

David R. Scherer, Ph.D.

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

Contact Info david.r.scherer@gmail.com
http://www.davidscherer.net
+1.520.907.1175

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. Research projects include:

UV Laser Beam Control for Quantum Computing: Demonstrated fast laser beam electro-optic amplitude modulation in the UV for trapped ion computing applications.

Cold Atom Chamber Development: Designed, developed, and characterized a miniature ultrahigh vacuum chamber with integrated Rb source and non-evaporable getter pumps for cold atom systems. Demonstrated pressure of 10^{-9} Torr using only passive pumps in a compact glass chamber.

Organic Photovoltaic Cells: Used FDTD modeling to optimize device design for OPVs with embedded periodic metallic nanostructures. Determined optimal nano-grating geometry for plasmonic absorption enhancement in OPVs.

Atomic Resonance Filters: 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 μ m). Worked with semiconductor die-bonding equipment to mount QCLs to submounts.

Optical Magnetometry: Developed a laboratory prototype self-oscillating potassium atom magnetometer. Integrated optical and mechanical sensor design and ultrasensitive noise-canceling electronics to demonstrate a compact diode-laser based atomic magnetometer.

1999-2007 Graduate Research Assistant, College of Optical Sciences, University of Arizona, Tucson, AZ

Bose-Einstein Condensation: 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, 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, optical multichannel array grating spectrometers, frequency doubling in nonlinear-optical crystals, atomic spectroscopy, laser cooling, atom trapping
- Hardware - Design and operation of ultra-high vacuum systems, use of high-speed analog and RF electronics and photodiode front ends
- Software - Matlab (advanced), LabVIEW, ZEMAX (basic), HITRAN, FDTD modeling (Lumerical)

Funding Awarded (*total of \$350K to date as PI*)

- 2010 - *Miniature Ultracold Atom Chamber*, Navy SBIR Phase I grant, \$80K, October 2010
 - *UV Beam Conditioner for Quantum Computing*, Army STTR Phase I grant, \$100K, October 2010
 - *Atomic Resonance Filter for Undersea Laser Communication*, Navy SBIR Phase I option grant, \$30K, February 2010
- 2009 - *Atomic Resonance Filter for Undersea Laser Communication*, Navy SBIR Phase I grant, \$70K, May 2009
 - *Diode Laser Based Magnetometer*, Navy SBIR Phase I grant, \$70K, 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)

Submitted Conference Presentations

- 2011 - *Plasmonic Absorption Enhancement in Organic Photovoltaic Cells with Periodic Metallic Nanostructures*, David Scherer, Peter Mayer, Joel Hensley, Mark Allen, Pran Mukherjee, Mark Schattenburg, CLEO, Baltimore, MD, May 2011 (accepted)
- 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

Invited Presentations

- 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 - Awarded an APS grant, *Hands-On Optics in Guatemala*, to develop a Spanish-language version of the Hands-on Optics kits for use by high 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)

Narrative Chronology

Dr. David R. Scherer received the B.S. degree in Electrical Engineering from Boston University in 1999, and then received the M.S. and Ph.D. degrees in Optical Sciences from the University of Arizona in 2002 and 2007, where he worked in the area of ultracold atomic physics under the direction of Prof. Brian Anderson. His thesis research demonstrated the formation of quantized vortices in an atomic-gas Bose-Einstein Condensate (BEC) by the merging and interference of multiple trapped BECs. This research was the first demonstration of a novel mechanism for vortex formation in superfluids, and resulted in publications in *Physical Review Letters* and *Nature*. Dr. Scherer was a recipient of a Graduate Assistantship in Areas of National Need (GAANN) Fellowship from the U.S. Department of Education from 1999 to 2001 and an SPIE Educational Scholarship in Optical Science and Engineering in 2006. Since 2008, Dr. Scherer has been employed as a principal scientist at Physical Sciences Inc., where he has led and contributed to a number of research projects in the areas of photonics, laser systems, and atomic physics. These include tunable external-cavity quantum cascade lasers, plasmonic absorption enhancement in organic photovoltaic cells, miniature ultrahigh vacuum systems for cold atom systems, UV laser beam control systems for quantum computing, and integrated micro-optical resonators for cold atom sensors. His research interests include bringing practical applications of quantum and atomic technology to market for defense and industrial applications. Dr. Scherer is a member of OSA and SPIE. He maintains a keen interest in promoting science in the developing world, and has participated in research visits and science outreach programs in Mexico, India, and Guatemala.