Dr. William F. Holmgren

Contact Information

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Research Interests

Energy and climate

- Technologies that enable high penetrations of renewable power on utility grids
- Relationships between weather prediction and energy use and generation
- Energy policies from local to international scales to encourage reliable, low-cost clean energy

Education

Ph.D. in Physics, University of Arizona, Tucson, May 2013
M.S. in Physics, University of Arizona, Tucson, May 2010
B.A. in Physics, University of Colorado, Boulder, May 2006

Academic Experience

University of Arizona, Department of Atmospheric Sciences

Postdoctoral Research Associate May 2013 to present

- Developed components for a hybrid forecasting system for photovoltaic power production that combines data from a network of irradiance sensors, satellite imagery, and numerical weather models by actively coordinating research teams in the Department of Atmospheric Sciences, the Department of Physics, the Renewable Energy Network, the College of Agriculture and Life Sciences, and the Department of Economics.
- Created a website (forecasting.uaren.org) to deliver power production forecasts to Tucson Electric Power.
- Led the development of a website (sveri.uaren.org) that shows, for the first time, the real-time mix of renewable and conventional generation in the southwest. This required leading and coordinating the seven utilities of SVERI and four web designers and developers.
- Represented our research team by giving 11 public, conference, and utility presentations of our work in less than a year.

University of Arizona, Department of Physics

Graduate Research Associate May 2008 to May 2013

- Developed and published a novel experiment to measure the dynamic polarizability and tune-out wavelengths of potassium.
- Designed, built, operated and published an atom interferometer experiment to measure atomic polarizabilities with 0.3% precision.

- Designed and published a new way to measure atom beam velocity in an interferometer with improved precision.
- Mentored three graduate students, two of which won NSF GRFP fellowships.
- Mentored four undergraduate students that went on to top graduate schools in physics.
- Assisted the design, data collection, and analysis of three experiments to precisely measure the van der Waals potentials of alkali atoms.

Teaching Assistant August 2007 to May 2008

- Assisted instruction of Physics 381/382/481/483 – Methods in Experimental Physics. Motivated and guided weekly and semester-long student projects.
- Mentored students in graduate school application process

University of Colorado, Department of Physics and JILA

Undergraduate Research and Teaching Assistant April 2004 to May 2007

- Worked with a team of 20 people at CU and two large companies to develop a portable atom chip vacuum cell for rapid Bose-Einstein condensate production.
- Co-taught introductory physics classes with graduate students as part of a pilot program to improve physics education.

Awards

2012 Galileo Circle Fellowship
2011-2012 TRIF Imaging Fellowship
2011 Galileo Circle Fellowship
2008-2009 TRIF Photonics Fellowship

Publications

Refereed journal articles

I. Hromada, R. Trubko, W.F. Holmgren, M.D. Gregiore, and A.D. Cronin, *"de Broglie wave-front curvature induced by electric-field gradients and its effect on precision measurements with an atom interferometer"* Physical Review A **89**, 033612 (2014).

W.F. Holmgren, R. Trubko, I. Hromada, and A.D. Cronin, *"Measurement of a Wavelength of Light for Which the Energy Shift for an Atom Vanishes"* Physical Review Letters **109**, 243004, (2012).

W.F. Holmgren, I. Hromada, C.E. Klauss, and A.D. Cronin, *"Atom beam velocity measurements using phase choppers"* New Journal of Physics 13, 115007 (2011).

V.P.A. Lonij, C.E. Klauss, W.F. Holmgren, and A.D. Cronin, *"Can atom-surface potential measurements test atomic structure models?"*, Journal of Physical Chemistry **115**, 7134 (2011).

V.P.A. Lonij, C.E. Klauss, W.F. Holmgren, and A.D. Cronin, *"Atom diffraction reveals the impact of atomic core electrons on atom-surface potentials"*, Physical Review Letters **105**, 233202 (2010).

W.F. Holmgren, M.C. Revelle, V.P.A. Lonij, and A.D. Cronin *"Absolute and ratio measurements of the polarizability of Na, K, and Rb with an atom interferometer"*, Physical Review A **81**, 053607 (2010).

V.P.A. Lonij, W.F. Holmgren, and A.D. Cronin, *"Magic ratio of window width to grating period for van der Waals potential measurements using material gratings"*, Physical Review A **80**, 062904 (2009).

Conference proceedings

W.F. Holmgren, A.T. Lorenzo, M. Leuthold, C.K. Kim, A.D. Cronin, and E.A. Betterton, *"An Operational, Real-Time Forecasting System for 250 MW of PV Power Using NWP, Satellite, and DG Production data"* submitted to the 40th IEEE Photovoltaic Specialist Conference (2014).

A.T. Lorenzo, W.F Holmgren, and A.D. Cronin, *"Short-term PV Power Forecasts Based on a Real-Time Irradiance Monitoring Network"* submitted to the 40th IEEE Photovoltaic Specialist Conference (2014).

Non-refereed articles

A.D. Cronin and W.F. Holmgren, *"Matter waves in a new light"* Nature Physics **9**, 137 (2013).

Patents

Solar irradiance measurement system and weather model incorporating results of such measurement, V. Lonij, WFH, A. Cronin, E. Betterton, M. Leuthold, No. 14/090602

Alkali metal dispenser and uses for same, S.E. McBride, S.A. Lipp, J.J. Michalchuk, D.Z. Anderson, WFH, M.B. Squires, No. 7955551.

SELECTED PRESENTATIONS AND POSTERS

Arizona Corporation Commission Workshop on Emerging Technologies, 2014, Talk: *Real-Time Renewable Power Forecasting* WFH, A.T. Lorenzo, M. Leuthold, C.K. Kim, E.A. Betterton, A.D. Cronin, R. Granillo, A. Barnhart

Utility Variable-Generation Integration Group, Workshop on VG Forecasting Applications to Power System Planning and Operations, 2014, Talk: *Real-Time Renewable Power Forecasting* WFH, A.T. Lorenzo, M. Leuthold, C.K. Kim, E.A. Betterton, A.D. Cronin, R. Granillo, A. Barnhart

Tucson Electric Power Integrated Resource Plan, 2013, Talk: *Real-Time PV Power Forecasting* WFH, T. Burhans.

Pima County Department of Environmental Quality Advisory Council, 2013, Talk: *Real-Time Renewable Power Forecasting* WFH, A.T. Lorenzo, M. Leuthold, C.K. Kim, E.A. Betterton, A.D. Cronin, R. Granillo, A. Barnhart

PV Insider Conference, 2013, Talk: *PV Power Forecasting for Tucson Electric Power* WFH, M. Romito.

Ph.D. Thesis Defense, 2013, Talk: *Polarizability and magic-zero wavelength measurements of alkali atoms* WFH.

Chemical Physics Program Seminar, 2013, Talk: *Magic-zero wavelengths and their applications.* WFH, R. Trubko, I. Hromada, and A.D. Cronin.

APS DAMOP 2012, Talk: *Measurement of the first tune-out wavelength of K with an atom interferometer.* WFH, R. Trubko, I. Hromada, and A.D. Cronin.

APS DAMOP 2011, Talk: *Polarizability measurements of the ground and metastable states of Sr, Yb, and Ba.* WFH, I. Hromada, C.E. Klauss, V.P.A Lonij, and A.D. Cronin.

APS DAMOP 2010, Talk: *Absolute and ratio measurements of the polarizability of Na, K, and Rb.* WFH, M.C. Revelle, V.P.A. Lonij, and A.D. Cronin.

APS DAMOP 2010, Poster: *A multispecies atom interferometer.* I. Hromada, C.E. Klauss, WFH, V.P.A. Lonij, and A.D. Cronin.

Low Energy Seminar, U of A Physics, Talk: *Absolute and ratio measurements of the polarizability of Na, K, and Rb.* WFH, M.C. Revelle, V.P.A. Lonij, and A.D. Cronin.

Frontiers of Matterwave Optics 2010, Poster: *Absolute and ratio measurements of the polarizability of Na, K, and Rb.* WFH, M.C. Revelle, V.P.A. Lonij, and A.D. Cronin.

APS DAMOP 2009, Poster: *Atom interferometry measurements of the polarizability of Na, K, and Rb*, WFH, M. C. Revelle, V. P. A. Lonij, and A. D. Cronin.

APS DAMOP 2007, Poster: *Portable Atom Chip Vacuum Cell for Rapid BEC Production* , M. B. Squires, E. A. Salim, WFH, D. Z. Anderson, S. E. McBride, S. A. Lipp, J. F. Denatale, R. E. Mihailovich.

Service

Solar Energy referee.
Women in Physics volunteer.
Physical Review A referee.

Guest lecturer, Physics 141. October 2012.
Davis Elementary School science fair judge. February 2012.
Assistant for the Bill Phillips Galileo Circle Lecture. January 2012.
Guest lecturer, Physics 578. March 2011.
Guest lecturer, Physics 141. November 2010.
GPSC Travel Grant judge. June 2008.
Physics Fun Night performer. December 2007.
CU-Physics Wizards program. April 2007.

Technical Skills

Electronics systems including lab-based and remote data acquisition systems, servo systems, low noise current sources, photodetectors, and phase lock loops.

Ultra-high vacuum system construction and maintenance of ion, titanium sublimation, turbo, scroll, and diffusion pumps.

Proficient machinist. Some experience in glass and woodworking.

Software packages

- Scientific Python stack (python, numpy, scipy, pandas): data processing and analysis, object-oriented software development, greater than 99% uptime of a forecasting delivery program.
- D3/jquery: DOM manipulation, interactive custom SVG line and stacked area charts.
- HTML/CSS/PHP/MySQL: website design and construction integrated with database queries and management
- Labview: instrumentation and control, data acquisition
- Igor Pro: modeling, data analysis, curve fitting
- Mathematica: modeling, data analysis, curve fitting
- SolidWorks 3D modeling/drafting
- LaTeX
- Some additional experience with Matlab, bash, Java, Perl, Objective-C