



Monika Schleier-Smith

Associate Professor of Physics

Bio

BIO

Schleier-Smith received her B.A. in 2005 from Harvard University, having studied Chemistry and Physics and (secondarily) Mathematics. She subsequently pursued graduate studies in experimental atomic physics at MIT. After receiving her Ph.D. in 2011, she was a postdoctoral fellow at the Max Planck Institute of Quantum Optics and Ludwig Maximilian University (LMU Munich), before arriving at Stanford in the fall of 2013.

ACADEMIC APPOINTMENTS

- Associate Professor, Physics

HONORS AND AWARDS

- 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)

PROFESSIONAL EDUCATION

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

LINKS

- Research Group: <https://sites.stanford.edu/sslab>
- AMO Physics at Stanford: <https://amo.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

2020-21

- Atoms, Fields and Photons: APPPHYS 203 (Aut)
- Quantum Information: Visions and Emerging Technologies: PHYSICS 14N (Win)

2019-20

- Atoms, Fields and Photons: APPPHYS 203 (Aut)
- Quantum Information: Visions and Emerging Technologies: PHYSICS 14N (Spr)

2017-18

- Quantum Information: Visions and Emerging Technologies: PHYSICS 14N (Spr)
- Thermodynamics, Kinetic Theory, and Statistical Mechanics I: PHYSICS 170 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

James Allen, David Berryrieser, Wil Kao, Stewart Koppell, Ronen Kroeze, Benjamin Malia, Tina Na Narong, Hunter Swan, Zhaoyou Wang

Postdoctoral Faculty Sponsor

Philipp Kunkel, Shankari Rajagopal

Doctoral Dissertation Advisor (AC)

Victoria Borish, Eric Cooper, Jacob Hines, Ognjen Markovic, Avikar Periwal

Postdoctoral Research Mentor

Shankari Rajagopal

Publications

PUBLICATIONS

- **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., Potimiche, 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)
- **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., 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., 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)