

Stanford



Leo Hollberg

Professor (Research) of Physics

 Curriculum Vitae available Online

CONTACT INFORMATION

- **Administrative Contact**

Ping Feng

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Bio

BIO

How can we make optimal use of quantum systems (atoms, lasers, and electronics) to test fundamental physics principles, enable precision measurements of space-time and when feasible, develop useful devices, sensors, and instruments?

Professor Hollberg's research objectives include high precision tests of fundamental physics as well as applications of laser physics and technology. This experimental program in laser/atomic physics focuses on high-resolution spectroscopy of laser-cooled and -trapped atoms, non-linear optical coherence effects in atoms, optical frequency combs, optical/microwave atomic clocks, and high sensitivity trace gas detection. Frequently this involves the study of laser noise and methods to circumvent measurement limitations, up to, and beyond, quantum limited optical detection. Technologies and tools utilized include frequency-stabilized lasers and chip-scale atomic devices. Based in the Hansen Experimental Physics Laboratory (HEPL), this research program has strong, synergistic, collaborative connections to the Stanford Center on Position Navigation and Time (SCPNT). Research directions are inspired by experience that deeper understanding of fundamental science is critical and vital in addressing real-world problems, for example in the environment, energy, and navigation. Amazing new technologies and devices enable experiments that test fundamental principles with high precision and sometimes lead to the development of better instruments and sensors. Ultrasensitive optical detection of atoms, monitoring of trace gases, isotopes, and chemicals can impact many fields. Results from well-designed experiments teach us about the "realities" of nature, guide and inform, occasionally produce new discoveries, frequently surprise, and almost always generate new questions and perspectives.

ACADEMIC APPOINTMENTS

- Professor (Research), Physics

ADMINISTRATIVE APPOINTMENTS

- Professor, Dept. of Physics, Stanford University, (2011- present)
- Lecturer, University of Colorado, Department of Physics, (1988- present)
- Postdoctoral position, A.T.&T. Bell Labs, (1984-1985)
- Postdoctoral position, Joint Institute for Laboratory Astrophysics, (1984-1984)
- Teaching assistant, Undergraduates Dept. Physics, Stanford University, (1975-1975)
- Fellow, Optical Society of America, (2003-2003)
- Fellow, American Physical Society, (2003-2003)

HONORS AND AWARDS

- Gold Medal Award, Department of Commerce (2001)
- Silver Medal Award, Department of Commerce (2005)
- I.I. Rabi award, IEEE-UFFC, International Frequency Control Symposium (2007)
- William F. Meggers Award, Optical Society of America (2009)
- Rank Prize for Optoelectronics, Rank Prize Funds (2013)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Chief Technical Officer, AOSense (2008 - 2011)
- Staff scientist, National Institute of Standards and Technology, Time and Frequency Division (1985 - 2008)
- Group Leader, National Institute of Standards and Technology, Time and Frequency Division (1985 - 2008)
- Research Assistant, Joint Institute for Laboratory Astrophysics (JILA) (1977 - 1984)
- Research Assistant, United States Geological Survey (1976 - 1977)
- Member, American Physical Society (APS)
- Member, Optical Society of America (OSA)
- Member, International IEEE
- Deputy Director, Stanford Center for Position Navigation and Time, SCPNT (2012 - 2013)
- Member, Physics Dept. Graduate Admissions Committee, Stanford University (2012 - 2013)
- Member, NASA Review Committee on Cold Atom Laboratory for Space (2013 - 2013)

PROFESSIONAL EDUCATION

- B.S., Stanford University , Physics (1976)
- Ph.D., University of Colorado, Boulder , Physics (1984)

PATENTS

- Leo Hollberg, J. Kitching, R. Wynands, S. Knappe. "United States Patent 10/175,324 Method of minimizing the short-term frequency instability of laser-pumped atomic clocks"
- Leo Hollberg, J. Kitching. "United States Patent 10/175,498 Miniature frequency standard based on all-optical containment vessel"
- Leo Hollberg, J. Kitching, L-A. Liew, S. Knappe, J. Moreland, V.L. Velichansky, H.G. Robinson. "United States Patent 10/821,236 Micromachined alkali-atom vapor cells and method of microfabrication"
- Leo Hollberg, Ma Lang-sheng, Jon H. Shirley, John L. Hall. "United States Patent 4,590,597. Modulation Transfer Spectroscopy for Stabilizing Lasers"
- Leo Hollberg, B. Dahmani. "United States Patent 4,907,237. Optical Feedback Locking of Semiconductor Lasers"

Teaching

COURSES

2020-21

- Experimental Methods in Quantum Physics: PHYSICS 106 (Spr)

2019-20

- Intermediate Physics Laboratory II: Experimental Techniques and Data Analysis: PHYSICS 107 (Win)

2018-19

- Intermediate Physics Laboratory II: Experimental Techniques and Data Analysis: PHYSICS 107 (Win)

2017-18

- Intermediate Physics Laboratory II: Experimental Techniques and Data Analysis: PHYSICS 107 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Dylan Black, Chas Blakemore, Edgard Bonilla, Yijun Jiang, Kuan-Yu Lin, Yunfan Wu

Orals Evaluator

Yudan Guo

Doctoral Dissertation Advisor (AC)

Hongquan Li, Tina Na Narong

Doctoral Dissertation Co-Advisor (AC)

Hunter Swan

Doctoral (Program)

Clarke Hardy, Noah Huffman, Aditya Mahadevan, Nicholas O'Dea, Jyotirmai Singh, Michelle Wu

Publications

PUBLICATIONS

- **Effect of atmospheric turbulence on timing instability for partially reciprocal two-way optical time transfer links** *PHYSICAL REVIEW A*
Taylor, M. T., Belmonte, A., Hollberg, L., Kahn, J. M.
2020; 101 (3)
- **Two-Way Time and Frequency Transfer via Ground-to-Satellite Optical Communications Links**
Taylor, M. T., Kahn, J. M., Hollberg, L., Inst Navigat
INST NAVIGATION.2020: 207–15
- **Architecture for the photonic integration of an optical atomic clock** *OPTICA*
Newman, Z. L., Maurice, V., Drake, T., Stone, J. R., Briles, T. C., Spencer, D. T., Fredrick, C., Li, Q., Westly, D., Ilic, B. R., Shen, B., Suh, M., Yang, et al
2019; 6 (5): 680–85
- **Polarization effects in silicon-nitride waveguides: Super-continuum, carrier-envelope offset, and optical beatnotes**
Wang, L., Li, H., Carlson, D., Papp, S. B., Hollberg, L., IEEE
IEEE.2019
- **Space-time reference with an optical link** *CLASSICAL AND QUANTUM GRAVITY*
Berceau, P., Taylor, M., Kahn, J., Hollberg, L.
2016; 33 (13)
- **Resonant interaction of trapped cold atoms with a magnetic cantilever tip** *PHYSICAL REVIEW A*
Montoya, C., Valencia, J., Geraci, A. A., Eardley, M., Moreland, J., Hollberg, L., Kitching, J.
2015; 91 (6)
- **Optical phase-noise dynamics of Titanium:sapphire optical frequency combs** *OPTICS COMMUNICATIONS*
Quraishi, Q., Diddams, S. A., Hollberg, L.
2014; 320: 84-87
- **Femtosecond frequency comb measurement of absolute frequencies and hyperfine coupling constants in cesium vapor** *PHYSICAL REVIEW A*
Stalnaker, J. E., Mbele, V., Gerginov, V., Fortier, T. M., Diddams, S. A., Hollberg, L., Tanner, C. E.
2010; 81 (4)
- **Optical frequency stabilization of a 10 GHz Ti:sapphire frequency comb by saturated absorption spectroscopy in (87)rubidium** *PHYSICAL REVIEW A*

-
- Heinecke, D. C., Bartels, A., Fortier, T. M., Braje, D. A., Hollberg, L., Diddams, S. A.
2009; 80 (5)
- **Brillouin-Enhanced Hyperparametric Generation of an Optical Frequency Comb in a Monolithic Highly Nonlinear Fiber Cavity Pumped by a cw Laser** *PHYSICAL REVIEW LETTERS*
Braje, D., Hollberg, L., Diddams, S.
2009; 102 (19)
 - **Generation of 20 GHz, sub-40 fs pulses at 960 nm via repetition-rate multiplication** *OPTICS LETTERS*
Kirchner, M. S., Braje, D. A., Fortier, T. M., Weiner, A. M., Hollberg, L., Diddams, S. A.
2009; 34 (7): 872-874
 - **Improved signal-to-noise ratio of 10 GHz microwave signals generated with a mode-filtered femtosecond laser frequency comb** *OPTICS EXPRESS*
Diddams, S. A., Kirchner, M., Fortier, T., Braje, D., Weiner, A. M., Hollberg, L.
2009; 17 (5): 3331-3340
 - **Low-noise synthesis of microwave and millimetre-wave signals with optical frequency comb generator** *ELECTRONICS LETTERS*
Xiao, S., Hollberg, L., Diddams, S. A.
2009; 45 (3): 170-171
 - **Toward Ultrafast Optical Waveform Synthesis with a Stabilized Ti:Sapphire Frequency Comb** *16th International Conference on Ultrafast Phenomena*
Kirchner, M. S., Fortier, T. M., Braje, D., Weiner, A. M., Hollberg, L., Diddams, S. A.
SPRINGER-VERLAG BERLIN.2009: 861-863
 - **Low-noise microwave synthesis up to 80 GHz with line-by-line processing of an optical frequency comb** *Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference (CLEO/QELS 2009)*
Xiao, S., Hollberg, L., Diddams, S. A.
IEEE.2009: 773-774
 - **Generation of a 20 GHz train of subpicosecond pulses with a stabilized optical-frequency-comb generator** *OPTICS LETTERS*
Xiao, S., Hollberg, L., Diddams, S. A.
2009; 34 (1): 85-87
 - **CHIP-SCALE ATOMIC DEVICES: PRECISION ATOMIC INSTRUMENTS BASED ON MEMS** *7th Symposium on Frequency Standards and Metrology*
Kitching, J., Knappe, S., Gerginov, V., Shah, V., Schwindt, P. D., Lindseth, B., Donley, E. A., Wang, Y., Hodby, E., Eardley, M., Jimenez, R., Griffith, W. C., Geraci, et al
WORLD SCIENTIFIC PUBL CO PTE LTD.2009: 445-453
 - **THE Yb OPTICAL LATTICE CLOCK** *7th Symposium on Frequency Standards and Metrology*
Lemke, N. D., Ludlow, A. D., Barber, Z. W., Poli, N., Hoyt, C. W., Ma, L. S., Stalnaker, J. E., Oates, C. W., Hollberg, L., Bergquist, J. C., Brusch, A., Fortier, T. M., Diddams, et al
WORLD SCIENTIFIC PUBL CO PTE LTD.2009: 200-208
 - **Laser noise cancellation in single-cell CPT clocks** *IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT*
Gerginov, V., Knappe, S., Shah, V., Hollberg, L., Kitching, J.
2008; 57 (7): 1357-1361
 - **Toward a low-jitter 10 GHz pulsed source with an optical frequency comb generator** *OPTICS EXPRESS*
Xiao, S., Hollberg, L., Newbury, N. R., Diddams, S. A.
2008; 16 (12): 8498-8508
 - **Frequency evaluation of the doubly forbidden S-1(0)-> P-3(0) transition in bosonic Yb-174** *PHYSICAL REVIEW A*
Poli, N., Barber, Z. W., Lemke, N. D., Oates, C. W., Ma, L. S., Stalnaker, J. E., Fortier, I. M., Diddams, S. A., Hollberg, L., Bergquist, J. C., Brusch, A., Jefferts, S., Heavner, et al
2008; 77 (5)
 - **Optical lattice induced light shifts in an Yb atomic clock** *PHYSICAL REVIEW LETTERS*
Barber, Z. W., Stalnaker, J. E., Lemke, N. D., Poli, N., Oates, C. W., Fortier, T. M., Diddams, S. A., Hollberg, L., Hoyt, C. W., Taichenachev, A. V., Yudin, V. I.
2008; 100 (10)
 - **The Yb Optical Lattice Clock** *Proc. 2008 Symp. on Freq. Stds. Metrology*
-

- Lemke, N., Ludlow, A., Barber, Z., Poli, N., Hoyt, C. W., Ma, L. S., Stalnaker, J. E., Oates, C. W., Hollberg, L., Bergquist, J. C., Brusch, A., Fortier, T., Diddams, et al
2008: 200–208
- **Time and Frequency Filtering of Optical Combs** *Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference (CLEO/QELS 2008)*
Braje, D. A., Kirchner, M., Fortier, T., Mbele, V., Fox, R., Weiner, A. M., Diddams, S. A., Hollberg, L.
IEEE.2008: 710–711
 - **Chip-scale atomic devices: precision atomic instruments based on MEMS** *Proc. 2008 Symp. Freq. Stds. Metrology*
Kitching, J., Knappe, S., Gerginov, V., Shah, V., Schwindt, P. D., Lindseth, B., Donley, E. A., Wang, Y. J., Hodby, E., Eardley, M., Jimenez, R., Griffith, W. C., Geraci, et al
2008: 445–453
 - **Optical-to-microwave frequency comparison with fractional uncertainty of 10⁻¹⁵** *APPLIED PHYSICS B-LASERS AND OPTICS*
Stalnaker, J. E., Diddams, S. A., Fortier, T. M., Kim, K., Hollberg, L., Bergquist, J. C., Itano, W. M., DELANY, M. J., Lorini, L., Oskay, W. H., Heavner, T. P., Jefferts, S. R., Levi, et al
2007; 89 (2-3): 167-176
 - **Demonstration of high-performance compact magnetic shields for chip-scale atomic devices** *REVIEW OF SCIENTIFIC INSTRUMENTS*
Donley, E. A., Hodby, E., Hollberg, L., Kitching, J.
2007; 78 (8)
 - **High-contrast coherent population trapping resonances using four-wave mixing in Rb-87** *OPTICS LETTERS*
Shah, V., Knappe, S., Hollberg, L., Kitching, J.
2007; 32 (10): 1244-1246
 - **Microfabricated saturated absorption laser spectrometer** *OPTICS EXPRESS*
Knappe, S. A., Robinson, H. G., Hollberg, L.
2007; 15 (10): 6293-6299
 - **Low-noise optical injection locking of a resonant tunneling diode to a stable optical frequency comb** *APPLIED PHYSICS LETTERS*
Ramond, T. M., Hollberg, L., Juodawlkis, P. W., Calawa, S. D.
2007; 90 (17)
 - **Absolute frequency measurement of the neutral Ca-40 optical frequency standard at 657nm based on microkelvin atoms** *METROLOGIA*
Wilpers, G., Oates, C. W., Diddams, S. A., Bartels, A., Fortier, T. M., Oskay, W. H., Bergquist, J. C., Jefferts, S. R., Heavner, T. P., Parker, T. E., Hollberg, L.
2007; 44 (2): 146-151
 - **Measurement of excited-state transitions in cold calcium atoms by direct femtosecond frequency-comb spectroscopy** *PHYSICAL REVIEW A*
Stalnaker, J. E., Le Coq, Y., Fortier, T. M., Diddams, S. A., Oates, C. W., Hollberg, L.
2007; 75 (4)
 - **Noise properties of microwave signals synthesized with femtosecond lasers** *IEEE TRANSACTIONS ON ULTRASONICS FERROELECTRICS AND FREQUENCY CONTROL*
Ivanov, E. N., McFerran, J. J., Diddams, S. A., Hollberg, L.
2007; 54 (4): 736-745
 - **Precision atomic spectroscopy for improved limits on variation of the fine structure constant and local position invariance** *PHYSICAL REVIEW LETTERS*
Fortier, T. M., Ashby, N., Bergquist, J. C., Delaney, M. J., Diddams, S. A., Heavner, T. P., Hollberg, L., Itano, W. M., Jefferts, S. R., Kim, K., Levi, F., Lorini, L., Oskay, et al
2007; 98 (7)
 - **Molecular fingerprinting with the resolved modes of a femtosecond laser frequency comb** *NATURE*
Diddams, S. A., Hollberg, L., Mbele, V.
2007; 445 (7128): 627-630
 - **Optical frequency standards based on mercury and aluminum ions** *Proc. 2007 SPIE Conf.*
Itano, W. M., Bergquist, J. C., Brusch, A., Diddams, S. A., Fortier, T. M., Heavner, T. P., Hollberg, L., Hume, D. B., Jefferts, S. R., Lorini, L., Parker, T. E., Rosenband, T., Stalnaker, et al
2007: 11

- **Injection-locked femtosecond Ti:sapphire lasers** *Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference*
Quraishi, Q., Hollberg, L., Diddams, S., Kobayashi, Y., Torizuka, K.
IEEE.2007: 554–555
- **A proposed laser frequency comb based wavelength reference for high resolution spectroscopy** *Proc. 2007 SPIE Conf.*
Osterman, S., Diddams, S. A., Beasley, M., Froning, C., Hollberg, L., MacQueen, P., Mbele, V., Weiner, A.
2007: 9
- **Self-Injection Locking of a Low-Power Microwave Oscillator by Using Four-Wave Mixing in an Atomic Vapor** *Proc. 2007 Joint Mtg. IEEE Intl. Freq. Cont. Symp. and EFTF Conf.*
Brannon, A., Shah, V., Popovic, Z., Gerginov, V., Knappe, S., Hollberg, L., Kitching, J.
2007: 275–278
- **Generation of coherent population trapping resonances with nearly 100% transmission contrast** *Joint IEEE International Frequency Control Symposium/21st European Frequency and Time Forum*
Shah, V., Knappe, S., Hollberg, L., Kitching, J.
IEEE, ELECTRON DEVICES SOC & RELIABILITY GROUP.2007: 1339–1341
- **A proposed laser frequency comb based wavelength reference for high resolution spectroscopy** *Conference on Techniques and Instrumentation for Detection of Exoplanets III*
Osterman, S., Diddams, S., Beasley, M., Froning, C., Hollberg, L., MacQueen, P., Mbele, V., Weiner, A.
SPIE-INT SOC OPTICAL ENGINEERING.2007
- **Magnetic Field-Induced Spectroscopy of Optical Clock Transitions in an Elliptically Polarized Lattice Field** *Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference*
Taichenachev, A. V., Yudin, V. I., Oates, C. W., Hollberg, L.
IEEE.2007: 105–106
- **Lattice-based optical clock using an even isotope of Yb** *Conference on Time and Frequency Metrology*
Barber, Z. W., Hoyt, C. W., Stalnaker, J. E., Lemke, N., Oates, C. W., Fortier, T. M., Diddams, S., Hollberg, L.
SPIE-INT SOC OPTICAL ENGINEERING.2007
- **The yb and ca standards: Approaches to high stability, high accuracy, and transportable optical atomic clocks** *IEEE LEOS Summer Topical Meeting 2007*
Oates, C. W., Barber, Z. W., STALNAKER, J., Hoyt, C. W., Le Coq, Y., Diddams, S. A., Fortier, T. M., Hollberg, L.
IEEE.2007: 149–150
- **Advances in chip-scale atomic frequency references at NIST** *Conference on Time and Frequency Metrology*
Knappe, S., Shah, V., Brannon, A., Gerginov, V., Robinson, H. G., Popovic, Z., Hollberg, L., Kitching, J.
SPIE-INT SOC OPTICAL ENGINEERING.2007
- **Optical frequency standards based on mercury and aluminum ions** *Conference on Time and Frequency Metrology*
Itano, W. M., Bergquist, J. C., Brusch, A., Diddams, S. A., Fortier, T. M., Heavner, T. P., Hollberg, L., Hume, D. B., Jefferts, S. R., Lorini, L., Parker, T. E., Rosenband, T., Stalnaker, et al
SPIE-INT SOC OPTICAL ENGINEERING.2007
- **Stable laser system for probing the clock transition at 578 nm in neutral ytterbium** *Joint IEEE International Frequency Control Symposium/21st European Frequency and Time Forum*
Oates, C. W., Barber, Z. W., Stalnaker, J. E., Hoyt, C. W., Fortier, T. M., Diddams, S. A., Hollberg, L.
IEEE, ELECTRON DEVICES SOC & RELIABILITY GROUP.2007: 1274–1277
- **Lattice-based optical clock using an even isotope of Yb** *Proc. 2007 SPIE Conf.*
Barber, Z., Hoyt, C., Stalnaker, J., Lemke, N., Oates, C. W., Fortier, T., Diddams, S. A., Hollberg, L.
2007: 9
- **Advances in Chip-Scale Atomic Frequency References at NIST** *Proc. 2007 SPIE Conf.*
Knappe, S., Shah, V., Brannon, A., Gerginov, V., Robinson, H. G., Popovic, Z., Hollberg, L., Kitching, J.
2007: 10
- **Improved limits on variation of the fine structure constant and violation of local position invariance** *Joint IEEE International Frequency Control Symposium/21st European Frequency and Time Forum*

Fortier, T. M., Ashby, N., Bergquist, J. C., Delaney, M. J., Diddams, S. A., Heavner, T. P., Hollberg, L., Itano, W. M., Jefferts, S. R., Kim, K., Oskay, W. H., Parker, T. E., Shirley, et al

IEEE, ELECTRON DEVICES SOC & RELIABILITY GROUP.2007: 663–665

- **Frequency uncertainty for optically referenced femtosecond laser frequency combs** *IEEE JOURNAL OF QUANTUM ELECTRONICS*
Ma, L., Bi, Z., Bartels, A., Kim, K., Robertsson, L., Zucco, M., Windeler, R. S., Wilpers, G., Oates, C., Hollberg, L., Diddams, S. A.
2007; 43 (1): 139-146
- **Long-term Stability of the NIST Chip-Scale Atomic Clock Physics Packages** *Proc. 2007 SPIE Conf.*
Knappe, S., Gerginov, V., Shah, V., Brannon, A., Robinson, H. G., Hollberg, L., Kitching, J.
2007: 9
- **Reduction of optical field noise by differential detection in atomic clocks based on coherent population trapping** *14th International School on Quantum Electronics on Laser Physics and Applications*
Gerginov, V., Knappe, S., Shah, V., Kitching, J., Hollberg, L.
SPIE-INT SOC OPTICAL ENGINEERING.2007
- **Spectral dependence of phase noise of stabilized optical frequency combs** *15th International Conference on Ultrafast Phenomena*
Quraishi, Q., Diddams, S., Hollberg, L.
SPRINGER-VERLAG BERLIN.2007: 139–141
- **Increasing the mode-spacing of stabilized frequency combs with optical filter cavities** *IEEE LEOS Summer Topical Meeting 2007*
Diddams, S. A., Weiner, A. M., Mbele, V., Hollberg, L.
IEEE.2007: 178–179
- **Long-term stability of the NIST chip-scale atomic clock physics packages** *Conference on MOEMS and Miniaturized Systems VI*
Knappe, S., Gerginov, V., Shah, V., Brannon, A., Hollberg, L., Kitching, J.
SPIE-INT SOC OPTICAL ENGINEERING.2007
- **Self-injection locking of a microwave oscillator by use of four-wave mixing in an atomic vapor** *Joint IEEE International Frequency Control Symposium/21st European Frequency and Time Forum*
Brannon, A., Shah, V., Popovic, Z., Gerginov, V., Knappe, S., Hollberg, L., Kitching, J.
IEEE, ELECTRON DEVICES SOC & RELIABILITY GROUP.2007: 275–278
- **Direct two-photon resonant excitation and absolute frequency measurement of cesium transitions using a femtosecond comb** *IEEE LEOS Summer Topical Meeting 2007*
Mbele, V., Stalnaker, J. E., Gerginov, V., Fortier, T. M., Diddams, S. A., Hollberg, L., Tanner, C. E.
IEEE.2007: 147–148
- **High-Resolution Spectroscopy with Femtosecond Optical Combs** *Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference*
Stalnaker, J. E., Diddams, S. A., Fortier, T. M., Gerginov, V., Le Coq, Y., Mbele, V., Oates, C. W., ORTEGA, D., Tanner, C. E., Hollberg, L.
IEEE.2007: 1343–1344
- **Chip-scale atomic devices at NIST** *14th International School on Quantum Electronics on Laser Physics and Applications*
Knappe, S., Schwindt, P., Gerginov, V., Shah, V., Brannon, A., Lindseth, B., Liew, L., Robinson, H., Moreland, J., Popovic, Z., Hollberg, L., Kitching, J.
SPIE-INT SOC OPTICAL ENGINEERING.2007
- **Magnetic resonance in an atomic vapor excited by a mechanical resonator** *PHYSICAL REVIEW LETTERS*
Wang, Y., Eardley, M., Knappe, S., Moreland, J., Hollberg, L., Kitching, J.
2006; 97 (22)
- **Kilohertz-resolution spectroscopy of cold atoms with an optical frequency comb** *PHYSICAL REVIEW LETTERS*
Fortier, T. M., Le Coq, Y., Stalnaker, J. E., ORTEGA, D., Diddams, S. A., Oates, C. W., Hollberg, L.
2006; 97 (16)
- **Continuous light-shift correction in modulated coherent population trapping clocks** *APPLIED PHYSICS LETTERS*
Shah, V., Gerginov, V., Schwindt, P. D., Knappe, S., Hollberg, L., Kitching, J.
2006; 89 (15)
- **Improved uncertainty budget for optical frequency measurements with microkelvin neutral atoms: Results for a high-stability Ca-40 optical frequency standard** *APPLIED PHYSICS B-LASERS AND OPTICS*

- Wilpers, G., Oates, C. W., Hollberg, L.
2006; 85 (1): 31-44
- **Compact phase delay technique for increasing the amplitude of coherent population trapping resonances in open Lambda systems** *OPTICS LETTERS*
Shah, V., Knappe, S., Schwindt, P. D., Gerginov, V., Kitching, J.
2006; 31 (15): 2335-2337
 - **Single-atom optical clock with high accuracy** *PHYSICAL REVIEW LETTERS*
Oskay, W. H., Diddams, S. A., Donley, E. A., Fortier, T. M., Heavner, T. P., Hollberg, L., Itano, W. M., Jefferts, S. R., Delaney, M. J., Kim, K., Levi, F., Parker, T. E., Bergquist, et al
2006; 97 (2)
 - **Microfabricated atomic clocks and magnetometers** *10th IEEE/LEOS International Conference on Optical MEMs and Their Applications*
Knappe, S., Schwindt, P. D., Gerginov, V., Shah, V., Liew, L., Moreland, J., Robinson, H. G., Hollberg, L., Kitching, J.
IOP PUBLISHING LTD.2006: S318-S322
 - **Atomic-based stabilization for laser-pumped atomic clocks** *OPTICS LETTERS*
Gerginov, V., Shah, V., Knappe, S., Hollberg, L., Kitching, J.
2006; 31 (12): 1851-1853
 - **Long-term frequency instability of atomic frequency references based on coherent population trapping and microfabricated vapor cells** *JOURNAL OF THE OPTICAL SOCIETY OF AMERICA B-OPTICAL PHYSICS*
Gerginov, V., Knappe, S., Shah, V., Schwindt, P. D., Hollberg, L., Kitching, J.
2006; 23 (4): 593-597
 - **Magnetic field-induced spectroscopy of forbidden optical transitions with application to lattice-based optical atomic clocks** *PHYSICAL REVIEW LETTERS*
Taichenachev, A. V., Yudin, V. I., Oates, C. W., Hoyt, C. W., Barber, Z. W., Hollberg, L.
2006; 96 (8)
 - **Direct excitation of the forbidden clock transition in neutral Yb-174 atoms confined to an optical lattice** *PHYSICAL REVIEW LETTERS*
Barber, Z. W., Hoyt, C. W., Oates, C. W., Hollberg, L., Taichenachev, A. V., Yudin, V. I.
2006; 96 (8)
 - **Optical frequency measurements of 6s S-2(1/2)-6p P-2(1/2) (D-1) transitions in Cs-133 and their impact on the fine-structure constant** *PHYSICAL REVIEW A*
Gerginov, V., Calkins, K., Tanner, C. E., McFerran, J. J., Diddams, S., Bartels, A., Hollberg, L.
2006; 73 (3)
 - **A Compact High Stability Optical Clock Based on Laser-Cooled Ca** *Proc. 2006 EFTF Conf.*
Oates, C. W., LeCoq, Y., Wilpers, G., Hollberg, L.
2006: 346-349
 - **Stable Isotopic Analysis of Atmospheric Methane by Infrared Spectroscopy Using Difference Frequency Generation in Periodically Poled Lithium Niobate** *Appl. Opt.*
Trudeau, M. E., Chen, P., Garcia, G. A., Hollberg, L. W., Tans, P. P.
2006; 45: 4136-4141
 - **Absolute Optical Frequency Measurements with a Fractional Uncertainty at 1 x 10⁻¹⁵** *Proc. 2006 IEEE Intl. Freq. Cont. Symp.*
Stalnaker, J., Diddams, S. A., Kim, K., Hollberg, L., Donley, E. A., Heavner, T. P., Jefferts, S. R., Levi, F., Parker, T. E., Bergquist, J. C., Itano, W. M., Jensen, M. J., Lorini, et al
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