

Swati Singh

Electrical and Computer Engineering,
University of Delaware,
ECE 139 the Green,
Newark, DE. 19716.
Office: (302) 831-3295,
Email: swatis@udel.edu

CURRENT RESEARCH INTERESTS Quantum sensors,
Hybrid quantum systems,
Quantum computing and Quantum Information,
Optomechanical systems

EMPLOYMENT **Assistant Professor**, 2020–Present,
Electrical and Computer Engineering and
Material Science and Engineering,
University of Delaware, Newark, DE.
Research Assistant Professor, 2018–2020,
Electrical and Computer Engineering,
University of Delaware, Newark, DE.
Assistant Professor, 2016–2018,
Department of Physics,
Williams College, Williamstown, MA.
Postdoctoral Research Associate, 2015–2016,
College of Optical Sciences, University of Arizona, Tucson, AZ.
ITAMP Postdoctoral Fellow, 2012–2015,
Institute for Theoretical Atomic, Molecular, and Optical Physics (ITAMP),
Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, and
Department of Physics, Harvard University, Cambridge, MA.

EDUCATION ♦ **Ph.D. in Physics**, 2007–2012,
Department of Physics, University of Arizona, Tucson, AZ.
Advisor: Prof. Pierre Meystre
Thesis: *Hybrid atomic-optomechanical systems: observing quantum effects in macroscopic oscillators.*
♦ **M.Sc. in Physics**, 2004–2007,
University of British Columbia, Vancouver, BC, Canada.
Advisor: Prof. Kirk Madison
Thesis: *Production of ultra-cold ensembles of lithium and rubidium.*
♦ **Hons. B.Sc. in Physics**, 2000–2004,
McMaster University, Hamilton, ON, Canada.
Advisors: Prof. Brian King and Prof. Joseph Thywissen
Senior Thesis: *Design, construction and evaluation of an atomic source of potassium-40 for degenerate Fermi gas experiments.*

SELECTED AWARDS AND HONORS ♦ KITP Scholar Award, 2018.
Awarded annually to 6-8 people doing theoretical physics at non-PhD granting institutions
♦ ITAMP Postdoctoral Fellowship, 2012.
Awarded annually to 1-2 people in theoretical atomic physics

- ◇ University of Arizona College of Science Award for Excellence in Scholarship, 2011.
Awarded annually to one graduate student in College of Science
- ◇ Best presentation award for the UA Physics Students Colloquium series, 2010.
Awarded annually to two graduate students in the Physics Department
- ◇ Ontario Graduate Fellowship (declined due to studying out of province), 2004.
- ◇ Dean’s Honour List at McMaster University for academic standing, 2000-2004.
- ◇ 2nd Prize: Best presentation at the 39th Canadian Undergraduate Physics Conference, 2003.
- ◇ NSERC Undergraduate Student Research Award at University of Toronto, 2003
and at McMaster University, 2001–2002.
- ◇ McMaster University Senate Scholarship, 2001.

GRANT
SUPPORT

National Science Foundation Quantum Leap Conceptualization Grant for “AMPICQ: Atomic, Molecular and Photonic Instruments on Chip for Quantum sensing”, Senior Personnel, 2019–2020, \$112,000.

National Science Foundation grant for “Sensors of relativistic phenomena using solid-state quantum platforms”, PI, 2019–2022, \$250,000.

Unidel Grand Challenge grant for “Interdisciplinary Graduate Degree Program in Quantum Science and Engineering”, co-PI, 2018, \$20,000.

Army Research Office Conference Grant Award for the “2014 Mechanical Systems in the Quantum Regime GRS”, PI, 2014, \$5000.

PUBLICATIONS

Journal Articles (21 Published, 1 submitted, 1 In progress)

Supervised students are underlined.

- 23) J. Manley, R. Stump, **S. Singh**, *Study of fiber-based strain sensing technology for dark matter detection*, In preparation (2021). Draft available upon request.
- 22) J. Manley, M. D. Chowdhury, D. Grin, **S. Singh**, D. J. Wilson, *Searching for vector dark matter with an optomechanical accelerometer*, Phys. Rev. Lett. **126**, 061301 (2021).
- 21) D. Carney, G. Krnjaic, D. C. Moore, C. A. Regal, G. Afek, S. Bhave, B. Brubaker, T. Corbitt, J. Cripe, N. Crisosto, A. Geraci, S. Ghosh, J. G. E. Harris, A. Hook, E. W. Kolb, J. Kujummen, R. F. Lang, T. Li, T. Lin, Z. Liu, J. Lykken, L. Magrini, J. Manley, N. Matsumoto, A. Monte, F. Monteiro, T. Purdy, C. J. Riedel, R. Singh, **S. Singh**, K. Sinha, J. M. Taylor, J. Qin, D. J. Wilson, Y. Zhao, *Mechanical Quantum Sensing in the Search for Dark Matter*, arXiv:2008.06074 (2020).
- 20) E. Bauch, **S. Singh**, J. Lee, C. Hart, J. Schloss, M. Turner, J. F. Barry, L. Pham, N. Bargill, S. F. Yelin and R. Walsworth, *Decoherence of ensembles of nitrogen-vacancy centers in diamond*, Phys. Rev. B **102**, 134210 (2020).
- 19) J. Manley, D. J. Wilson, R. Stump, D Grin and **S. Singh**, *Searching for Scalar Dark Matter with Compact Mechanical Resonators*, Phys. Rev. Lett. **124**, 151301 (2020).
- 18) E. Bauch, C. A. Hart, J. M. Schloss, M. J. Turner, J. F. Barry, P. Kehayias, **S. Singh**, and R. L. Walsworth, *Ultralong dephasing times in solid-state spin ensembles via quantum control*, Phys. Rev. X **8** (3), 031025 (2018).
- 17) **S. Singh**, L.A. DeLorenzo, I. Pikovski, and K.C. Schwab, *Detecting continuous gravitational waves with superfluid ^4He* , New J. Phys. **19**, 073023 (2017).
- 16) Q. Song, **S. Singh**, K. Zhang, W. Zhang, and P. Meystre, *One qubit and one photon: The simplest polaritonic heat engine*, Phys. Rev. A **94**, 063852 (2016).
- 15) F. Bariani, H Seok, **S. Singh**, M Vengalattore, P Meystre, *Atom-based coherent quantum-noise cancellation in optomechanics*, Phys. Rev. A **92**, 043817 (2015). (**Editors’ Suggestion**)

- 14) **S. Singh**, Y. Chu, M. Lukin, and S. F. Yelin, *Coherent Population Trapping, Nuclear Spin Cooling, and Lévy Flights in Solid-State Atom-Like Systems*, Adv. Atom. Mol. Opt. Phys. **64**, 273 (2015).
- 13) F. Bariani*, **S. Singh***, L.F. Buchmann, M. Vengalattore, P. Meystre, *Hybrid optomechanical cooling by atomic Λ systems*, Phys. Rev. A **90**, 033838 (2014). *co-first author.
- 12) S. K. Steinke, **S. Singh**, P. Meystre, K. C. Schwab, and M. Vengalattore, *Quantum back-action in spinor condensate magnetometry*, Phys. Rev. A **88**, 063809 (2013).
- 11) H. Seok, L. F. Buchmann, **S. Singh**, and P. Meystre, *Optically mediated nonlinear quantum optomechanics*, Phys. Rev. A **86**, 063829 (2012).
- 10) E. M. Wright, M. Mazilu, **S. Singh**, K. Dholakia, and P. Meystre, *Theory and simulation of an Optical Spring Mirror*, Proc. SPIE **8458**, “Optical Trapping and Optical Micromanipulation IX”, 84580A-1, doi 10.1117/12.929281 (2012).
- 9) **S. Singh**, H. Jing, E. M. Wright, and P. Meystre, *Quantum state transfer between a Bose-Einstein condensate and an optomechanical mirror*, Phys. Rev. A **86**, 021801(R) (2012).
- 8) H. Seok, L. F. Buchmann, **S. Singh**, S. K. Steinke, and P. Meystre, *Generation of mechanical squeezing via magnetic dipoles on cantilevers*, Phys. Rev. A **85**, 033822 (2012).
- 7) S. K. Steinke, **S. Singh**, M. E. Tasgin, P. Meystre, K. C. Schwab, and M. Vengalattore, *Quantum-measurement backaction from a Bose-Einstein condensate coupled to a mechanical oscillator*, Phys. Rev. A **84**, 023841 (2011).
- 6) **S. Singh**, G. A. Phelps, D. S. Goldbaum, E. M. Wright, and P. Meystre, *All-Optical Optomechanics: An Optical Spring Mirror*, Phys. Rev. Lett. **105**, 213602 (2010).
- 5) M. Bhattacharya, **S. Singh**, P. L. Giscard, and P. Meystre, *Optomechanical control of atoms and molecules*, Laser Physics **20**, 57 (2010).
- 4) **S. Singh**, and P. Meystre, *Atomic probe Wigner tomography of a nanomechanical system*, Phys. Rev. A **81**, 041804(R) (2010).
- 3) **S. Singh**, M. Bhattacharya, O. Dutta, and P. Meystre, *Coupling Nanomechanical Cantilevers to Dipolar Molecules*, Phys. Rev. Lett. **101**, 263603 (2008).
Also in the January 2009 issue of Virtual Journal of Quantum Information and January 2009 issue of Virtual Journal of Nanoscale Science & Technology
- 2) Z. Li, **S. Singh**, T. V. Tscherbul, and K. W. Madison, *Feshbach resonances in ultracold 85Rb - 87Rb and 6Li - 87Rb mixtures*, Phys. Rev. A **78**, 022710 (2008). Also in the September 2008 issue of Virtual Journal of Quantum Information.
- 1) S. Aubin, M. Extavour, S. Myrskog, L. LeBlanc, J. Esteve, **S. Singh**, P. Scrutton, D. McKay, R. McKenzie, I. Leroux, A. Stummer, and J. H. Thywissen, *Trapping Fermionic ^{40}K and Bosonic ^{87}Rb on a Chip*, J. Low Temp. Phys. **140**, 377 (2005).

PRESS
COVERAGE

- Article about “Searching for Scalar Dark Matter with Compact Mechanical Resonators”:
 ♦ <https://phys.org/news/2020-05-scalar-dark-compact-mechanical-resonators.html>
- Article about recent single-PI NSF grant:
 ♦ <https://www.udel.edu/udaily/2019/october/swati-singh-quantum-devices>
- Article about “Detecting continuous gravitational waves with superfluid ^4He ”:
 ♦ <http://physicsworld.com/cws/article/news/2017/jul/24/how-to-detect-gravitational-waves-using-superfluid-liquid-helium>
 ♦ http://www.realclearscience.com/2017/07/25/superfluid_helium_can_detect_gravitational_waves_277304.html

RECENT
CONFERENCE
ABSTRACTS

- 18) J. Manley, D. J. Wilson, R. Stump, D Grin and **S. Singh**, *Searching for Scalar Dark Matter with Compact Mechanical Resonators*, DAMOP Meeting, June 2020. (Oral Presentation).
- 17) **S. Singh**, *Resonant detection of gravitational waves and dark matter using superfluid helium*, QFS Meeting, Edmonton, Canada, August 2019. (Oral Presentation- **Invited**).

- 16) **S. Singh**, *Search for light scalar dark matter using optomechanical systems*, DAMOP Meeting, Milwaukee, WI, May 2019. (Oral Presentation).
- 15) **S. Singh**, *Search for light scalar dark matter using optomechanical systems*, APS March Meeting, Boston, MA, March 2019. (Oral Presentation).
- 14) **S. Singh**, L. DeLorenzo, I. Pikovski and K. C. Schwab, *Detecting continuous gravitational waves with superfluid helium*, Currents trends in open and non-equilibrium quantum optical systems workshop, MPL Erlangen, Germany, June 2018. (Oral Presentation- **Invited**)
- 13) **S. Singh**, L. DeLorenzo, I. Pikovski and K. C. Schwab, *Detecting continuous gravitational waves with helium*, APS March Meeting, Los Angeles, CA, March 2018. (Oral Presentation)
- 12) **S. Singh**, L. DeLorenzo, A. Pearlman, I. Pikovski and K. C. Schwab, *Detecting gravitational waves with superfluid ^4He* , Gordon Research Conference on Mechanical Systems in Quantum Regime, Ventura, CA, March 2018. (Poster Presentation)
- 11) **S. Singh**, L. DeLorenzo, I. Pikovski and K. C. Schwab, *Detecting continuous gravitational waves with superfluid helium*, SQuInT workshop, Santa Fe, NM, Feb 2018. (Oral Presentation)
- 10) **S. Singh**, L. DeLorenzo, I. Pikovski and K. C. Schwab, *Detecting continuous gravitational waves with helium*, DAMOP Meeting, Sacramento, CA, May 2017. (Oral Presentation)
- 9) **S. Singh**, L. DeLorenzo, A. Pearlman, I. Pikovski and K. C. Schwab, *Detecting gravitational waves with superfluid ^4He* , Gordon Research Conference on Quantum Science, Stonehill College, Easton, MA, August 2016. (Poster Presentation)
- 8) **S. Singh**, L. DeLorenzo, A. Pearlman, I. Pikovski and K. C. Schwab, *Detecting gravitational waves with superfluid ^4He* , DAMOP Meeting, Providence, RI, May 2016. (Oral Presentation)
- 7) D. Levonian, M. Goldman, **S. Singh**, M. Markham, D. Twitchen and M. Lukin, *Probing an NV Center's Nuclear Spin Environment with Coherent Population Trapping*, DAMOP Meeting, Providence, RI, May 2016. (Poster Presentation)
- 6) E. Bauch, P. Junghyun, **S. Singh**, T. Devakul, A. Feguin, C. Hart and R. Walsworth, *Spin noise in mixed spin systems*, DAMOP Meeting, Providence, RI, May 2016. (Oral Presentation)
- 5) **S. Singh**, L. DeLorenzo, A. Pearlman, I. Pikovski, M. Blencowe and K. C. Schwab, *Detecting continuous gravitational waves with a jug of superfluid*, APS March Meeting, Baltimore, MD, March 2016. (Oral Presentation)
- 4) **S. Singh**, Y. Chu, A. Pick, A. Aspect, M. Lukin and S. F. Yelin, *Probing nuclear spin dynamics near solid-state atom-like systems via photon statistics*, DAMOP Meeting, Columbus, OH, June 2015. (Oral Presentation)
- 3) A. Shaffer, L. Chang, Y. S. Patil, F. Bariani, **S. Singh**, A. Date, S. Chakram, K. C. Schwab, P. Meystre and M. Vengalattore, *Spin-mediated Hybrid Quantum Optomechanics*, DAMOP Meeting, Columbus, OH, June 2015. (Oral Presentation)
- 2) H. Seok, F. Bariani, **S. Singh**, M. Vengalattore and P. Meystre, *Sensing of mechanical motion at the quantum level via a hybrid atom-optomechanical setup*, DAMOP Meeting, Columbus, OH, June 2015. (Oral Presentation)
- 1) E. Bauch, J. Lee, **S. Singh**, M. L. Pham, K. Arai and R. Walsworth, *Suppression of Spin Noise in Diamond for improved Sensing and Imaging*, DAMOP Meeting, Columbus, OH, June 2015. (Poster Presentation)

RECENT INVITED TALKS Theoretical Physics seminar, Physics Department, University of Massachusetts at Lowell, November 2020.

Guest Lecturer, Presidential Dream Course on Hybrid Quantum Systems, University of Oklahoma, Norman OK, February 2020.

Particle Physics seminar, Physics Department, University of Delaware, December 2019.

Optics Colloquium, The Institute of Optics, University of Rochester, NY September 2019.

ITAMP Laboratory Cosmology Workshop, Harvard University, MA, September 2019.
 Material Science and Engineering department seminar, University of Delaware, March 2019.
 Quantum information and information Colloquium, HRI-Allahabad, India, January 2019.
 Special Colloquium, Physics Department, IISER-Pune, India, January 2019.
 Special Colloquium, Physics Department, IIT-Mumbai, India, January 2019.
 Optics and Photonics Workshop, University of Arizona, AZ, January 2019.
 Special Colloquium, Institute for Quantum Computing, Waterloo, Canada, November 2018.
 Physics Department Colloquium, McMaster University, Canada, November 2018.
 AMO Seminar, Stony Brook University, Stony Brook, NY, October 2018.
 Special seminar, University of Vienna, Austria, July 2018.
 Theory seminar, MPQ, Garching, Germany, June 2018.
 Special seminar, Physics Department, University of Turin, Italy, June 2018.
 Special seminar, INRiM, Turin, Italy, May 2018.
 CM seminar, Dartmouth College, April 2018.
 Physics Department Colloquium, Wellesley College, April 2018.
 Physics Department Colloquium, Miami University OH, March 2018.
 ECE seminar, University of Delaware, December 2017.
 Greylock Talk, Mt. Greylock High School, September 2017.
 Science Lunch Talk, Williams College, May 2017.
 Physics Department Colloquium, Amherst College, April 2017.
 ITAMP Lunch Seminar, Harvard University, Cambridge, MA, November 2016.
 Physics seminar, Williams College, Williamstown, MA, December 2015.
 DARPA Quasar Review Meeting, University of California, Santa Barbara, CA, October 2015.
 IQC seminar, University of Waterloo, Waterloo, ON, Canada, February 2015.

TEACHING
EXPERIENCE

- ◇ **Assistant Professor**
 ELEG 467/667 (Quantum Information Processing): Undergraduate or graduate elective course introducing concepts in quantum information (Spring 2021).
 ELEG 482/682 (Optics and Photonics): Graduate course for ECE students (Spring 2019, 2020 and 2021).
 PHYS 107 (Spacetime and Quanta): Modern Physics course for non-science majors (Fall 2017).
 PHYS 302 (Thermodynamics and Statistical Mechanics): Required course for Junior/Senior Physics majors (Spring 2017, 2018).
- ◇ **Teaching Assistant**
 Various freshman and sophomore Physics courses at University of Arizona (2007), University of British Columbia (2004-2007), and McMaster University (2001-2002).
 Freshman Calculus at McMaster University (2001-2002).

STUDENTS

Jack Manley, PhD student (2019-).
 Wei Wei, Masters student (2020-).
 Russell Stump, Masters student (2019-2020).
 Nathan Augenbraun, Undergraduate Research student (2019).
 Jose Louis Falla, Summer Exchange Masters student (2019).
 Joshua Reynolds (Williams College '2021), Research student (Winter Study 2018).
 Ellery Galvin (Williams College '2018), Undergraduate Thesis student (2017-18).

Qiyuan Hu (Williams College '2020), Summer Research student (Summer 2017).
Ashay Patel (Williams College '2018), Independent Study student (Spring 2017).

SCHOOLS AND
PROGRAMS
ATTENDED

Many-Body Physics with Light

October -November 2015, Kavli Institute for Theoretical Physics, UC Santa Barbara.

Les Houches Summer School on Quantum Optomechanics and Nanomechanics

August 2015, École de Physique, Les Houches.

ITAMP/B2 Institute Winter Graduate School on AMO Physics

January 2012, University of Arizona-Biosphere 2, Tucson, Arizona.

PROFESSIONAL
SERVICE

Steering Committee Member, Symposium on Quantum Fluids and Solids, 2019, 2021.

Organizer, Williams Physics Colloquium (2017-18).

ITAMP topical seminars (2014-15).

Panel member, Junior Faculty Panel, Physics Department at Harvard University, 2016.

Career Symposium, Women in Physics and Optics at the University of Arizona, 2016.

Chair, Gordon Research Seminar on Mechanical Systems in the Quantum Regime, 2014.

Grant Reviewer, National Science Foundation.

Manuscript Reviewer, Nature, Physical Review Letters, Physical Review A, Physical Review E and Quantum.

Member, American Physical Society, Optical Society of America, IEEE.