Mark Beck

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Education

Ph.D. in Optics, The Institute of Optics, University of Rochester, 1992;
Thesis: "Pulse Shaping in Colliding-Pulse, Mode-Locked Dye Lasers".

One year of graduate study, Department of Applied Physics, Stanford University, 1986.

B.S. in Optics, The Institute of Optics, University of Rochester, 1985.

Professional Appointments

September 2002 - present
Associate Professor, Dept. of Physics, Whitman College, Walla Walla, Washington.

July 2002 - June 2005
Chair, Dept. of Physics, Whitman College, Walla Walla, Washington.

September 1996 - August 2002
Assistant Professor of Physics, Whitman College, Walla Walla, Washington.

November 2000 – December 2000
Visiting Assistant Professor of Optics, The Institute of Optics, University of Rochester, Rochester, New York.

August 1994 - August 1996
Visiting Assistant Professor of Physics, Reed College, Portland, Oregon.

May 1992 - July 1994
Post-doctoral assistant to Prof. Michael Raymer, Department of Physics, University of Oregon, Eugene, Oregon

July 1986 - April 1992
Research Assistant, The Institute of Optics, University of Rochester, Rochester, New York.
Thesis advisor: Prof. Ian Walmsley.

September 1986 - May 1987
Teaching Assistant, The Institute of Optics, University of Rochester, Rochester, New York.

Honors and Awards

A.E. Lange Award for Distinguished Science Teaching, Whitman College, 2004
Phi Beta Kappa
Tau Beta Pi
University Research Initiative Fellowship, US Army Research Office, 1988 - 1992
Sproull Fellowship of the University of Rochester, 1986 - 1988
Polster Prize of The Institute of Optics, 1985
SPIE Scholarship in Optical Engineering, 1984

Other Professional Activities

Member-at-Large of the Executive Board of the Northwest Section of the American Physical Society. (2005-present)

Distinguished Traveling Lecturer (DTL) Committee Member. This committee serves the Division of Laser Sciences of the American Physical Society; we organize the DTL program in which distinguished scientists visit colleges and universities. (2002-present)

Program Committee, Annual Meeting of the Northwest Section of the American Physical Society, Seattle, WA, 2001

Program Committee, SPIE Symposium on "Generation, Amplification and Measurement of Ultrashort Laser Pulses III", San Jose, CA, 1996

External Research Grants Received

Principle Investigator on: "Photon Based Undergraduate Quantum Mechanics Curriculum," National Science Foundation, 2004-2007, $43,425.

Principle Investigator on: "RUI: Amplitude Squeezing of Pulsed, Vertical-Cavity, Surface Emitting Lasers," National Science Foundation, 2001-2005, $129,921.

Principle Investigator on: "Photon Statistics of Pulsed, Vertical-Cavity, Surface Emitting Lasers," National Science Foundation, 1998-2001, $120,000.

Principle Investigator on: "Photon Statistics of Pulsed, Vertical-Cavity, Surface Emitting Lasers," Research Corporation, 1998-2000, $30,700.

Co-Investigator on: "Innovative Experimental Stations for the Second Year Physics Laboratory", National Science Foundation, 1998-2000, $37,200.

Publications (underlines indicate undergraduate co-authors)

"Quantum mysteries tested: an experiment implementing Hardy's test of local realism," J. A. Carlson, M. D. Olmstead, and M. Beck, Am. J. Phys. **74**, 180-186 (2006).

"Comparing quantum and classical correlations in a quantum eraser," A. Gogo, W. D. Snyder, and M. Beck, Phys. Rev. A **71**, 052103 (2005). [Also included in the online compilation: Virtual Journal of Quantum Information <http://www.vjquantuminfo.org>, Vol. **5**, Iss. 6]

"Observing the quantum behavior of light in an undergraduate laboratory", J. J. Thorn, M. S. Neel, V. W. Donato, G. S. Bergreen, R. E. Davies, and M. Beck, Am. J. Phys. **72**, 1210-1219 (2004).

"Joint quantum measurement using unbalanced array detection," M. Beck, C. Dorrer, and I.A. Walmsley, in *Coherence and Quantum Optics VIII*, edited by N. P. Bigelow, J. H. Eberly, C. R. Stroud, and I. A. Walmsley, (Kluwer Academic/Plenum, New York, 2003) p.455.

"Simultaneous quantum state measurements using array detection," A.M. Dawes and M. Beck, in *Coherence and Quantum Optics VIII*, edited by N. P. Bigelow, J. H. Eberly, C. R. Stroud, and I. A. Walmsley, (Kluwer Academic/Plenum, New York, 2003) p. 301.

"Mode Optimization for Quantum State Tomography with Array Detectors," A.M. Dawes, M. Beck and K. Banaszek, Phys. Rev. A. **67**, 032102 (2003).

"Joint Quantum Measurement Using Unbalanced Array Detection," M. Beck, C. Dorrer, and I.A. Walmsley, Phys. Rev. Lett. **87**, 253601 (2001).

"Simultaneous quantum state measurements using array detection," A.M. Dawes and M. Beck, Phys. Rev. A. **63**, 040101 (R), (2001).

"Polarization correlations in pulsed, vertical-cavity, surface-emitting lasers," D.R. Shelly, T.W.S Garrison, M. Beck, and D.H. Christensen, Opt. Express **7**, 249 (2000).

"Quantum state tomography with array detectors," M. Beck, Phys. Rev. Lett. **84**, 5748 (2000).

"Noise behavior of pulsed, vertical-cavity, surface-emitting lasers", T.W.S Garrison, M. Beck, and D.H. Christensen, J. Opt. Soc. Am B **16**, 2124 (1999).

"Sub-Poissonian photocurrent statistics: Theory and undergraduate experiment", A.C. Funk and M. Beck, Am. J. Phys. **65**, 492 (1997).

"Ultrafast measurement of optical-field statistics by dc-balanced homodyne detection", M.G. Raymer, J. Cooper, H.J. Carmichael, M. Beck, and D.T. Smithey, J. Opt. Soc. Am B **12**, 1801, (1995).

"Ultrashort pulsed squeezing by optical parametric amplification", M.J. Werner, M.G. Raymer, M.Beck, P.D. Drummond, Phys. Rev. A **52**, 4202 (1995).

"Time-frequency spectrograms of optical pulses", M. Beck, in *Generation, Amplification, and Measurement of Ultrashort Laser Pulses II*, F.W. Wise, C.P.J. Barty, Eds., Proc. SPIE **2377**, 63, (1995).

"Optical phase retrieval by phase-space tomography and fractional-order Fourier transforms", D.F. McAlister, M. Beck, L. Clarke, A. Mayer, and M.G. Raymer, Opt. Lett. **20**, 1181 (1995).

"Quadrature squeezing with ultrashort pulses in nonlinear-optical waveguides", M.E. Anderson, M. Beck, M.G. Raymer, and J.D. Bierlein, Opt. Lett. **20**, 620 (1995).

"Imaging through scattering media using pulsed homodyne detection," M. Beck, M. Anderson and M.G. Raymer, *OSA Proceedings on Advances in Optical Imaging and Photon Migration*, Vol. **21**, R. Alfano ed., (1994), p. 257.

"Quantum states and number-phase uncertainty relations measured by optical homodyne tomography," M.G. Raymer, D.T. Smithey, M. Beck, and J. Cooper, Acta Phys. Pol. A **86**, 71, (1994).

"Spatial and temporal optical field reconstruction using phase-space tomography", M.G. Raymer, M. Beck, and D.F. McAlister, *Quantum Optics VI*, D.F. Walls and J.D. Harvey eds., (Springer-Verlag, Berlin, 1994), p. 245.

"Complex wave-field reconstruction using phase-space tomography", M.G. Raymer, M. Beck, and D.F. McAlister, Phys. Rev. Lett. **72**, 1137 (1994).

"Many-port homodyne detection of an optical phase," M.G. Raymer, J. Cooper, and M. Beck, Phys. Rev. A. **48**, 4617 (1993).

"Chronocyclic tomography for measuring amplitude and phase structure of optical pulses," M. Beck, M.G. Raymer, I.A. Walmsley, and V. Wong, Opt. Lett. **18**, 2041 (1993).

"Number-phase uncertainty relations," M. Beck, D.T. Smithey, and M.G. Raymer, *Optics and Photonics News* Vol. **4,** No. 12, p. 40 (December, 1993).

"Complete experimental determination of the state of a light mode via the Wigner function and the density matrix: application to quantum phase distributions of vacuum and squeezed-vacuum states" D.T. Smithey, M. Beck, J. Cooper, M.G. Raymer, and A. Faridani, Physica Scripta **T48**, 35 (1993).

"Measurement of number-phase uncertainty relations of optical fields," D.T. Smithey, M. Beck, J. Cooper, and M.G. Raymer, Phys. Rev. A **48**, 3159 (1993).

"Experimental determination of number-phase uncertainty relations," M. Beck, D.T. Smithey, J. Cooper, and M.G. Raymer, Opt. Lett. **18**, 1259, (1993).

“Experimental determination of quantum-phase distributions using optical homodyne tomography,” M. Beck, D.T. Smithey, and M.G. Raymer, Phys. Rev. A **48**, R890, (1993).

“Measurement of the Wigner distribution and the density matrix of a light mode using optical homodyne tomography: application to squeezed states and the vacuum,” D.T. Smithey, M. Beck, M.G. Raymer, and A. Faridani, Phys. Rev. Lett. **70**, 1244, (1993).

“Sub-shot-noise correlation of total photon number using macroscopic twin pulses of light,” D.T. Smithey, M. Beck, M. Belsley, and M.G. Raymer, Phys. Rev. Lett. **69**, 2650, (1992).

“The role of amplitude and phase shaping in the dispersive-pulse regime of a passively mode-locked dye laser,” M. Beck and I.A. Walmsley, IEEE J. of Quantum Electron. **QE-28**, 2274, (1992).

“Group delay measurements of optical components near 800 nm,” M. Beck, I.A. Walmsley, and J.D. Kafka, IEEE J. of Quantum Electron. **QE-27**, 2074, (1991).

“Measurement of group delay with high temporal and spectral resolution,” M. Beck and I.A. Walmsley, Opt. Lett. **15**, 492, (1990).

“Transition from quantum-noise-driven dynamics to deterministic dynamics in a multimode laser,” M. Beck, I. McMackin and M.G. Raymer, Phys. Rev. A. **40**, 2410, (1989).

“Instabilities and chaos in a multimode, standing-wave, cw dye laser,” I. McMackin, C. Radzewicz, M. Beck, and M.G. Raymer, Phys. Rev. A **38**, 820, (1988).

“Strong-field dynamics of a multimode, standing-wave dye laser,” M.G. Raymer, Z. Deng, and M. Beck, J. Opt. Soc. Am. B **5**, 1588, (1988).

Review Articles

"Experimental quantum state tomography of optical fields and ultrafast statistical sampling," M. G. Raymer and M. Beck, in *Quantum State Estimation*, ed. by M. G. A. Paris and J. Rehacek (Springer-Verlag, Berlin, 2004), p. 235-295.

Invited Presentations

"Interference, Complementarity, Entanglement and all that Jazz," Harvey Mudd College and Pomona College, Claremont, California, 2005.

"Interference, Complementarity, Entanglement and all that Jazz," Washington State University, Pullman, Washington, 2005.

"Interference, Complementarity, Entanglement and all that Jazz," Lewis and Clark College, Portland, Oregon, 2005.

"Interference, Complementarity, Entanglement and all that Jazz," Reed College, Portland, Oregon, 2005.

"Interference, Complementarity, Entanglement and all that Jazz," University of Oregon, Eugene, Oregon, 2005.

"Interference, Complementarity, Entanglement and all that Jazz," Oregon State University, Corvallis, Oregon, 2005.

“Quantum Mysteries,” Family Weekend Presentation, Whitman College, Walla Walla, Washington, 2004.

"Interference, Complementarity, Entanglement and all that Jazz," Walla Walla College, College Place, Washington, 2004.

"Interference, Complementarity, Entanglement and all that Jazz," Amherst College, Amherst, Massachusetts, 2004.

"Experiments with Individual Photons," Annual Meeting of the Northwest Section of the American Physical Society, Moscow, Idaho, 2004.

"Experiments with Single Photons: Existence Proof and Interference," 128th American Association of Physics Teachers National Meeting, Miami Beach, Florida, 2004.

“Light, What is it?” Reed College, Portland, Oregon, 2003.

“Noise behavior of pulsed, vertical-cavity, surface-emitting lasers,” University of Oregon, Eugene, Oregon, 1999.

“State measurement of optical fields,” Univ. of Toronto, Toronto, Ontario, 1996.

“State measurement of optical fields,” Whitman College, Walla Walla, WA, 1996.

“State measurement of optical fields,” Franklin and Marshal College, Lancaster, Pennsylvania, 1996.

“State measurement of optical fields,” Annual Meeting of the Optical Society of America, Portland, Oregon, 1995.

“Time-frequency spectrograms of optical pulses,” Generation, Amplification, and Measurement of Ultrashort Laser Pulses II, San Jose, California, 1995.

“Measuring the wavefunction of light,” Lewis and Clark College, Portland, Oregon, 1994.

“Measuring the wavefunction of light,” Reed College, Portland, Oregon, 1994.

“Measuring the wavefunction of light,” Oregon State University, Corvallis, Oregon, 1993.

“Measuring the wavefunction of light,” Chemical Physics Institute Retreat, University of Oregon, Charleston, Oregon, 1993.

“Why you have to be careful when you use the Kramers-Kronig relations,” University of Oregon, Eugene, Oregon, 1991.

“What do your CPM pulses really look like?” University of California, San Diego, California, 1991.

Other Presentations

"Experiments with Individual Photons in an Undergraduate Lab," Laser Science XX, Rochester, NY, 2004.

“Mode Optimization for Quantum State Tomography with Array Detectors,” Annual Meeting of the Optical Society of America, Orlando, Florida, 2002.

“Light, What is it?” Faculty Forum, Whitman College, Walla Walla, Washington, 2001.

“Joint Quantum Measurement Using Unbalanced Array Detection,” Coherence and Quantum Optics 8, Rochester, NY, June 2001.

“Noise behavior of pulsed vertical-cavity, surface-emitting lasers”, Quantum Optoelectronics, Snowmass, Colorado, 1999.

“Complex wave-field reconstruction using phase-space tomography,” QELS’94, Anaheim, California, 1994.

“Chronocyclic tomography for measuring the amplitude and phase structure of optical pulses,” CLEO’94, Anaheim, California, 1994.

“Imaging Through Scattering Media Using Pulsed Homodyne Detection,” Advances in Optical Imaging and Photon Migration, Orlando, Florida, 1994.

“Experimental determination of number-phase uncertainty relations,” Annual Meeting of the Optical Society of America, Toronto, Ontario, 1993.

“Experimental determination of quantum phase distributions using optical homodyne tomography,” QELS ‘93, Baltimore, Maryland, 1993.

“Pulse shaping in colliding-pulse mode-locked dye lasers,” CLEO’92, Anaheim, California, 1992.

“Experimental characterization of the intensity and phase of asymmetric 60 fs pulses from a CPM dye laser,” Annual Meeting of the Optical Society of America, San Jose, California, 1991.

"Linear causal filters that do not satisfy the Kramers-Kronig relation," QELS '91, Baltimore, Maryland, 1991.

"Measurement of group delay with high temporal and spectral resolution," CLEO '90, Anaheim, California", 1990.

"Mode switching and quantum fluctuations in multimode dye lasers," Annual Meeting of the Optical Society of America, Santa Clara, California, 1988.

"Numerical modeling of a multimode, standing-wave, cw dye laser," Annual Meeting of the Optical Society of America, Rochester, New York, 1987.

Book Reviews

Introductory Quantum Optics, by Christopher C. Gerry and Peter L. Knight; reviewed in Am. J. Phys. **73**, 1197 (2005).

Advanced LabVIEW Labs, by John Essick; reviewed in LabVIEW Technical Resource vol. **7**, number 3, pg. 23, (2000).

Measuring the Quantum State of Light, by Ulf Leonhardt; reviewed in Am. J. Phys. **66**, 550, (1998).