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- EDUCATION** Ph.D., Physics, Harvard University, March 4, 2008
A.M., Physics, Harvard University, March 11, 2003
B.S., Physics *Summa Cum Laude* (Astronomy minor), Case Western Reserve University,
May 20, 2001
- POSITIONS
and
APPOINTMENTS** Assistant Professor of Physics, Amherst College, 2011–present
Research associate, University of Colorado at Boulder, 2010–2011
Continuing work in the NIST Ion Storage Group
Postdoctoral fellow, National Institute of Standards and Technology, Boulder, CO, 2008–2010
Time and Frequency Division, Ion Storage Group
Advisor: David Wineland
Graduate student, Harvard University, Cambridge, MA, 2001–2007
Advisor: Gerald Gabrielse
Teaching fellow, Harvard University Physics Department, 2002
Instructor: Eric Mazur
Undergraduate student, Case Western Reserve University, Cleveland, OH, 1997–2001
Tutor, Case Western Reserve University Physics Department, 2000–2001
Advisor: Mano Singham
Grader, Case Western Reserve University Physics Department, 1998–2000
Instructors: Robert Brown, Charles Rosenblatt
- HONORS
and
AWARDS** Michelson Postdoctoral Prize Lectureship, 2010
American Recovery and Reinvestment Act Postdoctoral Fellowship, 2010
National Research Council (NRC) Postdoctoral Research Associateship, 2008–2010
Harold T. White Prize “for excellence in the teaching of physics,” Harvard Physics Dept., 2003
Certificate of Distinction in Teaching, Harvard, 2002
National Defense Science and Engineering Graduate (NDSEG) Fellowship, 2001–2004
Phi Beta Kappa, 2000
CWRU President’s Scholarship, 1997–2001
Leslie L. Foldy Award “to the outstanding senior in physics,” CWRU, 2001
John Schoff Millis Award “to the senior with the best academic record,” CWRU, 2001
Louis K. Levy Prize “for an outstanding junior” (university-wide), CWRU, 2000
B. S. Chandrasekhar Prize “awarded upon completion of the junior year to a physics major who
has demonstrated superior performance,” CWRU, 2000
Junior Award of Arts and Sciences “to the junior with the best academic record,” CWRU, 2000
Phi Beta Kappa Prize “to a sophomore with the best academic record,” CWRU, 1999
Case Alumni Association Junior/Senior Scholarship, 1999–2001
Peter Witt Scholarship for demonstrating “a vital and active interest in the improvement of life
in Cleveland,” CWRU, 1999 & 2000
Mortar Board, 1999
National Merit Corporate Scholarship (Union Pacific Corp.), 1997–2001
Dean’s High Honors, every semester enrolled at CWRU
Eagle Scout, 1997
- GRANTS
RECEIVED** Research Corporation, Single-Investigator Cottrell College Science Award (20929), 2012–
2014, *Quantum Logic Spectroscopy of Charged Molecules*

PROFESSIONAL SOCIETIES American Physical Society, 1999–present
American Association for the Advancement of Science, 2010–present
American Association of Physics Teachers, 2011–present

TEACHING and ADVISING

AMHERST COLLEGE

COURSES TAUGHT

- Introductory Physics II: Electromagnetism and Optics (PHYS-117), Fall 2012
- Quantum Mechanics (PHYS-348), Spring 2012
- Introductory Physics II: Electromagnetism and Optics, Lab sections (PHYS-117L), Spring 2012
- Modern Physics (PHYS-225), Fall 2011, Fall 2012
- Introductory Physics I: Mechanics and Wave Motion, Lab section (PHYS-116L), Fall 2011

THESIS STUDENTS ADVISED

- Celia Ou, 2013
- Shenglan Qiao, 2013

SPECIAL TOPICS COURSES

- Laser Applications, Fall 2012
- Quantum Physics Research, Spring 2012

ADVISING

- Advisor for two students
- First-year advisor for six students
- Research supervision of seven students: Summer 2011: Steven Santos '13; Fall 2011: Ben Scheetz '12; Interterm 2012: Celia Ou '13, Shah Saad Alam '14; Spring 2012: Ben Scheetz '12; Summer 2012: Celia Ou '13, Shenglan Qiao '13, Cheyenne Teng '14E, Dvij Bajpai '15; Fall 2012: Celia Ou '13, Shenglan Qiao '13, Cheyenne Teng '14E, Dvij Bajpai '15

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

- Coordinated the work of three graduate students on a quantum-information experiment
- Supervised one undergraduate student (projects included designing a control system for laser intensity stabilization and increasing beam-pointing stability by reducing air turbulence on a laser table)

HARVARD UNIVERSITY

UNDERGRADUATE SUPERVISION

- Supervised five undergraduate students
- Projects all aimed at increasing apparatus stability, including characterizing laboratory vibrations, designing a pump room and vacuum system, and calculating the magnetic field homogeneity and inductance matrix for a new solenoid

TEACHING FELLOW

- Assisted in teaching *Principles of Physics: Electricity, Waves, Nuclear Physics (Physics 1b)*, the second semester of a year-long introductory physics course for students in the life sciences
- Received the teaching awards mentioned above
- Co-taught a section of 12 students and whole-class review sessions
- Wrote and graded problem sets and exams
- Aided instruction during main lectures, which were taught using Peer Instruction, an

interactive format

CASE WESTERN RESERVE UNIVERSITY

- Tutored students at all levels of introductory physics through GetHIP (Get Help-In-Physics) Walk-In Tutoring
- Designed a java applet for *Introduction to Quantum Mechanics (PHYS 331)*
- Grader for *Physics and Frontiers I (PHYS 123)* (advanced freshman mechanics)
- Grader for *Physics and Frontiers II (PHYS 124)* (advanced freshman E&M)

**RESEARCH
EXPERIENCE**

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

- Realized the first programmable multi-qubit quantum processor
- Demonstrated a complete methods set for scalable ion-trap-based quantum information processing
- Created the first entangled state of two separated mechanical oscillators
- “Breakthrough of the Year” (*Physics World*, 2009)
- “Science News of the Year” (*Science News*, 2009)
- “Top 100 Stories of 2009” (*Discover*)
- Utilized quantum control of the internal and external degrees of freedom of individually trapped ${}^9\text{Be}^+$ and ${}^{24}\text{Mg}^+$ ions

HARVARD UNIVERSITY

- **Ph.D. Thesis: Cavity Control in a Single-Electron Quantum Cyclotron: An Improved Measurement of the Electron Magnetic Moment**
- Two new measurements of the electron magnetic moment
- Final uncertainty more than 15-times below the celebrated 1987 University of Washington measurement
- Determined the most accurate value of the fine structure constant
- “Physics Story of the Year” (American Institute of Physics’s *Physics News Update*, 2006)
- Performed precision frequency spectroscopy of a single trapped electron through quantum control and detailed analysis of systematic effects

CASE WESTERN RESERVE UNIVERSITY

- **Senior Thesis: A New Technique for Measuring Isotopic Impurity Diffusion in Solid Helium** (advisor: Arnold Dahm)
- Modeled force propagation in granular matter (advisor: Harsh Mathur)
- Simulated the dynamics of a sonoluminescing bubble and found an experimentally accessible order-to-chaos transition (advisors: Harsh Mathur and Kathleen Kash)

**PROFESSIONAL
SERVICE**

Referee for *Physical Review Letters*, 2010–present
Referee for *Physical Review A*, 2010–present
Referee for *Foundations of Physics*, 2010

**COLLEGE
SERVICE**

College Housing Committee, 2012–present
Moodle pilot program, 2011–2012

PUBLICATIONS **REFEREED PUBLICATIONS**
and
PRESENTATIONS

Coherent Diabatic Ion Transport and Separation in a Multizone Trap Array

R. Bowler, J. Gaebler, Y. Lin, T. R. Tan, D. Hanneke, J. D. Jost, J. P. Home, D. Leibfried, and D. J. Wineland
Physical Review Letters **109**, 080502 (2012)

Randomized Benchmarking of Multiqubit Gates

J. P. Gaebler, A. M. Meier, T. R. Tan, R. Bowler, Y. Lin, D. Hanneke, J. D. Jost, J. P. Home, E. Knill, D. Leibfried, and D. J. Wineland
Physical Review Letters **108**, 260503 (2012)

Normal modes of trapped ions in the presence of anharmonic trap potentials

J. P. Home, D. Hanneke, J. D. Jost, D. Leibfried, D. J. Wineland
New Journal of Physics **13**, 073026 (2011)

Cavity control of a single-electron quantum cyclotron: Measuring the electron magnetic moment

D. Hanneke, S. Fogwell Hoogerheide, and G. Gabrielse
Physical Review A **83**, 052122 (2011)

Realization of a programmable two-qubit quantum processor

D. Hanneke, J. P. Home, J. D. Jost, J. M. Amini, D. Leibfried & D. J. Wineland
Nature Physics **6**, 13–16 (2010)

Complete Methods Set for Scalable Ion Trap Quantum Information Processing

Jonathan P. Home, David Hanneke, John D. Jost, Jason M. Amini, Dietrich Leibfried, David J. Wineland
Science **325**, 1227–1230 (2009)

Entangled Mechanical Oscillators

J. D. Jost, J. P. Home, J. M. Amini, D. Hanneke, R. Ozeri, C. Langer, J. J. Bollinger, D. Leibfried, and D. J. Wineland
Nature **459**, 683–685 (2009)

New Measurement of the Electron Magnetic Moment and the Fine Structure Constant

D. Hanneke, S. Fogwell, and G. Gabrielse
Physical Review Letters **100**, 120801 (2008)

New Measurement of the Electron Magnetic Moment Using a One-Electron Quantum Cyclotron

B. Odom, D. Hanneke, B. D'Urso, and G. Gabrielse
Physical Review Letters **97**, 030801 (2006)

New Determination of the Fine Structure Constant from the Electron g Value and QED

G. Gabrielse, D. Hanneke, T. Kinoshita, M. Nio, and B. Odom
Physical Review Letters **97**, 030802 (2006)
An error by our theory collaborators was fixed in *Ibid.* **99**, 039902(E) (2007)

Single-Particle Self-Excited Oscillator

B. D'Urso, R. Van Handel, B. Odom, D. Hanneke, and G. Gabrielse
Physical Review Letters **94**, 113002 (2005)

OTHER PUBLICATIONS AND PRESENTATIONS

New Laser Scientists Conference, October, 2012, Rochester, NY

Invited talk: **Precision Measurements with Trapped Ions**

Southwest Quantum Information and Technology (SQuInT), February, 2011, Boulder, CO

Poster presented: **Quantum Information Processing using Scalable Techniques**

Workshop on Ion Trap Technology, February, 2011, Boulder, CO

Poster presented: **Quantum Information Processing using Scalable Techniques**

Amherst College, February, 2011, Amherst, MA

Colloquium: **Measuring the Electron Magnetic Moment**

Harvey Mudd College, January, 2011, Claremont, CA

Colloquium: **Measuring the Electron Magnetic Moment**

APS Laser Science (LS), October, 2010, Rochester, NY

Invited talk: **Progress towards Scalable Quantum Information Processing with Trapped Ions**

International Conference on Atomic Physics (ICAP), July, 2010, Cairns, Australia

Poster presented: **Multi-Qubit Operations using Scalable Techniques**

International Symposium on Lepton Moments, July, 2010, Centerville, Cape Cod, MA

Invited talk: **Measuring the Electron Magnetic Moment**

Michelson Postdoctoral Prize Lectures, May 10–14, 2010, Cleveland, OH

Entangled Mechanical Oscillators and a Programmable Quantum Computer: Adventures in Coupling Two-Level Systems to Quantum Harmonic Oscillators

Optical Atomic Clocks

Cavity Control in a Single-Electron Quantum Cyclotron: An Improved Measurement of the Electron Magnetic Moment

High-Energy Physics with Low-Energy Symmetry Studies

NIST Time and Frequency Division Seminar, March 18, 2010, Boulder, CO

Invited talk: **Cavity Control in a Single Electron Quantum Cyclotron: An Improved Measurement of the Electron Magnetic Moment**

Southwest Quantum Information and Technology (SQuInT), February, 2010, Santa Fe, NM

Contributed talk: **Putting the pieces together: Recent progress with trapped ions at NIST**

SPIE Photonics West, January, 2010, San Francisco, CA

Invited talk: **Recent progress in quantum information processing with trapped ions**

Boulder Laboratories Postdoctoral Poster Symposium 2009, Boulder, CO

Poster presented: **Universal quantum control of two qubits**

APS Division of Atomic, Molecular, and Optical Physics (DAMOP) 2009, Charlottesville, VA

Contributed talk: **Sympathetic cooling and trapped-ion quantum logic (Repeated two-qubit logic gates with scalable techniques)**

David Hanneke, J. D. Jost, J. P. Home, J. M. Amini, R. Ozeri, C. Langer, J. J. Bollinger, D. Leibfried, D. J. Wineland

Gordon Research Conference 2008 (Quantum Information Science), Big Sky, MT
Poster presented: **Distribution of entanglement in an ion trap array**

International Conference on Atomic Physics (ICAP) 2008, Storrs, CT
Proceedings: **More Accurate Measurement of the Electron Magnetic Moment and the Fine Structure Constant**

D. Hanneke, S. Fogwell, N. Guise, J. Dorr, and G. Gabrielse
In R. Côté, P. L. Gould, M. Rozman, W. W. Smith (eds.), *Pushing the Frontiers of Atomic Physics: Proceedings of the XXI International Conference on Atomic Physics*
World Scientific, pp. 46–55, 2009

Precision pins down the electron's magnetism

G. Gabrielse and D. Hanneke
CERN Courier, October 2006, pp. 35–37

International Conference on Atomic Physics (ICAP) 2006, Innsbruck, Austria
Poster presented: **New Measurement of the Electron Magnetic Moment and Fine Structure Constant**

Proceedings: **New Measurement of the Electron Magnetic Moment and Fine Structure Constant**

G. Gabrielse and D. Hanneke
In C. Roos, H. Haffner, R. Blatt (eds.), *Atomic Physics 20: XX International Conference on Atomic Physics – ICAP 2006*
AIP Conference Proceedings, Vol. 869, pp. 68–75, 2006

Conference on the Intersections of Particle and Nuclear Physics (CIPANP) 2006, Puerto Rico
Proceedings: **New Measurement of the Electron Magnetic Moment and Fine Structure Constant**

G. Gabrielse and D. Hanneke
In T. Liss (ed.), *Intersections of Particle and Nuclear Physics: 9th Conference CIPANP 2006*
AIP Conference Proceedings, Vol. 870, pp. 328–332, 2006

Lepton Moments International Symposium 2006, Cape Cod, MA
Poster presented: **New Measurement of the Electron Magnetic Moment and Fine Structure Constant**

International Conference on Atomic Physics (ICAP) 2004, Rio de Janeiro, Brazil
Poster presented: **Toward an Improved Electron $g-2$ Measurement**

SECONDARY REPORTS ON THE TRAPPED-ION WORK

- Moving Traps Offer Fast Delivery of Cold Ions**, Christian Roos, *Physics* **5**, 94 (2012)
Highlight of 2011, *New Journal of Physics*
Breakthrough of the Year, *Physics World*, posted online December 21, 2009
2009 Science News of the Year: Matter & Energy, *Science News*, January 2, 2010, Vol. 177
#1, p. 24
Top 100 Stories of 2009 – #40, Elizabeth Svoboda, *Discover*, January/February 2010, p.49
First Programmable Quantum Computer Created, Laura Sanders, *Science News*, December
19, 2009, Vol. 176 #13, p. 13
First universal programmable quantum computer unveiled, Colin Barras, *New Scientist*
online, November 15, 2009
The pieces put together, *Nature Physics* **5**, 622 (2009)
Mechanical Systems All Tangled Up, Laura Sanders, *Science News*, July 4, 2009, Vol. 176
#1, p.8
Physics Update: Entangled mechanical oscillators, *Physics Today*, July 2009, 22
Entanglement goes mechanical, Rainer Blatt, *Nature* **459**, 653–654 (2009)
Quantum Computing with Ions, Christopher R. Monroe and David J. Wineland, *Scientific
American*, August 2008, 64–71

SECONDARY REPORTS ON THE g -VALUE WORK

- The Physics Story of the Year for 2006**, P. Schewe, B. Stein, and D. Castelvechi, *Physics
News Update* 804, December 5, 2006
Plumbing the Electron's Depths, P. Schewe and B. Stein, *Physics News Update* 783, July 5,
2006
A More Precise Fine Structure Constant, D. Kleppner, *Science* **313**, 448–449 (2006)
A Finer Constant, A. Czarnecki, *Nature* **442**, 516–517 (2006)
**Gyromagnetic Ratio of a Lone Trapped Electron is Measured to Better than a Part Per
Trillion**, B. Schwarzhild, *Physics Today*, August 2006, 15–17
Precision pins down the electron's magnetism, G. Gabrielse and D. Hanneke, *CERN Courier*,
October 2006, 35–37
The Magnet in the Electron, G. Gabrielse, *Physics World*, February 2007, 32–36
In Constant Search of 'alpha', M. Inman, *New Scientist* **2568**, 40–43 (2006)