KRISTEN LYNN ZURASKI

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EDUCATION

PhD in Physical Chemistry — Jan 2013 – May 2018
University of Southern California, Los Angeles, CA

Bachelor of Science in Chemistry — Aug 2008 – May 2012
Michigan State University, East Lansing, MI

RESEARCH EXPERIENCE

Research Scientist II, *NOAA Chemical Sciences Laboratory*, Boulder, CO Jan 2021 – present

- *Group: Tropospheric Chemistry*
- Research to characterize and understand the atmospheric composition, reactivity, and air quality impacts of nitrogen oxide species and ozone. This work primarily consists of developing new instrumentation for airborne and ground-based measurements of these gas species in the troposphere. The interpretation of the retrieved data improves our understanding of atmospheric chemistry and air pollution transport from megacites to surrounding environments.

NASA Postdoctoral Program Fellow, *Jet Propulsion Laboratory*, Pasadena, CA

- *Advisor:* Dr. Stanley Sander July 2018 – Jan 2021
- Laboratory research in the area of atmospherically important chemical kinetics. This includes methods involving laser induced fluorescence (LIF), infrared kinetic spectroscopy (IRKS), and multiplexed photoionization mass spectrometry (MPIMS). The goals of these projects were to accurately determine kinetic information, branching ratios, and the effects of relative humidity, temperature, and pressure on chemical reactions to address uncertainties in atmospheric modeling and support current/future NASA flight projects including TES, MLS, and DISCOVER-AQ. The reactions studied include species important to the Earth's upper troposphere and lower stratosphere, including reactions between peroxy radicals, NO_x and HO_x species, as well as Creigee intermediates.
- Designed and implementing a method for simultaneous detection of HO_2, OH, and peroxy radicals by exploiting IR diode lasers using heterodyne wavelength modulated spectroscopy (WMS). The new optical design, pressure control, and programing has improved the overall sensitivity, stability, and autonomy of the IRKS instrument and significantly reduced the acquisition time for experiments. Using these improved instrument capabilities, reactions between HO_2 and peroxy radicals were studied over low temperatures focusing on rate enhancements resulting from hydrogen bond complexation moieties and changes in OH formation pathways. For analysis, I developed and wrote a Python programming code that fits time-dependent chemical kinetics simulations to data and performs Monte Carlo simulations for error and sensitivity analysis.
- Conducted research at the Advance Light Source (ALS), Lawrence Berkeley National Laboratory, using the MPIMS instrument during three campaigns over the course of 1.5 years. Investigated chemical kinetics and reaction dynamics of Creigee intermediates and organic nitrates, key species in the Earth's atmosphere.

Research Internship, *Jet Propulsion Laboratory*, Pasadena, CA June 2017 – May 2018

- *Advisor:* Dr. Stanley Sander
- Characterized and optimized a low pressure flow tube, mass spectrometer apparatus. Improvements to the system included achieving lower vacuum pressures and optimizing ion counts which enabled

the preliminary experiments into the effect of water complexation on organic nitrate formation. Ultimately, this work was used to guide and define the research conducted at the ALS.

- Designed, built, and characterized an infrared diode laser-based water spectrometer. This spectrometer is currently used to characterize water concentrations during kinetics laboratory measurements and has proved vital for experiments at the ALS on the MPIMS apparatus as well as on the LIF and IRKS systems in the Kinetics and Photochemistry Laboratory at JPL

Research Assistant, *University of Southern California*, Los Angeles, CA Jan 2013 – May 2018

- *Advisor*: Dr. Hanna Reisler
- Self-directed experimental studies on the molecular dissociation dynamics of small atmospherically relavant clusters. Focus involved fundamental studies of the $HCl_mH_2O_n$ (m = 1-3, n = 0-3) hydrogen-bonded clusters. The largest observed being the HCl-$(H_2O)_3$ tetramer. Clusters of all sizes were introduced into a high vacuum chamber via a pulsed molecular beam. The cluster of interest was then selected by infrared irradation that was absorbed to induce dissociation to HCl, H_2O, and $HCl_mH_2O_n$ fragments. The monomers were detected in selected ro-vibratational states by resonance enhanced multiphoton ionization (REMPI) in tandem with time-of-flight mass spectrometry (TOF-MS) and velocity map imaging (VMI). The goal of this project was to learn about the discossiation pathways, product energy distributions, and dissociation energies for individual clusters. Combined with other studies, this provides a better understanding of hydrogen bonding and acid solvation on a larger scale. Beyond fundamental interest, the motivations were also driven by aiding in the understanding of HCl reservoir interactions with polar stratospheric clouds.

Research Assistant, *Michigan State University*, East Lansing, CA Dec 2010 – Dec 2012

- *Advisor:* Dr. Marcos Dantus
- Primary project examined the effects of ultrafast infrared irradiation on whole body organisms.
- Experiments required the use and alignment of ultrafast laser systems, second and third harmonic light generation, two-photon imaging techniques, single beam four-wave mixing spectroscopy, coherent anti-Stokes Raman spectroscopy, and multiphoton intrapulse interferometry phase scan (MIIPS) pulse shaping.

AWARDS AND FUNDED GRANTS

2018: NASA Postdoctoral Program Fellowship (NPP); ~$200K

2016: Women in Science and Engineering Travel Grant (2)

2015: Women in Science and Engineering Travel Grant (2)

2011: Image of the Week Award in Optics and Photonics News

Midwestern Symposium Research Best Poster Award

KEY SKILLS

Lasers	Frequency modulated infrared diode lasers, Nd:YAG systems, Ti:Sapphire lasers (fiber and non-fiber), OPO/OPA systems, ultraviolet emiting dye lasers, and UV laser driven light sources

Detection Methods	Velocity mapped imaging (VMI), quadropole mass spectrometry, time-of-flight mass spectrometry (ToF-MS), PMTs, CCDs, pulsed and non-pulsed MCPs, UV absorption spectroscopy, IR action spectroscopy, photon counters, photoacoustic spectroscopy, resonance enhanced multiphoton ionization (REMPI) spectroscopy, and wavelength modulated spectroscopy (WMS)
Additonal Laboratory Experience	High to ultra-high vacuum technology, photoionization methods, microwave discharge systems, sample injection by pulsed piezo nozzle systems followed by cluster formation by supersonic expansion, molecular beam experiments, flow experiments, and longpath multipass Herriot optics setups
Programming	Highly experience in Python, MATLAB, and NI LabVIEW
Software	Graphing and data analysis with Igor PRO and Origin Pro. Spectroscopy simulations with HAPI (interfaced with Python) and PGOPHER. Kinetics simulations with Kintecus modeling software and self-developed Python 3 codes
Teaching	*Laboratory and Lecture Teaching Assistant* (Jan. 2013 – May 2018): honors general chemistry courses and organic chemistry courses at the University of Southern California Teaching and training graduate and undergraduate students in a research laboratory setting
Communication	Multiple Oral and poster presentations at National and International Conferences (see Conference presentations) as well as an invited talk at Caltech (March 2019)
Proposal Writing	Successfully funded NPP fellowship research proposal Named postdoctoral research assistant on two ROSES proposals
Leadership	Financial Director and boardmember of the University of Southern California's Graduate Student Government (2016-2018). This was a student-elected position that encompassed all the graduate school programs at USC.

PUBLICATIONS

1. M. F. Vansco, R. L. Caravan, S. Pandit, **K. Zuraski**, F. A. F. Winiberg, Kendrew Au, Trisha Bhagde, Nisalak Trongsiriwat, Patrick J. Walsh, David L. Osborn, Carl J. Percival, Stephen J. Klippenstein, Craig A. Taatjes, and Marsha I. Lester, "Formic acid catalyzed isomerization and adduct formation of an isoprene-derived Criegee intermediate: Experiment and theory." *Phys. Chem. Chem. Phys*. **2020**, *22*, 26796-26805. DOI: 10.1039/D0CP05018K

3. F. A. F. Winiberg, **K. Zuraski**, Y. Liu, S. P. Sander, C. J. Percival "Pressure and temperature dependencies of rate coefficients for the reaction OH + NO_2 + M → products." *J. Phys. Chem. A* **2020**, *124,* 10121-10131. DOI: 10.1021/acs.jpca.0c08920

2. **K. Zuraski**, A. O. Hui, F. Grieman, F. A. F. Winiberg, C. J. Percival, S. P. Sander, "Acetonyl peroxy and hydro peroxy self- and cross-reactions: Kinetics, mechanism, and chaperone enhancement from the perspective of the hydroxyl radical product." *J. Phys. Chem. A* **2020**, *124*, 8128-8143. DOI: 10.1021/acs.jpca.0c06220

4. M. F. Vansco, R. L. Caravan, **K. Zuraski**, F. A. F. Winiberg, K. Au, N. Trongsiriwat, P.J. Walsh, D.L. Osborn, C.J. Percival, M. A. H. Khan, D .E. Shallcross, C. A. Taatjes, M. I. Lester, "Experimental evidence

of dioxole unimolecular decay pathway for isoprene-derived Criegee intermediates" *J. Phys. Chem. A* **2020**, *124* (18), 3542-3554. DOI: 10.1021/acs.jpca.0c02138

5. R. L. Caravan, M. F. Vansco, K. Au, M. A. H. Khan, Y.-L. Li, F. A. F. Winiberg, **K. Zuraski**, Y.-H. Lin, W. Chao, N. Trongsiriwat, P. J. Walsh, D. L. Osborn, C. J. Percival, J. J.-M. Lin, D. E. Shallcross, L. Sheps, S. J. Klippenstein, C. A. Taatjes, and M. I. Lester, "Direct kinetic measurement and theoretical predictions of an isoprene-derived Criegee intermediate" *Proceedings of the National Academy of Sciences* **2020**, *117* (18) 9733-9740. DOI: 10.1073/pnas.1916711117

6. **K. Zuraski,** "Photodissociation Dynamics and Energetics of HCl-$(H_2O)_3$" Doctoral Dissertation, University of Southern California, Los Angeles, California USA, **2018**.

7. **K. Zuraski,** K. Wang, D. Kwasniewski, J. Bowman, and H. Reisler, "Predissociation dynamics of the HCl-$(H_2O)_3$ tetramer: An experimental and theoretical investigaion" *J. Chem. Phys.* **2018**, *148*, 204303. DOI: 10.1063/1.5026585

8. **K. Zuraski,** D. Kwasniewski, A. Samanta, and H. Reisler, "Vibrational predissociation of the HCl-$(H_2O)_3$ tetramer" *J. Phys. Chem. Lett.* **2016**, *7* (21), 4243-4247. DOI: 10.1021/acs.jpclett.6b01848

9. I. Saytashev, N. Winkler, **K. Zuraski**, V. Lozovoy, M. Dantus, "Pulse duration and energy dependence of phtodamage and lethality induced by femtosecond near infrared laser pulses in Drosophia melanogaster," *J. Photochem. Photobiol. B* **2012** *115*, 42-50. DOI: 10.1016/j/jphotobiol.2012.06.009

CONFERENCE PRESENTATIONS AND INVITED TALKS

K. Zuraski, F. Grieman, A. Hue, F.A.F. Winiberg, C.J. Percival, S.P. Sander , "Acetonylperoxy and hydroperoxy Kinetics from the Perspective of Hydroxyl Radicals," oral presentation at the American Geophysical Union Fall Meeting, December 2019, San Fransisco, CA.

K. Zuraski, F. Grieman, A. Hue, F.A.F. Winiberg, C.J. Percival, S.P. Sander, "Acetonylperoxy and hydroperoxy Kinetics from the Perspecive of Hydroxyl Radicals," oral presentation at the American Chemical Society Fall Meeting, August 2019, San Diego, CA

K. Zuraski, F. Grieman, A. Hue, Frank A. F. Winiberg, C.J. Percival, and S.P. Sander, "Acetonylperoxy and hydroperoxy Kinetics from the Perspecive of Hydroxyl Radicals," poster presentation at the JPL Postdoctoral Research Day, July 2019, Pasadena, CA.

K. Zuraski "A Closer Look at Hydrogen Bonds" Invited talk at the California Institue of Technology, Invitation from Dr. Yuk Yung, April 2019, Pasadena, CA.

K. Zuraski, D. Kwasniewski, A. Samanta, and H. Reisler, "Imaging Studies of Small HCl and H_2O Mixed Clusters," oral presentation at the Gordon Research Seminar on Moleclar Interactions & Dynamics, July 2016, Easton, MA.

K. Zuraski, D. Kwasniewski, A. Samanta, and H. Reisler, "Farewell to HCl: Dissociation Dynamics of Mixed HCl and H_2O Clusters" poster presentation at the Gordon Research Conference on Moleclar Interactions & Dynamics, July 2016, Easton, MA.

K. Zuraski, D. Kwasniewski, A. Samanta, and H. Reisler, "A Step Closer to Understanding Acid Solvation: Dissociation Dynamics of the HCl-$(H_2O)_3$ Tetramer" poster presentation at the 2015 International Chemical Congress of Pacific Basin Societies, December 2015, Honolulu, HI.

K. Zuraski, D. Kwasniewski, A. Samanta, and H. Reisler, "A Step Closer to Understanding Acid Solvation: Dissociation Dynamics of Mixed HCl and H_2O Clusters," poster presentation at the 62nd Pacific Conference on Spectroscopy and Dynamics, January 2015, Asilomar, CA.

K. Zuraski, I. Saytashev, N. Winkler, and M. Dantus "Imaging Photodamage in Full-bodied Organisms Induced by Ultrafast Laser Pulses," poster at the Nonlinear Optics in 50 Symposium, September 2011, Boston, MA.

K. Zuraski, I. Saytashev, N. Winkler, and M. Dantus, "Imaging Photodamage in Full-bodied Organisms Induced by Ultrafast Laser Pulses," poster at the Midwestern Symposium on Undergraduate Research in Chemistry, October 2011, East Lansing, MI.