

Scott G. Sayres

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FACULTY APPOINTMENTS

Assistant Research Professor, Arizona State University Aug 2014 - Present
Department of Chemistry & Biochemistry
Arizona State University, Tempe, AZ, USA

Assistant Research Professor, Arizona State University Aug 2014 - Present
The Biodesign Institute's Center for Applied Structural Discovery
Arizona State University, Tempe, AZ, USA

EDUCATION AND TRAINING

Postdoctoral Research Associate, May 2011 – Aug 2014
University of California, Berkley
Advisor: Stephen R. Leone

Ph.D. Chemistry, August 2010
The Pennsylvania State University
Advisor: A. W. Castleman, Jr.
Thesis: "The Strong-Field Ionization Mechanisms of Molecules and Clusters"

B.S., Double Major: Mathematics and Chemistry, May 2004
Shippensburg University, Graduated *cum laude*

RESEARCH EXPERIENCE

Postdoctoral Research Associate, University of California, Berkley May 2011 – Aug 2014

- Study of attosecond dynamics in gas phase samples using tabletop transient x-ray absorption
- Developed theoretical models to describe the double sequential tunnel ionization and coherences in Xe^+ and Xe^{2+}
- Experimentally measured the alignment of Xe^{2+} to demonstrate the role of electron correlation in the strong-field ionization process.

Postdoctoral Research Associate, The Pennsylvania State University Sep. 2010 – May 2011
Graduate Research Assistant, The Pennsylvania State University Jun. 2004 – Aug. 2010

- Characterization of a wide variety of molecular clusters
- Established new methodology to explore strong-field ionization
- Performed intensity resolved laser excitation experiments
- Used Coulomb explosion to determine the size of cluster where enhanced ionization begins
- Designed and constructed a time-of-flight mass spectrometer
- Used molecular-orbital ADK tunneling ionization theory to explore the strong-field response of molecules

SELECTED PUBLICATIONS

11. **S. G. Sayres**, E. R. Hosler, S. R. Leone. Exposing the Role of Electron Correlation in Strong-Field Double Ionization: X-ray Transient Absorption of Orbital Alignment in Xe^+ and Xe^{2+} . *J. Phys. Chem. A*. **118**, 8614-8624 (2014).
10. A. N. Pfeiffer, **S. G. Sayres**, S. R. Leone, Calculation of valence electron motion induced by sequential strong field ionization. *Mol. Phys.* **111**, 2283-2291 (2013).
9. D. E. Blumling*, **S. G. Sayres***, M. W. Ross, A. W. Castleman Jr. Strong-field ionization of small niobium and tantalum clusters. *Int. J. Mass. Spectrom.*, **333**, 55-58 (2013). ***These authors contributed equally to this work**
8. **S. G. Sayres**, M. W. Ross, A. W. Castleman Jr., Onset of Coulomb explosion in small silicon clusters exposed to strong-field laser pulses. *New Journal of Physics*, **14**, 055014 (2012).
7. V. Brites, K. Franzreb, J. N. Harvey, **S. G. Sayres**, M. W. Ross, D. E. Blumling, A. W. Castleman Jr., and M. Hochlaf, Oxygen-containing gas-phase diatomic trications and tetracations: ReO^{2+} , NbO^{2+} and HfO^{2+} ($z = 3, 4$). *Phys. Chem. Chem. Phys.* **13**, 15233-15243 (2011).
6. **S. G. Sayres**, M. W. Ross, A. W. Castleman, Jr. Delocalized electronic behavior observed in transition metal oxide clusters under strong-field excitation. *J. Chem. Phys.* **135**, 054312 (2011).
5. **S. G. Sayres**, M. W. Ross, A. W. Castleman Jr. Influence of clustering and molecular orbital shapes on the ionization enhancement in ammonia. *Phys. Chem. Chem. Phys.* **13**, 12231-12235 (2011). ***Selected as a hot article**
4. D. E. Blumling*, **S. G. Sayres***, A. W. Castleman Jr. Strong-field ionization and dissociation studies on small early transition metal carbide Clusters via time-of-flight mass spectrometry. *J. Phys. Chem. A*, **115**, 5038-5043 (2011). ***These authors contributed equally to this work.**
3. D. E. Blumling*, **S. G. Sayres***, A. W. Castleman Jr. Strong-field ionization and dissociation of small early transition metal oxide clusters. *Int. J. Mass. Spectrom.* **300**, 74-80 (2011). ***These authors contributed equally to this work.**
2. **S. G. Sayres**, M. W. Ross, A. W. Castleman Jr. Ultrafast ionization and fragmentation of molecular silane. *Physical Review A*, **82**, 033424 (2010).
1. S. J. Peppernick, D. D. K. Gunaratne, **S. G. Sayres**, A. W. Castleman Jr. Photoelectron imaging of small silicon cluster anions, Si_n^- ($n=2-7$). *J. Chem. Phys.*, **132**, 044302-044313 (2010).

PENDING GRANT PROPOSALS

- 2014 Army Research Office, FY 2015 Defense University Research Instrumentation Program (DURIP), High Intensity Few-cycle Laser Pulses for Observing Electron Dynamics on the Attosecond Timescale, \$741,850.
- 2014 Air Force Office of Scientific Research, FY 2015 Defense University Research Instrumentation Program (DURIP), High Intensity Few-cycle Laser Pulses for Observing Electron Dynamics on the Attosecond Timescale, \$741,850.

SELECTED AWARDS

Koerner Dissertation Award	2011
First Place Award, Graduation Exhibition Poster Competition, The Pennsylvania State University	2010
Dan H. Waugh Memorial Teaching Award, Honorable Mention	2005
Roberts Graduate Fellowship	2004
PSECU Student Award	2004
Clarence-Shock Award	2004
SICO Scholarship Award	2000-2003

TEACHING EXPERIENCE

The Pennsylvania State University

Tutor, Chemistry	2006-2008
Teaching assistant, Chemistry Dynamics, CHEM110	Spring 2005, Fall 2006
Teaching assistant, Experimental Chemistry I laboratory, CHEM111	Fall 2004
Teaching assistant, Experimental Chemistry II laboratory, CHEM113	Spring 2005

Arizona State University

SES494 Special Topics	Spring 2015
CHE392 Special Topics	Spring 2015

MENTORING EXPERIENCE

2014-present	Undergraduate Research Mentor, Youssef (Joe) Youssef, ASU, Space and Earth Science major, Ultrafast XUV Spectrometer System Design
2014-present	Undergraduate Research Mentor, Nancy Fujikado, ASU, Chemical Engineering major Investigating Ultrafast response of selenoproteins
2013-Summer	Undergraduate Research Mentor, Quynh Nguyen, Temple University, Chemistry major Investigating ultrafast atomic transient absorption
2010-Fall	Graduate Student Evaluator, The Pennsylvania State University, Served on the 2 nd year oral evaluation committee of graduate student: Jens Breffke, Chemistry

SCIENCE OUTREACH AND VOLUNTEERING

2015	Night of the Open Door, ASU: Organized an interactive scientific activity for Biodesign
2010	USA Science and Engineering Festival, National GWIS event: Helped plan and implement an interactive scientific activity for approximately 10,000 participants
2010	State College High School Workshop Organizer: Organized an introduction to lasers workshop and laboratory tour for high school students Organized Introduction to lasers workshop for high school students
2008-2011	Girl Scout Workshop: Participated in a biannual science outreach workshop, serving 50 7 th -12 th grade Girl Scouts each workshop.

PROFESSIONAL AFFILIATIONS

Graduate Women in Science, 2008-2009
American Physical Society, 2008-present
American Chemical Society, 2008-present
American Association for the Advancement of Science, 2011-present
Optical Society America, 2014-present

PEER REVIEWER

New Journal of Physics

SKILLS

Experimentation/ Instrumentation Experience

- **Cluster research:** Construction and characterization of a wide range of gas-phase clusters.
- **Ultrafast laser systems:** Maintained multiple ultrafast laser systems, including a colliding-pulse mode-locked dye laser and Ti:Sapphire based laser systems. Isolated attosecond pulse generation.
- **Intensity resolved scanning spectroscopy:** Strong-field and multiphoton ionization
- **Coulomb explosion Imaging:** Kinetic energy release measurements following the multiple ionization and dissociation of gas phase species.
- **Velocity map imaging spectroscopy:** Basex reconstruction, and angular momentum algebra
- **Mass Spectrometry:** Design and construction of a tandem time-of-flight mass spectrometer, with reflectron and mass gate.
- **High vacuum design and maintenance:** Designed HV vacuum system with multiple chambers and differential pumping. Experience with diffusion, turbo, ion pumping.
- **Attosecond x-ray transient absorption:** Tabletop high harmonic generation of 40-100 eV, including carrier envelope phase stabilization. Pump-probe spectroscopy with 4 fs pulses.
- **High Voltage electronics:** Synchronized electronic timing for high voltage switches for ion optics, and multichannel plate detector.

Computational/Programming Skills

- **Software Development:** Molecular Dynamics, BASEX reconstruction, and quantum tunneling simulations and data analysis software written in Python and C++. Instrumental interfacing, automation, and analysis with Labview.
- **Tunneling Ionization Theory:** ADK/MO-ADK tunneling rates, multipole expansion, double ionization electronic coherence and wave packets.
- **Ab Initio electronic structure:** DFT structure optimizations in Gaussian 03

SELECTED PRESENTATIONS

- S. G. Sayres**, Ultrafast Intense Light-Matter Interaction: Correlated Electron Dynamics and Molecular Fireworks. **Invited seminar speaker** at The Department of Chemistry and Biochemistry, Arizona State University, January 23, 2015.
- S. G. Sayres**, Tabletop Attosecond Laser Sources. **Invited speaker** at BioXFEL, Arizona State University, October 01, 2014.
- S. G. Sayres**, *Correlated Electron Dynamics and Strong-Field Ionization*. **Invited speaker** at Physics Department, Auburn University, Auburn, AL, April 2014.
- S. G. Sayres**, *Extreme Ionization of Clusters by Femtosecond Laser Pulses Leading to Coulomb Explosion*. **Invited speaker** at Chemistry Department Seminar, University of Nebraska- Lincoln, Lincoln, NE, November 2012.
- S. G. Sayres**, *Extreme Ionization of Clusters by Femtosecond Laser Pulses Leading to Coulomb Explosion*. Speaker at Chemistry Department, University of California- Berkeley, Berkeley, CA, October 2010
- S. G. Sayres**, M. W. Ross, A. W. Castleman Jr. *Extreme Ionization Mechanisms in Clusters by Femtosecond Lasers Leading to Coulomb Explosion*. Poster at the 2010 Penn State Graduate Exhibition. University Park, PA, March 2010.
- S. G. Sayres**, M. W. Ross, A. W. Castleman Jr. *Femtosecond Electron Dynamics of Silicon and Ammonia Clusters Leading to Coulomb Explosion*. Poster at the Meeting of the American Chemical Society. Washington, DC. August 2009.
- D. E. Blumling, **S. G. Sayres**, A. W. Castleman Jr. *Coulomb Explosion of Transition Metal Oxides*. Poster at the Division of Atomic and Molecular Optical Physics. University Park, PA. May 2008.
- D. E. Blumling, **S. G. Sayres**, A. W. Castleman Jr. *Coulomb Explosion of Transition Metal Oxide Clusters:*

Experiments and Simulations. Poster at the Gordon Research Conference: “Clusters, Nanocrystals, & Nanostructures”. South Hadley, MA. July 2007.

D. E. Blumling, **S. G. Sayres**, A. W. Castleman Jr. *Investigations of Mass Selected Transition Metal Oxides Clusters via Tandem TOF-MS.* Poster at Theory of Atomic and Molecular Clusters, Richmond, VA. May 2007.