Todd P. Meyrath

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Physicist, Electrical Engineer

Over 10 years of design and implementation experience with optics and electronics; over 3 years of supervisory experience. Ph.D. Physics (Texas), MSEE (Caltech). Problem solver. Expertise in optical and electronic design, imaging, sensors, interfacing, device and system engineering, simulation, technical writing, public speaking, grant writing. Supervisory skills, broad technical knowledge, outstanding speaking skills, foreign language skills, US citizen with international experience.

Objectives

Research, development, and project management for advanced optical and/or electronic integrated subsystems and final devices for commercial, consumer, research, medical, or military applications.

Professional and Research Experience

- **Research Scientist,** Stuttgart, Germany, Jan. 2006-Present
  Fourth Physics Institute; Max Planck Institute, Stuttgart
  Led several small groups simultaneously, supervised doctoral researchers, wrote successful research funding application, delivered seminars at multiple international conferences, collaborated with international industrial partners. Developed industrial prototypes with integrated optics and electronics. Primary projects:
  - Laboratory and theoretical work on nanostructured optical materials, developed models for optical frequency resonance circuits, studied nano-antennas and apertures at optical frequencies, effective material parameters theory, phase measurements of metamaterials. Designs useful for optical gas or bio-sensing.
  - Developed a unique and innovative optical hydrogen sensor: prototype electronics and experiment, collaborated with a German company. Designed and constructed an industry compatible operating device.
  - Construction of a high power femtosecond solid state laser for supercontinuum white light generation. Laser crystal thermal design and lensing. Final device useful for temporally- and spectrally-resolved imaging applications over a wide spectrum.
  - Novel optical fiber forming methods for smooth concave fiber tips for creation of optical cavities.

- **Doctoral Research,** University of Texas, Austin, Texas USA, Sept. 1998- Sept. 2005
  Laboratory work with Bose-Einstein Condensates (BEC) in novel high frequency optical traps. Designed and constructed a modern atomic and optical physics experiment from the ground up for ultra-cold atom physics.
  - Developed methods for study of quantum effects in lower dimensional Boson systems. Succeeded in producing BEC in an optical box trap, a reservoir for potential extraction of individual ground state atoms. Directly observed atom number squeezing (sub-Poissonian statistics) of a BEC prepared in an optical box.
  - Designed and constructed numerous electronic and electro-optical devices. Major laboratory devices include:
    - Ultra-stable magnetic trap for neutral atoms, high current control electronics, fluid cooling design
    - Hardware for computer control system: large scale analog, digital, RF system
    - Computer controlled digital radio frequency synthesizers
    - DACs, ADCs
    - Acousto-optic laser intensity stabilizers with logarithmic intensity control
    - Ultra-high vacuum chambers
    - Frequency locked diode laser system and driving electronics
    - Photodiode amplifiers
    - Temperature regulation electronics
    - Opto-mechanical devices, mechanical shutters and drivers

Education

- **University of Texas,** Austin, Texas USA
  Ph.D., Physics, May 2005.
  Specialty: Experimental ultra-cold atom physics, optical physics
  M.S., Applied Physics, GPA: 3.9/4.0, Aug. 2000.
- **California Institute of Technology,** Pasadena, California USA
  M.S., Electrical Engineering, GPA: 4.0/4.0, June 2001.
  Specialty: Semiconductor electronics, CMOS design, optoelectronics
- **Georgia Institute of Technology,** Atlanta, Georgia USA
  B.S., Physics and B.S., Applied Mathematics, GPA: 3.9/4.0, June 1998.
  With Highest Honor (Summa Cum Laude), Class Rank: 1st

Summary of Skills

- **Design / Laboratory:** Have designed, built, and implemented numerous laboratory electronic devices and optical systems. Familiar with precision analog, radio frequency, digital electronics, computer interfacing, embedded systems, control systems, imaging optics, optical devices, detectors, photodiodes, APDs, CCDs, spectrometers, electro-optic acousto-optic modulators, lasers, ultra-high vacuum systems, optical coatings, mechanical and housing design, machine shop.
- **Theoretical:** Knowledge of advanced mathematics, numerical methods. Engineering problem solving skills.
- **Computer:** Knowledge of mechanical CADs, circuit and PCB programs, SPICE, assembly and C for PIC microcontrollers, MS Windows application programming in C, Python, Matlab, CST Microwave Studio.
- **Managerial:** Led and worked as part of groups to achieve project goals. Organized R&D collaborations with industrial partners. Managed doctoral researchers, dealt with interpersonal issues, and oversaw laboratory work, presentation, and publication preparation. Evaluated competitive bids.
- **Communication:** Excellent public speaking skills, strong writing skills for technical and non-technical audience. Have written successful research funding applications. Effective communication and interpersonal skills. Co-author of numerous journal publications, public domain releases, manuals, and book translation.
- **Language:** English (native), German, Russian

Major Awards

Alexander von Humboldt Foundation, Research Fellowship, Germany 2006-present.

National Science Foundation, Graduate Research Fellowship, USA 1999-2002.

Undergraduate Research

- **Summer Research,** Los Alamos National Laboratory, Los Alamos, New Mexico USA, Summer 1997 Computational theory on linear ion traps for quantum computer applications. Performed computer simulations to simulate ion motion in a Paul trap and calculated ion positions for large ion numbers. Used Los Alamos supercomputers for computations.
- **Undergraduate Research,** Georgia Institute of Technology, Atlanta, Georgia USA, 1996-1998 Pattern Formation and Control Laboratory. Built an experiment to study pattern formation and control for a convection fluid. Constructed experimental apparatus, imaging and CO_2 laser system, and computer control system. Wrote control system and data acquisition software. Gained experience in laboratory design and implementation.

Published Work

Journal Publications

1. F. Hoos, T.P. Meyrath, S. Li, B. Braun, and H. Giessen, "Femtosecond 4.9 W Yb:KGW slab laser oscillator pumped by a single broad-area diode for supercontinuum generation," submitted (2008).
2. D.M.B. Kunert, T.P. Meyrath, and H. Giessen, "Fabrication of a fiber-based microcavity with spherical concave fiber tips," submitted (2008).
3. T.P. Meyrath, T. Zentgraf, C. Rockstuhl, H. Giessen, "Electromagnetic Induction in Metamaterials" Appl. Phys. B (2008), in press.
4. H. Guo, T.P. Meyrath, T. Zentgraf, N. Liu, L. Fu, H. Schweizer, and H. Giessen, "Optical resonances of bowtie slot antennas and their geometry and material dependence," Opt. Express 16, 7756-7766 (2008).
5. F. Hoos, S. Li, T.P. Meyrath, B. Braun, and H. Giessen, "Thermal lensing in an end-pumped Yb:KGW slab with high power single emitter diodes," Opt. Express 16, 6041 (2008).
6. C. Rockstuhl, T. Zentgraf, T.P. Meyrath, H. Giessen, and F. Lederer, "Resonances in complementary metamaterials and nanoapertures," Opt. Express 16, 2080 (2008).
7. C. Rockstuhl, T. Pertsch, F. Lederer, T. Zentgraf, T.P. Meyrath, and H. Giessen, "Transition from thin film to bulk properties of metamaterials," Phys. Rev. B 77, 035126 (2008).
8. H. Guo, N. Liu, L. Fu, T.P. Meyrath, T. Zentgraf, H. Schweizer, and H. Giessen, "Resonance hybridization in double split-ring resonator metamaterials," Optics Express, 15, 12095-12101 (2007).
9. T. Zentgraf, T.P. Meyrath, A. Seidel, S. Kaiser, H. Giessen, C. Rockstuhl and F. Lederer, "Babinets principle for optical frequency metamaterials," Phys. Rev. B 76 033407 (2007).
10. T.P. Meyrath, T. Zentgraf, and H. Giessen, "Lorentz Model for Metamaterials: Optical Frequency Resonance Circuits," Phys. Rev. B 75, 205102 (2007).
11. C-S. Chuu, F. Schreck, T.P. Meyrath, J.L. Hanssen, G.N. Price, M.G. Raizen, "Direct Observation of Sub-Poissonian Number Statistics in a Degenerate Bose Gas," Phys. Rev. Lett., 95, 260403, December 2005.
12. T.P. Meyrath, F. Schreck, J.L. Hanssen, C-S. Chuu, and M.G. Raizen, "Bose-Einstein Condensate in a Box," Phys. Rev. A, 71, 041604(R), April 2005.
13. T.P. Meyrath, F. Schreck, J.L. Hanssen, C-S. Chuu, and M.G. Raizen, "A High Frequency Optical Trap for Atoms Using Hermite-Gaussian Beams," Optics Express, 13, 2843-2851, April 2005.
14. J.L. Hanssen, V. Milner, T.P. Meyrath, M.G. Raizen, "Real-time Control of Atomic Motion Using Feedback," *Coherence and Quantum Optics VIII*, pp. 233-240, 2003.
15. T.P. Meyrath, D.F.V. James, "Theoretical and Numerical Studies of the Positions of Cold Trapped Ions," Physics Letters A 240 pp. 37-42, 1998.

Theses

1. T.P. Meyrath, "Experiments with Bose-Einstein Condensation in an Optical Box," Doctoral Dissertation, May 2005. george.ph.utexas.edu/~quantopt/thesis/todd_diss.pdf
2. T.P. Meyrath, "Two-Dimensional Magneto-Optical Trap as a Low Velocity Source of Atomic Sodium," Master's Thesis, 2000.

Books

1. Georg A. Klein, "Industrial Color Physics," 2nd revised Ed., translated by T.P. Meyrath (German to English), Springer, New York, 2009 (in preparation).

Electronics Designs (These few designs have been put into the Public Domain for academic use)

1. T.P. Meyrath, "Multipurpose Analog PID Controller," Informal publication george.ph.utexas.edu/~meyrath/informal, May 2005.
2. T.P. Meyrath, F. Schreck, "A Laboratory Control System for Cold Atom Experiments: Hardware and Software," Informal publication george.ph.utexas.edu/~control, March 2004. Includes an analog and digital output system as well as a direct digital synthesis radio frequency source. Our system has been adopted by a number of other research groups worldwide.
3. T.P. Meyrath, "An Analog Current Controller Design for Laser Diodes," Informal publication george.ph.utexas.edu/~meyrath/informal, November 2003.
4. T.P. Meyrath, "Inexpensive Mechanical Shutter and Driver for Optics Experiments," Informal publication george.ph.utexas.edu/~meyrath/informal, May 2003.
5. T.P. Meyrath, "Precision Analog Optocoupler," Informal publication george.ph.utexas.edu/~meyrath/informal, July 2002.