

DAVID MINOT WELD

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Research Interests

Nonequilibrium dynamics, Floquet engineering, anyons, quantum simulation of ultrafast phenomena, quantum sensing, quasiperiodicity, energy harvesting, quantum interfaces.

Education

- Ph.D. in Physics**, Stanford University April 2007
Dissertation: *Design, Construction, and Operation of an Apparatus for Detecting Short-Length-Scale Deviations From Newtonian Gravity.*
- B.A. in Physics**, Harvard University June 1998
Magna cum laude, phi beta kappa

Research Experience

- Assistant & Associate Professor** Sept. 2011 – present
University of California, Santa Barbara
- Research Scientist** July 2010 – Sept. 2011
Massachusetts Institute of Technology
Led ^{87}Rb BEC experiment and initiated a new ^7Li BEC experiment.
- Postdoctoral Fellow** Jan. 2007 – July 2010
Massachusetts Institute of Technology
Proposed, developed, and demonstrated spin gradient thermometry and spin gradient demagnetization cooling of ultracold atoms.
- Graduate Student Researcher** Sept. 1999 – Nov. 2006
Stanford University
Developed a novel cryogenic probe to constrain deviations from Newtonian gravity at the micron scale.

Honors & Awards

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| National Science Foundation CAREER Award | 2016 |
| UC President's Research Catalyst Award (Lead PI) | 2015 |
| Presidential Early Career Award for Scientists & Engineers (PECASE) | 2014 |
| Hellman Family Faculty Fellow | 2013 |
| Alfred P. Sloan Research Fellow | 2013 |
| Young Investigator Prize, Air Force Office of Scientific Research | 2012 |
| Richard Whited Endowed Chair in Interdisciplinary Science | 2011 – 2017 |
| ARCS Fellowship | 2004 – 2005 |
| National Defense Science & Engineering Graduate Fellowship | 1999 – 2002 |

Selected Publications

Probing Nonexponential Decay in Floquet-Bloch Bands. A. Cao, C. Fujiwara, R. Sajjad, E.Q. Simmons, E. Lindroth, and D.M. Weld. *Zeit. Naturforschung A* **75**:5, 443 (2020).

Phasonic Spectroscopy of a Quantum Gas in a Quasicrystalline Lattice. S.V. Rajagopal, T. Shimasaki, P. Dotti, M. Raciunas, R. Senaratne, E. Anisimovas, A. Eckardt, and D.M. Weld. *Phys. Rev. Lett.* **123**, 223021 (2019).

Quantifying and controlling prethermal nonergodicity in interacting Floquet matter. K. Singh, K. M. Fujiwara, Z. A. Geiger, E. Q. Simmons, M. Lipatov, A. Cao, P. Dotti, S. V. Rajagopal, R. Senaratne, T. Shimasaki, M. Heyl, A. Eckardt, and D. M. Weld. *Phys. Rev. X* **9**, 041021 (2019).

Transport in Floquet-Bloch bands. K. M. Fujiwara, K. Singh, Z.A. Geiger, R. Senaratne, S. V. Rajagopal, M. Lipatov, and D.M. Weld. *Phys. Rev. Lett.* **122**, 010402 (2019).

Observation and Uses of Position-space Bloch Oscillations in an Ultracold Gas. Z. Geiger, K. M. Fujiwara, K. Singh, R. Senaratne, S. V. Rajagopal, M. Lipatov, T. Shimasaki, R. Driben, V. V. Konotop, T. Meier, and D. M. Weld. *Phys. Rev. Lett.* **120**, 213201 (2018). (Selected as an Editor's Choice, featured with a commentary in *Physics*.)

Quantum Simulation of Ultrafast Dynamics Using Trapped Ultracold Atoms. R. Senaratne, S. V. Rajagopal, T. Shimasaki, P. E. Dotti, K. M. Fujiwara, K. Singh, Z.A. Geiger, and D.M. Weld. *Nature Communications* **9**, 2065 (2018).

Energy Harvesting with a Liquid-Metal Microfluidic Influence Machine. C. Conner, T. de Visser, J. Loessberg, S. Sherman, A. Smith, S. Ma, M. Napoli, S. Pennathur, and D.M. Weld. *Phys. Rev. Applied* **9**, 044008 (2018).

Experimental Realization of a Relativistic Harmonic Oscillator. K.M. Fujiwara, Z.A. Geiger, K. Singh, R. Senaratne, S.V. Rajagopal, M. Lipatov, T. Shimasaki, and D.M. Weld. *New J. Phys.* **20**, 063027 (2018).

Observation of Two-beam Collective Scattering Phenomena in a Bose-Einstein Condensate. I. Dimitrova, W. Lunden, J. Amato-Grill, N. Jepsen, Y. Yu, M. Messer, T. Rigaldo, G. Puentes, D.M. Weld, and W. Ketterle. *Phys. Rev. A* **96**, 051603(R) (2017).

Photoacoustic Ultrasound Sources from Diffusion-limited Aggregates. K. Patel, M. Brubaker, A. Kotlerman, R. Salazar, E. Wolf, D.M. Weld. *Appl. Phys. Lett.* **109**, 183109 (2016).

Fibonacci Optical Lattices for Tunable Quantum Quasicrystals. K. Singh, K. Saha, S.A. Parameswaran, and D. M. Weld. *Phys. Rev. A* **92**, 063426 (2015).

Bragg Scattering as a Probe of Atomic Wavefunctions and Quantum Phase Transitions in Optical Lattices. H. Miyake, G. Siviloglu, G. Puentes, D.E. Pritchard, W. Ketterle, and D.M. Weld. *Phys. Rev. Lett.* **107**, 175302 (2011).

Spin Gradient Demagnetization Cooling of Atoms in an Optical Lattice. P. Medley, D. Weld, H. Miyake, D. Pritchard, and W. Ketterle. *Phys. Rev. Lett.* **106**, 195301 (2011).

Spin Gradient Thermometry for Ultracold Atoms in Optical Lattices. D.M. Weld, P. Medley, H. Miyake, D. Hucul, D. Pritchard, and W. Ketterle. *Phys. Rev. Lett.* **103**, 245301 (2009).

Teaching

Classroom Instruction & Course Development: Taught upper-division undergraduate quantum mechanics, electromagnetism, solid-state physics, and statistical mechanics. Taught and supervised expansion of honors sophomore lab class and senior lab class. Completely redesigned and taught a graduate course on special topics in condensed matter physics. Designed and taught a new graduate atomic physics course (now Physics 228) on subjects including atomic structure, atom-atom interactions, atom-field interactions, laser cooling and trapping, quantum gases, and modern experimental techniques.

Integration of Teaching and Research: Supervisor for ten undergraduate theses and thirty-two student-quarters of Physics 199, guiding undergraduate students through hands-on research. Instructor for seventy-four student-quarters of Physics 596, guiding graduate students working on advanced research projects. Worked to strengthen undergraduate laboratory research classes by commissioning a new senior lab unit on atomic spectroscopy and helping to enlarge the capacity of the honors sophomore lab sequence. Led a team which conceived, secured funding for, and installed a facility to distribute spectroscopy-grade laser light to ten research and teaching labs in Broida hall, opening up numerous exciting possibilities for direct integration of cutting-edge research with laboratory classes.

Metrics: Instructor ratings exceed departmental averages for every course taught. Nominated by the physics department for a campus-wide Distinguished Teaching Award in 2018.

Professional Activities, Mentoring, and Outreach

- *Leadership Activities:* Founding director of the California Institute for Quantum Emulation. Lead PI for the Broadly-tunable Illumination Facility for Research, Outreach, Scholarship, and Training (BIFROST), a multi-user light source facility. Graduate education coordinator for the Quantum Foundry. Co-lead organizer of the 2019 Workshop on Emerging Directions & Opportunities in Quantum Science. Lead organizer of the 2021 KITP Program “Revealing Emergent Many-Body Phenomena with Spatiotemporal Control.”
- *Mentoring:* Faculty Advisor for Training in Teaching and Mentoring at UCSB’s Center for Science and Engineering Partnerships. Scientific mentor for three postdocs, eleven graduate students, and twenty-six undergraduates.
- *Outreach to K-12 Students:* Performed scientific demonstrations and presentations on topics such as superconductivity, Bose-Einstein condensation, and fractals for audiences ranging in age from second grade through high school in San Jose CA, Redwood City CA, Malden MA, Baltimore MD and Goleta CA. Worked with UCSB’s successful “Physics Circus” elementary school outreach program.
- *Postdoctoral Professional Development:* Founded, organized, and ran a “soft skills” seminar series for postdocs at Harvard and MIT. Continued to engage with professional education of young scientists at UCSB, serving as a panelist for the professional development seminar series at the Center for Science and Engineering Partnerships.