

## DAVID HANNEKE

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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

Associate Professor of Physics, Amherst College, 2018–present

### and

Assistant Professor of Physics, Amherst College, 2011–2018

### APPOINTMENTS

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

### GRANTS

### RECEIVED

National Science Foundation (PHY–2207623), 2022–2025,

*RUI: PM: Optical Molecular Clocks for New Physics Searches*

National Science Foundation (PHY–1806223), 2018–2023,

*RUI: Driving Forbidden Vibrational Overtones in Trapped Molecular Ions*

National Science Foundation (PHY–1255170), 2013–2019,

*CAREER: Fundamental Physics through Precision Measurement of Trapped Charged Particles*

Research Corporation, Single-Investigator Cottrell College Science Award (20929),  
2012–2014,

*Quantum Logic Spectroscopy of Charged Molecules*

### HONORS

### and

### AWARDS

Senior Sabbatical Fellowship, Amherst College, 2018–2019, 2022

Trustee Faculty Fellowship, Amherst College, 2014–2015

Cottrell Scholar, Research Corporation, Class of 2012

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

**TEACHING  
and  
ADVISING**

**COURSES TAUGHT**

- Oscillations and Waves (PHYS 125), Fall 2023
- Quantum Mechanics I (PHYS 348), Spring 2023
- Spacetime, Particles, and the Universe (PHYS 113), Spring 2023
- The Maxwellian Synthesis: Dynamics of Charges and Fields (PHYS 124), Spring 2022
- Oscillations and Waves (PHYS 125), Fall 2021
- Space, Time, Matter, and the Cosmos (PHYS 113), Fall 2021
- The Maxwellian Synthesis: Dynamics of Charges and Fields (PHYS 124), Spring 2021
- Oscillations and Waves (PHYS 125), Fall 2020
- Signals and Noise Laboratory (PHYS 226), Spring 2020
- The Maxwellian Synthesis: Dynamics of Charges and Fields (PHYS 124), Spring 2020
- Oscillations and Waves (PHYS 125), Fall 2019
- Signals and Noise Laboratory (PHYS 226), Spring 2018
- The Newtonian Synthesis: Dynamics of Particles and Systems, Waves (PHYS 123), Fall 2017
- Signals and Noise Laboratory (PHYS 226), Spring 2017
- The Newtonian Synthesis: Dynamics of Particles and Systems, Waves (PHYS 123), Fall 2016
- Intermediate Laboratory (PHYS 226), Spring 2016
- The Newtonian Synthesis: Dynamics of Particles and Systems, Waves (PHYS 123), Fall 2015
- Quantum Mechanics (PHYS 348), Spring 2014
- Statistical Mechanics and Thermodynamics (PHYS 230), Spring 2014
- Introductory Physics II: Electromagnetism and Optics (PHYS 117), Fall 2013
- Quantum Mechanics (PHYS 348), Spring 2013
- Statistical Mechanics and Thermodynamics (PHYS 230), Spring 2013
- Introductory Physics II: Electromagnetism and Optics (PHYS 117), Fall 2012
- Modern Physics (PHYS 225), 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
- Introductory Physics I: Mechanics and Wave Motion, Lab section (PHYS 116L), Fall 2011

**SPECIAL TOPICS COURSES**

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

#### HONORS THESIS STUDENTS ADVISED

- Lukas Song '24
- Will Henshon '23, *Radiofrequency circuit design for ion trapping of  $O_2^+$  molecules*
- Addison Hartman '22, *Two-Photon Vibrational Transitions in  $O_2^+$*
- Annika Lunstad '21, *Driving Forbidden Vibrational Transitions in Molecular Oxygen*
- Boran Kuzhan '21E, *A Molecular Beam Apparatus to Search for Time-Variation of Fundamental Constants*
- Julia Pfatteicher '19, *Developing Rapid Quenching Electronics for Coupling an Ion Trap to a Mass Spectrometer*
- Christian Pluchar '18, *An Ultraviolet Laser for Beryllium Photoionization*
- Alex Frenett '18, *State-selective Production of Oxygen Molecular Ions for New Physics Searches*
- David Lane '17, *Developing a Quantum Toolbox: Experiments with a Single-Atom Harmonic Oscillator and Prospects for Probing Molecular Ions*
- Edward (Ned) Kleiner '16, *Quantum Control of  $Be^+$  Ions*
- Jiajun Shi '15E, *Radiofrequency Synthesis System for Laser Modulation*
- Phyto Aung Kyaw '14, *Constructing an Ultra-High Vacuum Chamber and a Radio Frequency Helical Resonator for Trapping Ions*
- Chu Cheyenne Teng '14E, *Frequency Control and Stabilization of a Laser System*
- Celia Ou '13, *Third Harmonic Conversion*
- Shenglan Qiao '13, *Constructing a Linear Paul Trap System for Measuring the Time-variation of Electron-Proton Mass Ratio*

#### ADVISING

- Postdoctoral advisor for Dr. Ryan Carollo
- Academic advisor for 82 students
- Faculty advising network, 2017–2018
- Research supervision of 44 students

#### COLLEGE SERVICE

Chair, Physics & Astronomy Department, 2023–2026  
Observatory Director, 2021–present  
Committee on Educational Policy, 2023–2025  
Equity in Course Materials (“Textbook”) Task Force, 2023  
Committee on Adjudication, 2021–2022  
Committee on Academic Standing and Special Majors, 2019–2021 (co-chair, 2020–2021)  
Science Faculty Steering Committee, 2019–2022, 2023–present  
Student Fellowships Committee, 2015–2017  
Advisor to the Electronics Club, 2013–present  
College Housing Committee, 2012–2014  
Laura Ayres Snyder Poetry Prize Committee, 2016  
Physics & Astronomy Department Curriculum Committee, 2012–2017  
Search committees for tenure-track faculty (3), visiting faculty and other teaching staff (7), and technical or administrative staff (5)

**PROFESSIONAL SERVICE** Chair line of the American Physical Society's Topical Group on Precision Measurement & Fundamental Constants, (Vice Chair, 2019–2020; Chair-Elect, 2020–2021; Chair, 2021–2022; Past Chair, 2022–2023)  
Program Committee for the annual meeting of the American Physical Society's Division of Atomic, Molecular, and Optical Physics (DAMOP), chair of the Collisions & Spectroscopy Subcommittee, 2018–2021  
Member-at-Large, Executive Committee of the APS's Topical Group on Precision Measurement & Fundamental Constants, 2015–2018  
Reviewer for the *National Science Foundation* (panelist, site visit team, ad hoc reviewer)  
• *Department of Energy* • *Research Corporation for Science Advancement* • *National Institute of Standards and Technology* • *United Kingdom Research and Innovation* • *Alfred P. Sloan Foundation* (past 5 years)  
Journal referee for *Physical Review Letters* • *Physical Review A* • *Review of Scientific Instruments* • *Journal of Molecular Spectroscopy* • *Foundations of Physics* • *Modern Physics Letters A* • *The Journal of Physical Chemistry Letters* • *Journal of the Optical Society of America B* • *Annalen der Physik* (past 5 years)

**PUBLICATIONS and PRESENTATIONS** \* indicates an undergraduate co-author

**PEER-REVIEWED PUBLICATIONS**

**Optical clocks based on molecular vibrations as probes of variation of the proton-to-electron mass ratio**

David Hanneke, Boran Kuzhan\*, Annika Lunstad\*  
*Quantum Science and Technology* **6**, 014005 (2021)

**Two-Photon Vibrational Transitions in  $^{16}\text{O}_2^+$  as Probes of Variation of the Proton-to-Electron Mass Ratio**

Ryan Carollo, Alexander Frenett\*, David Hanneke  
*Atoms* **7**, 1 (2019)

**Third-harmonic-generation of a diode laser for quantum control of beryllium ions**

Ryan A. Carollo, David A. Lane\*, Edward K. Kleiner\*, Phyoo Aung Kyaw\*, Chu C. Teng\*, Celia Y. Ou\*, Shenglan Qiao\*, David Hanneke  
*Optics Express* **25** 7220–7229 (2017)

**High sensitivity to variation in the proton-to-electron mass ratio in  $\text{O}_2^+$**

D. Hanneke, R. A. Carollo, D. A. Lane\*  
*Physical Review A* **94**, 050101(R) (2016)

**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)

Ibid. **109**, 179902(E) (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)

**INVITED TALKS**

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, May, 2019,  
Milwaukee, WI

Invited talk: **Optical clocks based on molecular vibrations as probes of time-varying mass ratios**

Dartmouth College, April, 2019, Hanover, NH

Colloquium: **Driving Forbidden Vibrational Overtones in Trapped Molecular Ions**

Northwestern University Center for Fundamental Physics, February, 2019, Evanston, IL

Colloquium: **Driving Forbidden Vibrational Overtones in Trapped Molecular Ions**

Tufts University, September, 2018, Medford, MA

Condensed Matter Seminar: **Driving Forbidden Vibrational Overtones in Trapped Molecular Ions**

Optics and Photonics Workshop, January, 2018, Tucson, AZ

Invited talk: **Optical control of atomic and molecular quantum states**

1<sup>st</sup> North American Conference on Trapped Ions (NACTI), August, 2017, Boulder, CO

Invited talk: **Nonpolar Molecular Ions for Precision Measurements**

International Workshop on Cold Molecular Ions, May–June, 2017, Haute Savoie, France

Invited talk: **Nonpolar molecular ions for precision measurements**

Hamilton College, October, 2016, Clinton, NY

Colloquium: **Quantum Control of Molecular Ions**

Bates College, November, 2014, Lewiston, ME

Colloquium: **A Programmable Quantum Information Processor**

Williams College, February, 2013, Williamstown, MA

Colloquium: **A Programmable Quantum Information Processor**

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

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

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 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**

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

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

#### **OTHER PUBLICATIONS AND PRESENTATIONS**

Gordon Research Conference (Atomic Physics), June, 2023, Newport, RI

Poster presented: **An Optical Molecular Clock for New Physics Searches**

David Hanneke, Will Henshon\*, Lillia Hammond\*, Ouyanatu Maina\*, Michael Mitchell\*, Rachel Willick\*

APS New England Section Meeting, March, 2023, Amherst, MA

Poster presented: **Determining the Masses of Ions in a Paul Trap**

Michael Mitchell\*, Lillia Hammond\*, Rachel Willick\*, David Hanneke

Poster presented: **Modeling Electric Potentials and Fields of a Paul Trap Using SIMION**

Rachel Willick\*, Lillia Hammond\*, Michael Mitchell\*, David Hanneke

#### **New Horizons: Scalar and Vector Ultralight Dark Matter**

D. Antypas, . . . , D. Hanneke, *et al.* (129 authors)

Submitted to the Proceedings of the US Community Study on the Future of Particle Physics (Snowmass 2021)

arXiv:2203.14915

#### **Quantum Sensors for HEP Science - Interferometers, Mechanics, Traps, and Clocks**

Oliver Buchmueller, . . . , David Hanneke, *et al.* (16 authors)

Submitted to the Proceedings of the US Community Study on the Future of Particle Physics (Snowmass 2021)

arXiv:2203.07250

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, June, 2021, Virtual

Poster presented: **Driving forbidden vibrational transitions in  $O_2^+$**

Annika Lunstad\*, Boran Kuzhan\*, Addison Hartman\*, Ethan Spingarn\*, David Hanneke

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, June, 2020,  
Virtual

Poster presented: **Two-photon vibrational transitions in  $O_2^+$**

Boran Kuzhan\*, Annika Lunstad\*, James Logan\*, Addison Hartman\*, David Hanneke

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, May, 2019,  
Milwaukee, WI

Contributed talk: **Two-Photon Vibrational Transitions in  $O_2^+$  as Probes of Variation of the Proton-to-Electron Mass Ratio**

David Hanneke, Ryan Carollo, Alexander Frenett\*

Poster presented: **Progress towards spectroscopy of forbidden vibrational overtones in  $O_2^+$**

Annika Lunstad\*, Julia Pfatteicher\*, David Hanneke

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, May, 2018, Ft.  
Lauderdale, FL

Contributed talk: **Search for Time Variation of Fundamental Constants in Nonpolar Molecular Ions**

Ryan Carollo, Alexander Frenett\*, Christian Pluchar\*, David Hanneke

Poster presented: **Toward All-Optical Loading of Co-Trapped  $Be^+$  and  $O_2^+$**

Alexander Frenett\*, Christian Pluchar\*, Ryan Carollo, David Hanneke

Advance Laboratory Physics Association (ALPhA) New England Regional Conference, June,  
2017, Amherst, MA

Led tours of Amherst College's laboratory facilities.

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, June, 2017,  
Sacramento, CA

Poster presented: **Towards measurements with sympathetically cooled state-selected molecular ions**

Ryan A. Carollo, David A. Lane\*, Alexander Frenett\*, David Hanneke

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, May, 2016,  
Providence, RI

Poster presented: **Towards quantum control of molecular ions**

David Hanneke, Edward Kleiner\*, Alexander Frenett\*

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, June, 2015,  
Columbus, OH

Poster presented: **Trapped ion system for multi-species quantum control**

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

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

R. Bowler, D. Hanneke, J. D. Jost, J. P. Home, Y. Lin, T-R. Tan, D. Leibfried, D. J. Wineland

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

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

R. Bowler, D. Hanneke, J. D. Jost, J. P. Home, Y. Lin, T-R. Tan, D. Leibfried, D. J. Wineland



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

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

J. P. Home, D. Hanneke, J. D. Jost, R. Bowler, J. Amini, Y. Lin, T-R. Tan, D. Leibfried, D. J. Wineland

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

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

Boulder Laboratories Postdoctoral Poster Symposium 2009, Boulder, CO

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

David Hanneke, Jonathan Home, John Jost, Jason Amini, Dietrich Leibfried, David Wineland

APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting, 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**

J. D. Jost, J. P. Home, J. Amini, C. Langer, R. Ozeri, D. Hanneke, J. J. Bollinger, R. B. Blakestad, K. R. Brown, J. Britton, D. Leibfried, S. Seidelin, N. D. Walrath, D. J. Wineland

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**

D. Hanneke, B. Odom, B. D'Urso, G. Gabrielse

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**

D. Hanneke, B. Odom, B. D'Urso, G. Gabrielse

International Conference on Atomic Physics (ICAP) 2004, Rio de Janeiro, Brazil

Poster presented: **Toward an Improved Electron  $g-2$  Measurement**

David A. Hanneke, Brian C. Odom, Gerald Gabrielse

## 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

- Deviations from 2**, A. Moscatelli, *Nature Physics* **13**, 518 (2017)  
**Fundamental constants: The teamwork of precision**, E. G. Myers, *Nature* **506**, 440–441 (2014)  
**The standard model’s greatest triumph**, G. Gabrielse, *Physics Today* **66**(12), 64 (2013)  
**The Physics Story of the Year for 2006**, P. Schewe, B. Stein, and D. Castelvecchi, *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)