

David R. Scherer, Ph.D.

Ph.D. optical scientist with experimental background in lasers, photonics, electronics, and atomic physics. Interests include bringing practical applications of quantum and atomic technology to market.

Info

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Education

2007 Ph.D. Optical Sciences, University of Arizona, Tucson, AZ
Dissertation: *Vortex Formation by Merging and Interference of Multiple Trapped Bose-Einstein Condensates*, Advisor: Dr. Brian Anderson

2002 M.S. Optical Sciences, University of Arizona, Tucson, AZ

1999 B.S. Electrical Engineering, Boston University, Boston, MA, *summa cum laude*
Thesis: *Measurement of One- and Two-Photon Absorption in a Photomultiplier Tube using Phase-Sensitive Detection*, Advisor: Dr. Bahaa Saleh

Employment

3/2008 - Principal Scientist, Physical Sciences Inc., Andover, MA
Led or participated in several multidisciplinary research programs through the conceptualization, grant writing, execution, and reporting phase. Major technical achievements include:
Optical Magnetometry: Served as the Principal Investigator on a Navy SBIR Phase I program that developed a laboratory prototype potassium atom magnetometer. Integrated optical and mechanical sensor design, ultrasensitive noise-canceling electronics, and atomic spectroscopy fundamentals to demonstrate a compact, ultrasensitive diode-laser based atomic magnetometer.
Atomic Resonance Filters: Served as the Principal Investigator on a Navy SBIR Phase I program that investigated the feasibility of developing a narrow-linewidth active magnesium atomic resonance filter at 518 nm.
Quantum Cascade Lasers: Integrated a quantum cascade laser in a grating-stabilized external cavity configuration, used the laser for spectroscopic measurements in the long-wavelength infrared (8 μm). Worked with semiconductor die-bonding equipment to mount QCLs to submounts.

1999-2007 Graduate Research Assistant, College of Optical Sciences, University of Arizona, Tucson, AZ
Laser Cooling and Trapping: Participated as the lead graduate student in a team that built an apparatus to use lasers and magnetic fields to cool rubidium atoms to nK temperatures in an ultrahigh vacuum chamber, creating a Bose-Einstein Condensate (BEC). Discovered a novel mechanism for vortex formation in superfluid BECs by engineering their merging and interference.

1997-1999 Undergraduate Research Assistant, Quantum Imaging Laboratory, Department of Electrical Engineering, Boston University, Boston, MA

Summer 1998 Intern, Polaroid Corporation, Cambridge, MA

Summer 1997 Research Experience for Undergraduates Summer Student, Department of Electrical Engineering, Princeton University, Princeton, NJ

Summer 1996 Intern, The Charles Stark Draper Laboratory, Cambridge, MA

Technical Skills

- Photonics - Design and assembly of external-cavity grating-stabilized quantum cascade and semiconductor diode lasers, operation and alignment of cw and femtosecond ti:sapphire lasers, benchtop free-space and fiber-optic optomechanical components, frequency doubling in nonlinear-optical crystals, atomic spectroscopy, laser cooling, atom trapping, and optical imaging of atoms
- Hardware - Design and operation of ultra-high vacuum systems, use of high-speed analog and RF electronics and photodiode front ends
- Software - Matlab (advanced), ZEMAX (basic), HITRAN

Funding Awarded

- 2009 - Navy SBIR Phase I grant, \$70K, *Atomic Resonance Filter for Undersea Laser Communication*, May 2009
- Navy SBIR Phase I grant, \$70K, *Diode Laser Based Magnetometer*, January 2009

Refereed Journal Publications

- 2008 - *Spontaneous Vortices in the Formation of Bose-Einstein Condensates*, Chad N. Weiler, Tyler W. Neely, David R. Scherer, Ashton S. Bradley, Matthew J. Davis, Brian P. Anderson, *Nature*, 455, 948-951, 2008
- 2007 - *Vortex Formation by Merging of Multiple Trapped Bose-Einstein Condensates*, David Scherer, Chad Weiler, Tyler Neely, Brian Anderson, *Physical Review Letters* 98, 110402 (2007)

Conference Presentations

- 2009 - *Tunable External-Cavity Quantum Cascade Laser Sources for Gas Sensing and Spectroscopy*, David R. Scherer, Juan Montoya, Krishnan R. Parameswaran, Joel M. Hensley, Mark G. Allen, CLEO/IQEC Conference, Baltimore, MD, June 2009
- 2006 - *Using Computer-Generated Holograms to Study Bose-Einstein Condensates in Segmented Potentials*, David R. Scherer, Chad N. Weiler, Tyler Neely, Brian P. Anderson, APS DAMOP Meeting, Knoxville, TN, 15 May 2006
- 2005 - *Atom Interferometry with 2-Dimensional Bose-Einstein Condensates*, David R. Scherer, Canadian-American-Mexican Physics Graduate Student Conference, San Diego, CA, 19 Aug 2005
- 2003 - *Coupled-ring Atomic-phase Interference Devices with Bose-Einstein Condensates*, David Scherer, Elaine Ulrich, Chad Weiler, M. David Henry, Brian Anderson, Kishan Dholakia, Ewan Wright, Optical Society of America Annual Meeting, Tucson, AZ, 7 Oct 2003

Reports Written

- 2009 - *Atomic Resonance Filter for Undersea Laser Communication* SBIR Phase I Final Report, November 2009
- *Diode Laser Based Magnetometer* SBIR Phase I Final Report, July 2009
- *Towards Development of a Practical, Scalable, Multi-Qubit Ion-Trap Quantum Computer*, White Paper in response to IARPA RFI-09-01, Multi-Qubit Coherent Operations, April 2009
- 2008 - *Quantum Cryptography*, PSI Proprietary White Paper, May 2008

Colloquiums

- 2007 - *Vortex Formation by Merging and Interference of Multiple Trapped Bose-Einstein Condensates*, Indian Association for the Advancement of Science, Jadavpur University, Kolkata, India, 29 June 2007
- 2006 - *Spontaneous Formation of Vortices in a Bose-Einstein Condensate*, Instituto de Física, Universidad Nacional Autónoma de México, Mexico City, 25 May 2006
- 2005 - *The Coldest Place in Arizona, or, How we made a Bose-Einstein Condensate*, University of Arizona Optical Sciences Community Speakers Series, 18 Nov 2005

Honors and Awards

- 2006 - SPIE Educational Scholarship in Optical Science and Engineering
- 2005 - Travel Grant, Canadian-American-Mexican Physics Graduate Student Conference, San Diego, August 2005
- 1999-2001 - Graduate Assistantship in Areas of National Need (GAANN) Fellowship, US Department of Education (all expenses paid for 1.5 years)
- 1999 - Honorable Mention, NSF Graduate Research Fellowship
- 1999 - Participant, Undergraduate Summer Institute in Applied Science, UC-Davis/LLNL, August 1999

Community Service / Volunteer Activities

- 2010 - Recently awarded an APS grant, *Hands-On Optics in Guatemala*, to develop a Spanish-language version of the Hands-on Optics kits for use by middle school students in Guatemala as part of LaserFest 2010
- 2009 - Supervised a high school summer intern student at PSI
- Served as a judge at the MA High School State Science Fair, May 2009, MIT
- 2005 - Optics Resource Volunteer, Hands-on Optics (HOO) Program, Safford Magnet Middle School, Tucson, AZ

Professional Society Memberships

- 2006 - present Member of Optical Society of America (OSA)
- 2006 - present Member of Society of Photo-Optical Instrumentation Engineers (SPIE)