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
• President's Early Career Award for Science and Engineering (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

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)

2016-17

• Intermediate Physics Laboratory II: Experimental Techniques and Data Analysis: PHYSICS 107 (Win)
• 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

Postdoctoral Faculty Sponsor
Shankari Rajagopal

Doctoral Dissertation Advisor (AC)
Victoria Borish, Eric Cooper, Emily Davis, Ognjen Markovic, Avikar Periwal

Doctoral Dissertation Co-Advisor (AC)
Nora Brackbill

Postdoctoral Research Mentor
Shankari Rajagopal

Publications

PUBLICATIONS

• 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
  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.
• 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
  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
  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*
  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)