primary Instructor
2021 Sp	Waves & Oscillations (PHYS 107) - Primary Instructor
2020 Fall	Quantum Mechanics (PHYS 163) - Primary Instructor
2020 Fall	General Physics - Mechanics (PHYS 50) - Lab Instructor

University of Maryland, College Park

2017 Sp	Non-relativistic Quantum Field Theory (PHYS625) - Guest Lecturer (2 lectures)
2013 Fall	Physics for Biologists 1 (PHYS131) - Teaching Assistant

Colorado School of Mines

2012 Sp	Physics II: Electromagnetism and Optics (PHGN200) - Lead Teaching Assistant
2009 Fall - 2011 Fall	Physics II: Electromagnetism and Optics (PHGN200) - Teaching Assistant
2009 Sp - 2009 Fall	Physics I: Mechanics (PHGN100) - Teaching Assistant

RESEARCH

2020- *Principal Investigator*, Quantum Control in Atomic, Molecular, & Optical and Condensed Matter Systems, SJSU
Creation and manipulation of novel many-body phases using measurement and feedback control for ultracold atomic systems optical lattices. Theoretical modeling of quantum control and quantum sensing protocols in a variety of environments. Quantum simulation with superconducting qubit arrays.

2018-20 *Postdoctoral Researcher*, Spielman Research Group, NIST/JQI
Weak measurement of many-body systems including numerical modeling of phase contrast imaging in spinor Bose-Einstein condensates. Creation and manipulation of novel many-body phases using measurement and feedback control.

2014-17 *Research Assistant*, Galitski Group
Condensed matter theory including spin-orbit coupling in atomic gases, topological insulators (TI) and interplay of TI surface states and unconventional magnetic textures such as skyrmions and magnetic vortices. Combination of analytical an numerical techniques including scattering theory, non-relativistic quantum field theory and simulations of Gross-Pitaevskii equations for Bose-Einstein condensates.

2016 Su *Research Intern*, Laboratory for Physical Sciences
Noninvasive spectroscopy of Si/SiGe quantum wells. Development of new ways to measure valley splitting in Si/SiGe quantum wells using longitudinal coupling. Valley splitting determines the effectiveness of a Si/SiGe quantum well as a spin qubit.

2012 Sp *Senior Design Project*, Colorado School of Mines
Exploited the entanglement properties of quantum dots to perform simple logic functions. Computational quantum simulations in Mathematica were used to design a quantum dot molecule for uses in quantum computing.

2011 Su *Undergraduate Research Intern*, Colorado Nanofabrication Lab
Fabrication and testing of GaAsBi/GaAs heterojunction bipolar transistors including photoresist spinning, etching, 4-point resistance measurements and e-beam lithography.

SERVICE

San José State University

2023- Member, Curriculum Committee, SJSU College of Science
2023- Program Director, SJSU Master of Science in Quantum Technology
2022- Chair, Curriculum Committee, SJSU Physics & Astronomy Department
2022- Member, Program Planning Committee, SJSU Physics & Astronomy Department
2020- Reviewer: *Physical Review A, Physical Review Letters, Physical Review Research*
2020- Member, Scholarship Committee, SJSU Physics & Astronomy Department
2020-23 Member, Anti-Racism Committee, SJSU Physics & Astronomy Department
2020-21 Member, Organizing Committee, NSF Quantum Education Workshop

University of Maryland, College Park

2017- Reviewer: *Scientific Reports*, *Annals of Physics*
2015-17 Physics Department Representative, *UMD Graduate Student Government*
2016 -18 Reviewer, *New Journal of Physics*

OTHER PROFESSIONAL QUALIFICATIONS

2017 *University Teaching and Learning Program Completion: Associate Level*, Teaching and Learning Transformation Center, University of Maryland
2016-18 *TS/SCI Cleared*. Most recent polygraph: February 25, 2016.

Programming Experience

Most experience with Python, Mathematica, and Julia
Some experience with MATLAB and Bash shell scripting

MEMBERSHIPS

2009-

American Physical Society

2010 Sigma Pi Sigma (Physics Honor Society), year inducted.

2009 Tau Beta Pi Colorado Alpha Chapter (Engineering Honor Society), year inducted.

2008-12 Society of Women Engineers.

REFERENCES

Prof. Victor Galitski
Office 2270, Physical Sciences Complex
Joint Quantum Institute
University of Maryland
College Park, MD 20742 USA
Email: galitski@umd.edu
Phone: 301-405-6107

Dr. Ian B. Spielman
Office: Building 216, Room B131
National Institute of Standards and Technology and the University of Maryland
100 Bureau Drive, Stop 8424
Gaithersburg, MD 20899 USA
Email: ian.spielman@nist.gov
NIST Phone: 301-975-8664
NIST Fax: 301-975-8272

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