Gretchen K. Campbell

2149 Physical Science Complex
University of Maryland,
College Park, MD 20742-411

Phone: (301) 405-0934
Email: gcampbe1@umd.edu
Homepage: https://campbell.jqi.umd.edu/

Education

Ph.D. Physics, Massachusetts Institute of Technology, 2007
Thesis: ^{87}Rubidium Bose-Einstein Condensates in Optical Lattices
Presidential Fellow

B.A. Physics with Honors, *Summa Cum Laude*, Wellesley College, 2001
Thesis: Construction and Calibration of Optical Tweezers

Professional Experience

University of Maryland, Division of Research, College Park, Md
Associate Vice President for Quantum Research and Education
July 2025-Present

White House Office of Science and Technology Policy, Washington, DC
Assistant Director for Quantum Information Science
Director, National Quantum Coordination Office
March 2024–May 2025
Deputy Director, National Quantum Coordination Office
September 2022–March 2024.

National Institute of Standards and Technology, Gaithersburg, Md
Group Leader/Supervisory Physicist
October 2019–July 2025.
Responsibilities: Leader, Laser Cooling and Trapping group in the Quantum Measurement Division. The LC Group has 7 permanent staff and over 30 graduate students and post-docs.
Co-director, Joint Quantum Institute
April 2016–July 2025.

Research Physicist, Laser Cooling and Trapping Group
September 2009–September 2019.

Fellow, Joint Quantum Institute
September 2009–present.

University of Maryland, Department of Physics, College Park, Md
Adjunct Professor, Department of Physics
January 2019–present.
Adjunct Associate Professor, Department of Physics
September 2015–December 2018.
Adjunct Assistant Professor, Department of Physics
September 2009–August 2015.

JILA/National Institute of Standards and Technology, Boulder, Co
Postdoctoral Research Associate
Supervisor: Jun Ye

Research: Optical frequency metrology with strontium in an optical lattice.
November 2006–August 2009

MIT, Department of Physics, Cambridge, Ma
Research Assistant
Supervisor: Wolfgang Ketterle and Dave Pritchard
Research: Experiments with ^{87}Rb Bose-Einstein condensates in one, two and three dimensional optical lattices.
September 2001–October 2006

National Institute of Standards and Technology, Gaithersburg, Md
Summer Research Student
Supervisor: Paul Lett
Worked on photoassociation spectroscopy of ultra-cold molecules
May 2000–August 2000 Supervisor: Kris Helmerson
Constructed an optical tweezer setup
May 1999–August 1999

Wellesley College, Department of Physics, Wellesley, Ma
Undergraduate Researcher
Supervisor: Ted Ducas
Constructed and characterized an infrared optical tweezer apparatus
August 2000–May 2001

Teaching Experience

University of Maryland, Department of Physics, College Park, Md
Co-taught graduate class: Atomic and Optical Physics, with Trey Porto.
Fall 2011, Fall 2012, Fall 2013, Fall 2017, Fall 2018

MIT, Department of Physics, Cambridge, Ma
Teaching Assistant, Atomic and Optical Physics I
Graded problem sets and assisted students with their homework.
Spring 2004

Wellesley College, Wellesley, Ma
Physics Department: Teaching Assistant for introductory physics courses.
Graded problem sets and staffed physics help room.
Spring 2000, Fall 2001
Computer Science Department: Teaching Assistant for introductory programming class.
Assisted during lab sections, graded problem sets and assisted students with their homework.
Spring 1999

Honors, Awards, & Fellowships

2020 UMD Dept of Physics George M. Snow Award for Promotion of Women in Physics

2016 Fellow, American Physical Society

2015 APS Maria Goeppert Mayer Award

2015 IUPAP C15 Young Scientist Prize

2015 Finalist, Samuel J. Heyman Service to Americal Medals, Call to Service category

2013 Sigma Xi Katharine B. Gebbie Young Scientist Award

2012 Presidential Early Career Award in Science and Engineering

2012 Arthur S. Flemming Award

2011 Bronze Medal, Department of Commerce

2008 Finalist DAMOP thesis prize of the American Physical Society

2006 National Research Council Postdoctoral Research Fellowship

2006 Martin Deutsch Prize for Excellence in Experimental Physics, MIT

2005 Optical Society of America New Focus/Bookham Student Award

2001 Jerome A. Schiff Fellow, Wellesley College

2001 Phyllis Fleming Physics Prize

2001 Member of Sigma Xi

2000 Phi Beta Kappa

1998 First-year Academic Distinction

Invited Publications

1. *Quantum gases: Superfluidity goes 2D*. G.K. Campbell, Nature Phys, **8**, 643-644 (2012).
2. *News and Views: When Ultracold is not cold enough.* G. K. Campbell, Nature **480**, 463 (2011).

Publications

1. *Grating magneto-optical traps with complicated level structures*, Daniel S Barker, Peter K Elgee, Ananya Sitaram, Eric B Norrgard, Nikolai N Klimov, Gretchen K Campbell and Stephen Eckel, New J. Phys. **25**, 103046 (2023).
2. *Accurate Determination of Hubble Attenuation and Amplification in Expanding and Contracting Cold-Atom Universes*, S. Banik, M. Gutierrez Galan, H. Sosa-Martinez, M. Anderson, S. Eckel, I. B. Spielman, G. K. Campbell, Phys. Rev. Lett **128**, 090401 (2022).
3. *Programmable system on chip for controlling an atomic physics experiment*, A. Sitaram, G.K. Campbell, A. Restelli, Rev. Sci. Instr. **92**, 055107 (2021).
4. *Confinement of an alkaline-earth element in a grating magneto-optical trap*, A. Sitaram, P. K. Elgee, G. K. Campbell, N. N. Klimov, S. Eckel, D. S. Barker, Rev. Sci. Instr. **91**, 103202 (2020).
5. *Isotope shift spectroscopy of the* $^1S_0 \rightarrow {}^3P_1$ *and* $^1S_0 \rightarrow {}^3P_0$ *transitions in strontium*, H. Miyake, N. C. Pisenti, P. K. Elgee, A. Sitaram, G. K. Campbell, Phys. Rev. Research **1**033113 (2019).
6. *A Rapidly Expanding Bose-Einstein Condensate: An Expanding Universe in the Lab*, S. Eckel, A. Kumar, T. Jacobson, I. B. Spielman, G. K. Campbell, Phys. Rev. X **8** 021021 (2018).
7. *Spectrum Estimation of Density Operators with Alkaline-Earth Atoms*, M.E. Beverland, J. Haah, G. Alagic, G.K. Campbell, A. M. Rey, A. V. Gorshkov, Phys. Rev. Lett. **120** 025301 (2018).
8. *Temperature induced decay of persistent currents in superfluid ultracold gas*, A. Kumar, S. Eckel, F. Jendrzejewski, and G. K. Campbell, Phys. Rev. A. **95** 021602 (2017).
9. *Subwavelength-width optical tunnel junctions for ultracold atoms*, F. Jendrzejewski, S. Eckel, T. G. Tiecke, G. Juzeli?nas, G. K. Campbell, Liang Jiang, A. V. Gorshkov, Phys. Rev. A **94** 063422 (2016)
10. *An ultra-low noise, high-voltage piezo-driver*, N.C Pisenti, A. Restelli, B.J. Reschovsky, D. S. Barker, and G.K. Campbell, Rev. Sci. Instr. **87** 124702 (2016).

11. *Minimally destructive, Doppler measurement of a quantized flow in a ring-shaped Bose − Einstein condensate*, A. Kumar, N.W. Anderson, W.D. Phillips, S. Eckel, G.K. Campbell, S. Stringari, New J. Phys. **18**, 025001 (2016).

12. *Resonant wavepackets and shock waves in an atomtronic SQUID*, Y. Wang, A. Kumar, F. Jendrzejewski, R. M. Wilson, M. Edwards, S Eckel, G K Campbell and C.W. Clark, New J. Phys. **17** 125012 (2015).

13. *Enhanced Magnetic Trap Loading for Atomic Strontium*, D.S. Barker, B.J. Reschovsky, N.C. Pisenti, and G.K. Campbell, Phys. Rev. A **92**, 043418 (2015).

14. *Contact resistance and phase slips in mesoscopic superfluid atom transport*, J. Lee, S. Eckel, F. Jendrzejewski, C.J. Lobb, G.K. Campbell, and W.T. Hill III, Phys. Rev. A **93**, 063619 (2016).

15. *Three-photon process for producing a degenerate gas of metastable alkaline-earth-metal atoms*, D. S. Barker, N. C. Pisenti, B. J. Reschovsky, and G. K. Campbell, Physics. Rev. A **93** 053417 (2016).

16. *Self-heterodyne detection of the in situ phase of an atomic superconducting quantum interference device*, R. Mathew, A. Kumar, S. Eckel, F. Jendrzejewski, G. K. Campbell, Mark Edwards, and E. Tiesinga, Phys. Rev. A **92**, 033602 (2015).

17. *Interferometric measurement of the current-phase relationship of a superfluid weak link*, S. Eckel, F. Jendrzejewski, A. Kumar, C. J. Lobb and G. K. Campbell, Phys. Rev. X **4**, 031052 (2014).

18. *Resistive flow in a weakly interacting Bose-Einstein condensate*, F. Jendrzejewski, S. Eckel, N. Murray, C. Lanier, M. Edwards, C. J. Lobb, and G.K. Campbell, Phys. Rev. Lett. **113**, 045305 (2014).

19. *Hysteresis in a quantized superfluid atomtronic circuit*, S. Eckel, J.G. Lee, F. Jendrzejewski, N. Murray, C.J. Lobb, M. Edwards, W.D. Phillips, and G.K. Campbell, Nature, **506**, 200 (2014). *Popular accounts of this paper*: Nature Physics News & Views.

20. *Threshold for Creating Excitations in a Stirred Superfluid Ring* , K. C. Wright, R. B. Blakestad, C. J. Lobb, W. D. Phillips, and G. K. Campbell, Phys. Rev. A **88**, 063633 (2013).

21. *Probing the circulation of ring-shaped Bose-Einstein condensates*, N. Murray, M. Krygier, M. Edwards, K. C. Wright, G. K. Campbell, and C W. Clark, Phys. Rev. A, **88**, 053615 (2013).

22. *Driving phase slips in a superfluid atom circuit with a rotating weak link*, K. C. Wright, R. B. Blakestad, C. J. Lobb, W. D. Phillips, and G. K. Campbell, Phys. Rev. Lett. **110**, 025302 (2013). *Popular accounts of this paper*: Physics World, APS *Physics* Synopsis, Nature Physics News & Views.

23. *Partial-Transfer Absorption Imaging: A versatile technique for optimal imaging of ultracold gases* A. Ramanathan, S. R. Muniz, K. C. Wright,R. P. Anderson, W. D. Phillips, S. R. Muniz,and G. K. Campbell, Rev. Sci. Instrum. **83**, 083119 (2012).

24. *Superflow in a Toroidal Bose-Einstein Condensate: An Atom Circuit with a Tunable Weak Link.* A. Ramanathan, K. C. Wright, S. R. Muniz,M. Zelan, W. T. Hill III, C. J. Lobb, K. Helmerson, W. D. Phillips, and G. K. Campbell, Phys. Rev. Lett **106**, 130401 (2011). *Popular accounts of this paper*: Science News, New Scientist.

25. *Tunable optical tweezers for wavelength-dependent measurements* B. Hester, G. K. Campbell, C. Lopez-Mariscal, C. L. Filguiera, R. Huschka, N. J. Halas and K. Helmerson, Rev. Sci. Instrum. **83**, 043114 (2012).

26. *Ultracold atoms and precise time standards.* G. K. Campbell and W. D. Phillips, Philos. T. Roy. Soc. A **369**, 4078 (2011).

27. *Precision Measurement of Fermionic Collisions Using an ^{87}Sr Optical Lattice Clock with 1x10^{-16} Inaccuracy.*M. D. Swallows, G. K. Campbell, A. D. Ludlow, M. M. Boyd, J. W. Thomsen, M. J. Martin, S. Blatt, T. L. Nicholson and J. Ye, IEEE Trans. Ultrason. Ferroelectr., Freq. Control. **57** 574 (2010).

28. *Probing Interactions Between Ultracold Fermions.* G. K. Campbell, M. M. Boyd, J. W. Thomsen, M. J. Martin, S. Blatt, M. Swallows, T. L. Nicholson, T. Fortier, C. W. Oates, J. Ye, A. D. Ludlow, Science **324**, 360 (2009).

29. *Rabi Spectroscopy and Excitation Inhomogeneity in a 1D Optical Lattice Clock.* S. Blatt, J. W. Thomsen, G. K. Campbell, A. D. Ludlow, M. D. Swallows, M. J. Martin, M. M. Boyd, Jun Ye, Physical Review A **80**, 052703 (2009).

30. *Precisely Engineered Interactions between Light and Ultracold Matter.* M. M. Boyd, A. D. Ludlow, S. Blatt, G. K. Campbell, T. Zelevinsky, and J. Ye, in Atom Optics and Space Physics, Proceedings of the International School of Physics "Enrico Fermi," Course **CLXVIII**, E. Arimondo, W. Ertmer, and W. P. Schleich, Eds., (IOS Press, Amsterdam and SIF, Bologna 2009) p. 277 – 297.

31. *Quantum metrology with lattice-confined ultracold Sr atoms.* A. D. Ludlow, G. K. Campbell, S. Blatt, M. M. Boyd, M. J. Martin, T. L. Nicholson, M. Swallows, J. W. Thomsen, T. Fortier, C. W. Oates, S. A. Diddams, N. D. Lemke, Z. Barber, S. G. Porsev, and J. Ye, in Seventh Symposium on Frequency Standards and Metrology, L. Maleki, Ed., World Scientific, Singapore, p. 73 – 81 (2009).

32. *Precision measurement of fermionic collisions with a ^{87}Sr optical lattice clock at 1 x 10^{-16} inaccuracy.*M. Swallows, G. K. Campbell, A. D. Ludlow, M. M. Boyd, J. Thomsen, M. J. Martin, S. Blatt, T. L. Nicholson, and J. Ye, IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control **57**, 574 (2010)

33. *The Absolute Frequency of the ^{87}Sr Optical Clock Transition.* G. K. Campbell, A. D. Ludlow, S. Blatt J. W. Thomsen, M. J. Martin M. H. G. de Miranda, T. Zelevinsky, M. M. Boyd, J. Ye, S. A. Diddams, T. P. Heavner, T. E. Parker, S. R. Jefferts, Metrologia **45**, 539 (2008).

34. *New Limits on Coupling of Fundamental Constants to Gravity using^{87}Sr Optical Lattice Clocks.* S. Blatt, A. D. Ludlow, G. K. Campbell, J. W. Thomsen, T. Zelevinsky, M. M. Boyd, J. Ye, X. Baillard, M. Fouche, R. Le Targat, A. Brusch, P. Lemonde, M. Takamoto, F.F. Hong, H. Katori, V. V. Flambaum, Phys. Rev. Lett **100**, 140801 (2008).

35. *Sr Lattice Clock at the 1 x 10-16 Fractional Uncertainty by Remote Optical Evaluation with a Ca clock.* A. D. Ludlow, T. Zelevinsky, G. K. Campbell, S. Blatt, M. M. Boyd, M. H. G. de Miranda, M. J. Martin, J. W. Thomsen, S. M Foreman, J. Ye, T. M Fortier, J. E. Stalnaker, S. A. Diddams, Y. Le Coq, Z. W. Barber, N. Poli, N. D. Lemke, K. M. Beck, C. W. Oates, Science **319**, 1805 (2008).

36. *Highly coherent spectroscopy of ultracold atoms and molecules in optical lattices.* T. Zelevinsky, S. Blatt, M. M. Boyd, G. K. Campbell, A. D. Ludlow, J. Ye, Chem. Phys. Chem. **9**, 375 (2008)

37. *Sr Optical Clock with High Stability and Accuracy.* A. D. Ludlow, S. Blatt, M. M. Boyd, G. K. Campbell, S. M. Foreman, M. J. Martin, M. H. G. de Miranda, T. Zelevinsky, J. Ye, T. M. Fortier, J. E. Stalnaker, S. A. Diddams, C. W. Oates, Z. W. Barber, and N. Poli, in Laser Spectroscopy XVIII, L. Hollberg, J. C. Bergquist, and M. Kasevich, Eds., World Scientific, Singapore, p. 303 (2008).

38. *Ultracold Strontium Clock: Applications to the measurement of fundamental constant variations.* A. D. Ludlow, S. Blatt, T. Zelevinsky, G. K. Campbell, M. J. Martin, J. W. Thomsen, M. M. Boyd, and J. Ye, Euro. Phys. J. Special Top. **163**, 9 (2008).

39. *Phase Diagram for a Bose-Einstein Condensate Moving in an Optical Lattice.* J. Mun, P. Medley, G. K. Campbell, L. G. Marcassa, D. E. Pritchard and W. Ketterle. Phys. Rev. Lett. **99**, 150604 (2007)

40. *Atom Trapping with a Thin Magnetic Film.* M. Boyd, E. W. Streed, P. Medley, G. K. Campbell, J. Mun, W. Ketterle, and D. E. Pritchard, Phys. Rev. A. **76**, 043624 (2007).

41. *Imaging the Mott Insulator Shells by using Atomic Clock Shifts.* G. K. Campbell, J. Mun, M. Boyd, P. Medley, A. E. Leanhardt, L. G. Marcassa, D. E. Pritchard, and W. Ketterele, Science **313**, 649 (2006).

42. *Continuous and Pulsed Quantum Zeno Effect.* E. W. Streed, J. Mun, M. Boyd, G. K. Campbell, P. Medley, W. Ketterle, and D. E. Pritchard, Phys. Rev. Lett. **97**, 260402 (2006).

43. *Parametric Amplification of Scattered Atom Pairs.* G. K. Campbell, J. Mun, M. Boyd, E. W. Streed, W. Ketterle and D. E. Pritchard, Phys. Rev. Lett **96**, 020406 (2006).

44. *Photon Recoil Momentum in Dispersive Media.* G. K. Campbell, J. Mun, M. Boyd, E. W. Streed, W. Ketterle and D. E. Pritchard, Phys. Rev. Lett **94**, 170403 (2005).

45. *Large Atom number Bose-Einstein Condensate Machines.* Erik W. Streed, Ananth P. Chikkatur, Todd L Gustavson, Micah Boyd, Yoshio Torii, Dominik Schneble, Gretchen K. Campbell, David E. Pritchard, and Wolfgang Ketterle, Rev. Sci. Inst. **77**, 023106 (2006).

46. *Raman Amplification of Matter Waves.* D. Schneble, G. K. Campbell, E W. Streed, M. Boyd, D.E. Pritchard and W. Ketterle, Phys. Rev. A **69**, 041601(R) (2004).

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