David A. Anderson

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EDUCATION

Ph.D., Applied Physics
University of Michigan, Ann Arbor, MI — May 2015
Advisor: Georg Raithel

M.S.E., Electrical Engineering and Computer Science
University of Michigan, Ann Arbor, MI — December 2011

B.S., Physics, *Magna cum Laude*
Northeastern University, Boston, MA — May 2006

RESEARCH EXPERIENCE

University of Michigan, Ann Arbor, MI, USA
Department of Physics — 2008 – Present
Ph.D. research (advisor: Georg Raithel)
Committee: Georg Raithel (chair), Luming Duan, Alex Kuzmich, Thomas Pohl, Vanessa Sih
Dissertation title: Rydberg molecules and circular Rydberg states in cold atom clouds
Summary: My Ph.D. work focused on studies of cold Rydberg atoms and molecules whose angular-momentum character strongly influences their properties and dynamics. This included the realization of a technique to produce and trap circular Rydberg atoms at low temperature, required for a proposed precision measurement of the Rydberg constant and possible quantum information applications. A second project focused on the effects of angular momentum in Rb_2 long-range Rydberg molecules. Studies revealed these molecules exhibit a wide range of angular momentum coupling schemes which have a significant influence on their properties, features immediately relevant in precision measurements of low-energy electron-atom scattering phase shifts with these new molecular systems.

University of Michigan, Ann Arbor, MI, USA
Department of Physics — 2014
Collaboration with NIST researchers Chris Holloway and Joshua Gordon
Summary: Development of atom-based sensors for electric field measurements. Performed first atom-based measurements of mm-wave electric fields for traceability to fundamental constants and demonstrated sub-wavelength imaging. Two-photon transitions and strong-field effects in Rydberg atoms were also investigated using the measurement technique.

Cornell University, Ithaca, NY, USA
Department of Chemical Engineering — 2007-2008
Laboratory Technician (supervisor: Paul Steen)
Summary: Development of reversible super-adhesive technology exploiting liquid surface tension at microscopic length scales. Advanced the device design to enhance its electrokinetic and microfluidic properties for improved switching times and adhesive strengths. Successfully designed, fabricated, and tested a second-generation device. User at Cornell Nanoscale Science and Technology Facility (CNF) utilizing lithography, thin-film deposition and characterization tools and techniques.

National Institute for Nuclear Physics - LNL, Padova, Italy Summer 2007
U.S. Department of Energy/INFN Summer Research Fellowship (supervisor: Alberto Andrighetto)
Summary: Assisted in the design and testing of measurement methods for thermo-mechanical characterizations of materials at high temperatures (1500-2000^{o}C). Designed and implemented hardware interfacing for data acquisition and real-time visualization/analysis.

Weill Cornell Medical College, New York, NY, USA
Department of Genetic Medicine 2006-2007
Laboratory Technician (supervisors: Neil Hackett, Dolan Sondhi)
Summary: Good Manufacturing Practice (GMP) technician responsible for the creation, purification and characterization of viral gene transfer vectors for US FDA regulated pre-clinical and phase-1 human clinical trials. Development and optimization of quantification methods for measuring virus infectivity and purification efficiency. Successfully constructed AAV serotype-5 helper DNA plasmids used to increase viral vector production efficiency at the facility.

Northeastern University, Boston, MA, USA
Department of Physics 2005-2006
Undergraduate Research Assistant (advisor: Donald Heiman)
Summary: Measured the magnetic coercivity of Co and Co_2MnAl samples using the surface magneto-optic Kerr effect technique.

University of Rochester, Rochester, NY, USA
Laboratory for Laser Energetics 2004
Laboratory Technician (supervisor: Frederic J. Marshall)
Summary: Performed measurements on the absolute response of Kodak Biomax-MS film to x ray line energies in the 1.5 to 8-keV energy range.

PUBLICATIONS

D. A. Anderson, A. Schwarzkopf, S. A. Miller, N. Thaicharoen, G. Raithel, C. L. Holloway, J. Gordon, "Two-photon microwave transitions and strong-field effects in a room-temperature Rydberg-atom gas," Physical Review A, 90, 043419 (2014). http://link.aps.org/doi/10.1103/PhysRevA.90.043419

D. A. Anderson, S. A. Miller, and G. Raithel, "Photoassociation of Long-Range nD Rydberg Molecules," Physical Review Letters, 112, 163201 (2014). http://link.aps.org/doi/10.1103/PhysRevLett.112.163201

D. A. Anderson, S. A. Miller, and G. Raithel, "Angular-momentum Couplings in Long-range Rb_2 Rydberg Molecules," Physical Review A, 90, 062518 (2014). http://journals.aps.org/pra/abstract/10.1103/PhysRevA.90.062518

C. L. Holloway, J. Gordon, A. Schwarzkopf, **D. A. Anderson**, S. A. Miller, N. Thaicharoen, and G. Raithel, "Sub-Wavelength Imaging and Field Mapping via EIT and Autler-Townes Splitting In Rydberg Atoms," Applied Physics Letters, 104, 244102 (2014). http://dx.doi.org/10.1063/1.4883635

J. Gordon, C. L. Holloway, A. Schwarzkopf, **D. A. Anderson**, S. A. Miller, N. Thaicharoen, and G. Raithel, "Millimeter Wave Detection via Autler-Townes Splitting in Rubidium Rydberg atoms," Applied Physics Letters, 105, 024104 (2014). http://dx.doi.org/10.1063/1.4890094

A. Schwarzkopf, **D. A. Anderson**, N. Thaicharoen, and G. Raithel, "Spatial correlations between Rydberg atoms in an optical dipole trap," Rapid Communication Physical Review A, 88, 061406(R) (2013). Selected as an Editors pick. http://link.aps.org/doi/10.1103/PhysRevA.88.061406

D. A. Anderson, A. Schwarzkopf, R. E. Sapiro, and G. Raithel, "Production and trapping of cold circular Rydberg atoms," Rapid Communication Physical Review A, 88, 031401(R) (2013). Selected as an Editors pick. http://link.aps.org/doi/10.1103/PhysRevA.88.031401

F.J. Marshall, J.P. Knauer, **D. Anderson**, and B.L. Schmitt, "Absolute calibration of Kodak Biomax-MS film response to x rays in the 1.5- to 8-keV energy range," Review of Scientific Instruments, 77, 10F308 (2006). http://dx.doi.org/10.1063/1.2221698

J.P. Knauer, F.J. Marshall, B. Yaakobi, **D. Anderson**, B.A. Schmitt, et al., "Response model for Kodak Biomax-MS film to x rays," Review of Scientific Instruments, 77, 10F331 (2006).
http://dx.doi.org/10.1063/1.2220046

PAPERS IN PREPARATION

D. A. Anderson, S. A. Miller, G. Raithel, C. L. Holloway, J. Gordon, "Precision field measurements of high-power radiation sources with Rydberg atoms."

OUTREACH PUBLICATIONS

D. A. Anderson, "Science gets political: The APS Congressional Visit Day 2012," American Physical Society Forum on Graduate Student Affairs Newsletter (2012).
http://www.aps.org/units/fgsa/newsletters/upload/july12.pdf

PATENTS

S. A. Miller, G. Raithel, **D. A. Anderson**, and A. Cadotte. Miniature Mechanical Shutter. U.S. Patent pending, filed March 13, 2014

TALKS AND CONFERENCE CONTRIBUTIONS

TALKS

D. A. Anderson, "Rydberg atoms and molecules in high angular momentum states," invited talk, Air Force Research Laboratory, Kirtland Air Force Base, Albuquerque, New Mexico, USA (September 2014).

D. A. Anderson, S. A. Miller, and G. Raithel, "Excitation of ultra-long-range nd Rydberg molecules," APS March Meeting in Denver, Colorado, USA (March 2014).

D. A. Anderson, S. A. Miller, and G. Raithel, "Photoassociation of long-range nD molecules," Bulletin of the American Physical Society 59, APS DAMOP in Madison, Wisconsin, USA (June 2014).

S. A. Miller, **D. A. Anderson**, A. Schwarzkopf, N. Thaicharoen, and G. Raithel, "Microwave-induced two-photon Autler-Townes splitting in Rydberg EIT," Bulletin of the American Physical Society 59, APS DAMOP in Madison, Wisconsin, USA (June 2014).

N. Thaicharoen, A. Schwarzkopf, **D. A. Anderson**, and G. Raithel, "The effects of light-shift and temporal evolution on collective Rydberg excitations," Bulletin of the American Physical Society 59, APS DAMOP in Madison, Wisconsin, USA (June 2014).

D. A. Anderson, S. A. Miller, and G. Raithel, "Photoassociation of ultra-long-range nD molecules," Bulletin of the American Physical Society 59, APS March Meeting in Denver, Colorado, USA (March 2014).

D. A. Anderson, A. Schwarzkopf, and G. Raithel, "Magnetic trapping of circular Rydberg atoms," Bulletin of the American Physical Society 58, APS-DAMOP in Quebec City, Quebec, Canada (June 2013).

D. A. Anderson, A. T. Cadotte, R. E. Sapiro, and G. Raithel, "Interaction between ultra-cold ions and Bose-Einstein condensates," Bulletin of the American Physical Society 56, APS-DAMOP in Atlanta, GA, USA (June 2011).

D. A. Anderson, "Laser cooling, atom trapping and Bose-Einstein condensation," Society of Physics Students at Northeastern University, Boston, MA, USA (April 2010).

D. A. Anderson, "Cold Atoms: An overview of experiments in the Raithel group," Midwestern Cold Atom Workshop at the University of Michigan, Ann Arbor, MI, USA (November 2010).

POSTERS

D. A. Anderson, S.A. Miller, and G. Raithel, "Microwave-induced two-photon Autler-Townes splitting in Rydberg EIT," Midwestern Cold Atom Workshop, Argonne National Laboratory, Lemont, Illinois, USA (November 2014).

S. Miller, **D. A. Anderson**, and G. Raithel, "Electric-field and two-photon excitation calculations for BEC-ion interaction Experiments," Bulletin of the American Physical Society 58, Quebec City, Quebec, Canada (June 2013).

D. A. Anderson, A. Schwarzkopf, and G. Raithel, "Cold Rydberg atoms in circular states," Bulletin of the American Physical Society 57, APS-DAMOP in Anaheim, California, USA (June 2012).

A. Schwarzkopf, **D. A. Anderson**, and G. Raithel, "Imaging spatial correlations of Rydberg excitations in cold atom clouds," Bulletin of the American Physical Society 57, Anaheim, California, USA (June 2012).

S. Miller, **D. A. Anderson**, A. T. Cadotte, and G. Raithel, "A miniature mechanical shutter for atomic beams," Bulletin of the American Physical Society 57, APS-DAMOP in Anaheim, California, USA (June 2012).

D. A. Anderson, R. E. Sapiro, and G. Raithel, "Ion-BEC interactions," Bulletin of the American Physical Society 55, APS-DAMOP in Houston, TX, USA (June 2010).

D. A. Anderson, A. T. Cadotte, R. E. Sapiro, and G. Raithel, "Interaction between ultra-cold ions and Bose-Einstein condensates," Workshop on ultra-cold Rydberg atoms in Recife, Brazil (December 2010).

D. A. Anderson, R. E. Sapiro, R. Zhang, G. Raithel, "Atom interferometry using Kapitza-Dirac scattering," Bulletin of the American Physical Society 54, APS-DAMOP at the University of Virginia, Charlottesville, VA, USA (June 2009).

AWARDS AND FELLOWSHIPS

University of Michigan Rackham Pre-doctoral Fellowship 2014-2015

University of Michigan College of Engineering Recruit at Home grant 2010

University of Michigan Applied Physics Fellowship 2008-2010

U.S. Department of Energy/INFN Summer Exchange Fellowship 2007

Northeastern University Presidential Scholarship 2002-2006

Northeastern University Amelia Peabody Scholarship 2002-2006

COMPUTER SKILLS

Programming languages: Python, MATLAB, C/C++, LaTeX, NI Labview, HTML, MySQL

Operating systems: Windows and Linux

LANGUAGES

English: native language

Italian: speak fluently, read and write with high proficiency

German: speak, read and write with basic competence

PROFESSIONAL ASSOCIATIONS

American Physical Society, member 2009-Present

APS Forum on Graduate Student Affairs, member and treasurer 2012-2014

OUTREACH AND VOLUNTEER WORK

Treasurer for the American Physical Society Forum on Graduate Student Affairs 2012-2014

- Made annual budgets; was in charge of allocating and distributing FGSA funds.
- Managed and administered "FGSA Travel Award for Excellence in Graduate Research."
- Chaired invited session on "Postdocs and the Application Process," APS March Meeting 2014.

University of Michigan Physics Olympiad (http://olympiad.physics.lsa.umich.edu/) 2014

- Member of the preparation team and judge for "Katapult event."

APS Congressional Visit Day 2012

- Graduate student representative in APS Congressional Visit Day (February 2012).
- Met with Michigan representatives in the U.S. Congress to discuss science policy and societal/economic benefits of science funding for basic and applied research on behalf of the APS membership.

University of Michigan Demo Day 2009 and 2010

- Gyroscope demonstrations for middle school students.