Stanford

Monika Schleier-Smith

Associate Professor of Physics

Curriculum Vitae available Online

CONTACT INFORMATION

- **Administrative Contact**

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Bio

BIO

Monika Schleier-Smith is an Associate Professor in the Physics Department at Stanford University. She received her Ph.D. from the Massachusetts Institute of Technology, following undergraduate studies at Harvard University, and subsequently pursued postdoctoral research at the LMU Munich and Max Planck Institute of Quantum Optics. Her current research centers on advancing optical control of interactions among laser-cooled atoms, with an eye towards applications in quantum simulation, metrology, and computation. She has pioneered techniques and ideas for simulating phenomena of condensed-matter physics and quantum gravity using tools of atomic physics, and developed protocols in quantum control for entanglement-enhanced sensing.

ACADEMIC APPOINTMENTS

- Associate Professor, Physics

ADMINISTRATIVE APPOINTMENTS

- Executive Committee Member, Q-FARM, Stanford-SLAC Quantum Science and Engineering Initiative, (2019- present)
- Faculty Senator, Stanford University, (2020-2022)

HONORS AND AWARDS

- Fellow, American Physical Society (2021)
- I. I. Rabi Prize in Atomic, Molecular, and Optical Physics, American Physical Society (2021)
- MacArthur Fellowship, MacArthur Foundation (2020)
- Presidential Early Career Award for Scientists and Engineers (PECASE), Department of Defense (2019)
- NSF CAREER Award, National Science Foundation (2018)
- Cottrell Scholar Award, Research Corporation (2017)
- Hellman Fellowship, Hellman Fellows Fund (2015)
- AFOSR Young Investigator Award, Air Force Office of Scientific Research (2014)
- Alfred P. Sloan Research Fellowship, Alfred P. Sloan Foundation (2014)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member-at-Large of the Executive Committee, Division of Atomic, Molecular, and Optical Physics (DAMOP), American Physical Society (APS) (2020 - 2023)
- Member of the Board of Directors, Fannie and John Hertz Foundation (2019 - 2022)
- Editorial Board Member, PRX Quantum (2020 - 2023)

PROFESSIONAL EDUCATION

- Ph.D., Massachusetts Institute of Technology , Physics (2011)
- A.B., Harvard University , Chemistry & Physics, Mathematics (2005)

LINKS

- Research Group: https://sslab.stanford.edu

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

In between the few--particle realm where we have mastered quantum mechanics and the macroscopic domain describable by classical physics, there lies a broad swath of territory where quantum effects are relevant but still largely out of our control and partly beyond our comprehension. This territory includes metrological instruments whose precision is limited by the quantum projection noise of millions of atoms; and materials whose bulk properties emerge from many-body interactions intractable to simulation on classical computers. Professor Schleier--Smith's research aims to advance our control and understanding of many--particle quantum systems by engineering new quantum states and Hamiltonians with ensembles of laser-cooled atoms.

Teaching

COURSES

2025-26

- Quantum Information: Visions and Emerging Technologies: PHYSICS 14N (Spr)

2024-25

- Electricity, Magnetism, and Optics: PHYSICS 23 (Win)

2023-24

- Electricity, Magnetism, and Optics: PHYSICS 23 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Han Hiller, Hunter Swan, Kangning Yang

Postdoctoral Faculty Sponsor

Lin Xin

Doctoral Dissertation Advisor (AC)

Sam Cohen, Prithvi Raj Datla, Merrick Ho, Jonathan Jeffrey, Neomi Lewis, Xuanwei Liang, Gabriel Moreau, Nolan Peard, Michael Wahrman, Michelle Wu, Tony Zhang, Ocean Zhou

Publications

PUBLICATIONS

- **Optically accessible high-finesse millimeter-wave resonator for cavity quantum electrodynamics with atom arrays** *PHYSICAL REVIEW APPLIED*
  Zhang, T., Wu, M., Cohen, S. R., Xin, L., Das, D., Multani, K. K. S., Peard, N., Valente-Feliciano, A., Welander, P. B., Safavi-Naeini, A. H., Nanni, E. A., Schleier-Smith, M.
  2025; 24 (4)

- **Graph states of atomic ensembles engineered by photon-mediated entanglement** *NATURE PHYSICS*
  Cooper, E. S., Kunkel, P., Periwal, A., Schleier-Smith, M.
  2024

- **Spin Squeezing by Rydberg Dressing in an Array of Atomic Ensembles.** *Physical review letters*
  Hines, J. A., Rajagopal, S. V., Moreau, G. L., Wahrman, M. D., Lewis, N. A., Marković, O., Schleier-Smith, M.
  2023; 131 (6): 063401

- **Programmable interactions and emergent geometry in an arrayof atom clouds.** *Nature*
  Periwal, A., Cooper, E. S., Kunkel, P., Wienand, J. F., Davis, E. J., Schleier-Smith, M.
  1800; 600 (7890): 630-635

- **Number Partitioning With Grover's Algorithm in Central Spin Systems** *PRX QUANTUM*
  Anikeeva, G., Markovic, O., Borish, V., Hines, J. A., Rajagopal, S., Cooper, E. S., Periwal, A., Safavi-Naeini, A., Davis, E. J., Schleier-Smith, M.
  2021; 2 (2)

- **Protecting Spin Coherence in a Tunable Heisenberg Model** *PHYSICAL REVIEW LETTERS*
  Davis, E. J., Periwal, A., Cooper, E. S., Bentsen, G., Evered, S. J., Van Kirk, K., Schleier-Smith, M. H.
  2020; 125 (6)

- **Transverse-Field Ising Dynamics in a Rydberg-Dressed Atomic Gas** *PHYSICAL REVIEW LETTERS*
  Borish, V., Markovic, O., Hines, J. A., Rajagopal, S. V., Schleier-Smith, M.
  2020; 124 (6)

- **Integrable and Chaotic Dynamics of Spins Coupled to an Optical Cavity** *PHYSICAL REVIEW X*
  Bentsen, G., Potirniche, I., Bulchandani, V. B., Scaffidi, T., Cao, X., Qi, X., Schleier-Smith, M., Altman, E.
  2019; 9 (4)

- **Treelike Interactions and Fast Scrambling with Cold Atoms** *PHYSICAL REVIEW LETTERS*
  Bentsen, G., Hashizume, T., Buyskikh, A. S., Davis, E. J., Daley, A. J., Gubser, S. S., Schleier-Smith, M.
  2019; 123 (13)

- **Photon-Mediated Spin-Exchange Dynamics of Spin-1 Atoms** *PHYSICAL REVIEW LETTERS*
  Davis, E. J., Bentsen, G., Homeier, L., Li, T., Schleier-Smith, M. H.
  2019; 122 (1)

- **Painting Nonclassical States of Spin or Motion with Shaped Single Photons** *PHYSICAL REVIEW LETTERS*
  Davis, E. J., Wang, Z., Safavi-Naeini, A. H., Schleier-Smith, M. H.
  2018; 121 (12)

- **Floquet Symmetry-Protected Topological Phases in Cold-Atom Systems** *PHYSICAL REVIEW LETTERS*
  Potirniche, I., Potter, A. C., Schleier-Smith, M., Vishwanath, A., Yao, N. Y.
  2017; 119 (12): 123601

- **Measuring the scrambling of quantum information** *PHYSICAL REVIEW A*
  Swingle, B., Bentsen, G., Schleier-Smith, M., Hayden, P.
  2016; 94 (4)

- **Bloch state tomography using Wilson lines** *SCIENCE*
  Li, T., Duca, L., Reitter, M., Grusdt, F., Demler, E., Endres, M., Schleier-Smith, M., Bloch, I., Schneider, U.

2016; 352 (6289): 1094-1097

- **Approaching the Heisenberg Limit without Single-Particle Detection** *PHYSICAL REVIEW LETTERS*
  Davis, E., Bentsen, G., Schleier-Smith, M.
  2016; 116 (5)
- **An Aharonov-Bohm interferometer for determining Bloch band topology** *SCIENCE*
  Duca, L., Li, T., REITTER, M., Bloch, I., Schleier-Smith, M., Schneider, U.
  2015; 347 (6219): 288-292
- **Orientation-Dependent Entanglement Lifetime in a Squeezed Atomic Clock** *PHYSICAL REVIEW LETTERS*
  Leroux, I. D., Schleier-Smith, M. H., Vuletic, V.
  2010; 104 (25)
- **Implementation of Cavity Squeezing of a Collective Atomic Spin** *PHYSICAL REVIEW LETTERS*
  Leroux, I. D., Schleier-Smith, M. H., Vuletic, V.
  2010; 104 (7)
- **States of an Ensemble of Two-Level Atoms with Reduced Quantum Uncertainty** *PHYSICAL REVIEW LETTERS*
  Schleier-Smith, M. H., Leroux, I. D., Vuletic, V.
  2010; 104 (7)
- **Degradation of Ta2O5 / SiO2 dielectric cavity mirrors in ultra-high vacuum** *OPTICS EXPRESS*
  Rudelis, A., Hu, B., Sinclair, J., Bytyqi, E., Schwartzman, A., Brenes, R., Zhitomirsky, T., Schleier-Smith, M., Vuletic, V.
  2023; 31 (24): 39670-39680
- **Solving a puzzle with atomic qubits.** *Science (New York, N.Y.)*
  Schleier-Smith, M.
  2022; 376 (6598): 1155-1156
- **Measure in circles** *NATURE PHYSICS*
  Kunkel, P., Schleier-Smith, M.
  2022; 18 (2): 124-125
- **Quantum Simulators: Architectures and Opportunities** *PRX QUANTUM*
  Altman, E., Brown, K. R., Carleo, G., Carr, L. D., Demler, E., Chin, C., DeMarco, B., Economou, S. E., Eriksson, M. A., Fu, K. C., Greiner, M., Hazzard, K. R. A., Hulet, et al
  2021; 2 (1)
- **Transverse-Field Ising Dynamics in a Rydberg-Dressed Atomic Gas.** *Physical review letters*
  Borish, V., Marković, O., Hines, J. A., Rajagopal, S. V., Schleier-Smith, M.
  2020; 124 (6): 063601
- **Spectrum, Landau-Zener theory and driven-dissipative dynamics of a staircase of photons** *NEW JOURNAL OF PHYSICS*
  Marino, J., Shchadilova, Y. E., Schleier-Smith, M., Demler, E. A.
  2019; 21
- **Photon-mediated spin-mixing dynamics**
  Bentsen, G. S., Davis, E. J., Homeier, L., Periwal, A., Cooper, E., Van Kirk, K., Schleier-Smith, M. H.
  edited by Shahriar, S. M., Scheuer, J.
  SPIE-INT SOC OPTICAL ENGINEERING.2019
- **Squeezing out higher precision.** *Science (New York, N.Y.)*
  Schleier-Smith, M.
  2019; 364 (6446): 1137–38
- **One- and two-axis squeezing of atomic ensembles in optical cavities** *NEW JOURNAL OF PHYSICS*
  Borregaard, J., Davis, E. J., Bentsen, G. S., Schleier-Smith, M. H., Sorensen, A. S.
  2017; 19

- **Advantages of Interaction-Based Readout for Quantum Sensing**
  Davis, E., Bentsen, G., Li, T., Schleier-Smith, M.
  edited by Hasan, Z. U., Hemmer, P. R., Lee, H., Migdall, A. L.
  SPIE-INT SOC OPTICAL ENGINEERING.2017
- **Editorial: Hybridizing Quantum Physics and Engineering.** *Physical review letters*
  Schleier-Smith, M.
  2016; 117 (10): 100001-?
- **Dynamic optical superlattices with topological bands** *PHYSICAL REVIEW A*
  Baur, S. K., Schleier-Smith, M. H., Cooper, N. R.
  2014; 89 (5)
- **Generating entangled spin states for quantum metrology by single-photon detection** *PHYSICAL REVIEW A*
  McConnell, R., Zhang, H., Cuk, S., Hu, J., Schleier-Smith, M. H., Vuletic, V.
  2013; 88 (6)
- **Unitary cavity spin squeezing by quantum erasure** *PHYSICAL REVIEW A*
  Leroux, I. D., Schleier-Smith, M. H., Zhang, H., Vuletic, V.
  2012; 85 (1)
- **Optomechanical Cavity Cooling of an Atomic Ensemble** *PHYSICAL REVIEW LETTERS*
  Schleier-Smith, M. H., Leroux, I. D., Zhang, H., Van Camp, M. A., Vuletic, V.
  2011; 107 (14)
- **Squeezing the collective spin of a dilute atomic ensemble by cavity feedback** *PHYSICAL REVIEW A*
  Schleier-Smith, M. H., Leroux, I. D., Vuletic, V.
  2010; 81 (2)
- **A linear AC trap for polar molecules in their ground state** *JOURNAL OF PHYSICAL CHEMISTRY A*
  Schnell, M., Lutzow, P., van Veldhoven, J., Bethlem, H. L., Kupper, J., Friedrich, B., Schleier-Smith, M., Haak, H., Meijer, G.
  2007; 111 (31): 7411-7419
- **Nanotube-substrate interactions: Distinguishing carbon nanotubes by the helical angle** *PHYSICAL REVIEW LETTERS*
  Kolmogorov, A. N., Crespi, V. H., Schleier-Smith, M. H., Ellenbogen, J. C.
  2004; 92 (8)