DR. FRANK A. F. WINIBERG

EDUCATION

Feb 2010 – Jan 2014	Ph.D in Physical Chemistry (Atmospheric Chemistry), University of Leeds.
Oct 2005 – Jul 2009	MChem. Int. (Hons) in Chemistry, Upper Second Class (2:1), University of Leeds.

RESEARCH EXPERIENCE

Mar 2020 – Present **Research Scientist, *Jet Propulsion Laboratory, Pasadena, CA*.**

- Lead optomechanical design engineer for the MiniTOCA Tunable Laser Spectrometer; a compact trace gas sensor for a life support system on the International Space Station.
- Instrument lead for the Airborne Scanning Microwave Limb Sounder, a stratospheric remote sensing instrument to measure ozone, water vapour and carbon monoxide on the ER-2 aircraft.
- Design and implementation of new laboratory for spectroscopic and chemical kinetic investigations of planetary and exoplanet atmospheres.
- Laboratory investigations of chemical reaction kinetics important to the atmospheres of Earth and Venus in collaboration with Caltech and the Space Science Institute.

Jul 2017 – Mar 2020 **Staff Scientist, *California Institute of Technology, Pasadena, CA*.**

- Used Pulsed Laser Photolysis – Laser Induced Fluorescence (PLP-LIF) apparatus to investigate the reaction of OH + NO_2 and OH + NO over a range of temperatures and pressures important to the upper troposphere/lower stratosphere.
- Collaborated with Sandia National Laboratories and Caltech. Led research effort into the kinetics and yield of β-hydroxy nitrates from the corresponding peroxy radical + NO using photoionization mass spectrometry at the Advanced Light Source.
- Bimolecular reactions of Criegee intermediates in a joint collaboration with University of Pennsylvania, University of Bristol and Sandia National Laboratories. Contributed to the research direction, apparatus and method development for experiments at the Advanced Light Source.

Oct 2014 – Jul 2017 **NASA Postdoctoral Program, *Jet Propulsion Laboratory, Pasadena, CA*.**

- Developed a unique Photolysis Induced Fluorescence (PIF) method of detecting nitric acid for use in chemical kinetic studies.
- Used the PLP-LIF apparatus, combined with the new PIF technique, to investigate the reaction of nitric acid with OH radicals over a range of pressures and temperatures.
- Collaborated with the Okumura group at Caltech. Helped run experiments using Mid-infrared Cavity Ringdown Spectroscopy and developed chemical kinetic simulation for the investigation of nitric acid yields from HO_2 + NO.

Apr 2014 – Aug 2014 **Postdoctoral Researcher, *School of Chemistry, University of Leeds*.**

- Characterised a chemical kinetics model for the product yields from the HO_2 + $CH_3C(O)O_2$ reaction.

Feb 2010 – Jan 2014 **Ph.D, Prof. Paul Seakins and Prof. Dwayne Heard groups, *School of Chemistry, University of Leeds.***

- Developed a low pressure, Laser Induced Fluorescence based OH and HO_2 (HO_x) radical detection instrument for use in an atmospheric simulation chamber and validated the conventional calibration method using two new calibration techniques in the atmospheric simulation chamber.
- Installed and characterised a new temperature control system for a ~2 m^3 stainless steel simulation chamber, expanding the scope of future investigations.

PUBLICATIONS

W. Chao, G. Jones, M. Okumura, C.J. Percival, **F.A.F. Winiberg**, "*Spectroscopic and Kinetic Studies of the ClSO radical from Cl_2SO Photolysis*", JACS, 2022.

L.A. Mertens, **F.A.F. Winiberg**, H.M. Allen, M. Okumura and S. P. Sander, *"Upper Limits on the Yields of $HONO_2$ and HOONO from the Reaction of HO_2 and NO with Pulsed Laser Photolysis and Mid-IR Cavity-Ringdown Spectroscopy"*, JPCA (Atmospheric Chemistry Special Issue), 126, 40, 2022.

M.F. Vansco, K. Zuraski, **F.A.F. Winiberg**, K. Au, N. Trongsiriwat, P.J. Walsh, D.L Osborn, C.J. Percival, S.J. Klippenstein, C.A. Taatjes, M.I. Lester, R.L. Caravan, "*Functionalized Hydroperoxide Formation from the Reaction of Methacrolein-Oxide, an Isoprene-Derived Criegee Intermediate, with Formic Acid: Experiment and Theory.*" Molecules, 26, 10, 2021.

C.A. Taatjes, R. L Caravan, **F.A.F. Winiberg**, K. Zuraski, K. Au, L. Sheps, D. L Osborn, L. Vereecken, C. J. Percival, *"Insertion products in the reaction of carbonyl oxide Criegee intermediates with acids: Chloro (hydroperoxy) methane formation from reaction of CH_2OO with HCl and DCl"*, Molecular Physics, 199, 2021.

K. Zuraski, A.O. Hui, F.J. Grieman, E. Darby, K.H. Møller, **F.A.F. Winiberg**, C.J. Percival, M.D. Smarte, M. Okumura, 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*." The Journal of Physical Chemistry A, 124, (40), DOI: 10.1021/acs.jpca.0c06220, 2020.

F.A.F. Winiberg, C. J. Percival, K. Zuraski, Y. Liu, S. P. Sander, "*Pressure and Temperature Dependences of Rate Constants for the Reaction OH + NO_2 + M → Products.*" The Journal of Physical Chemistry A, 124 (49), 10121-10131, DOI: 10.1021/acs.jpca.0c08920, 2020.

F.A.F Winiberg, L. Christensen, M. Kale, A. Jones, C. Morrison, "*Miniature TOC Analyzer using Tunable Laser Spectroscopy and Combustion*" Proceedings of the 2020 International Conference on Environmental Systems, 2020-399, DOI:https://hdl.handle.net/2346/86263, 2020.

M.F. Vansco, R.L. Caravan, K. Zuraski, **F.A.F. Winiberg**, K. Au, N. Trongsiriwat, et al., "*Experimental Evidence of Dioxole Unimolecular Decay Pathway for Isoprene-Derived Criegee Intermediates*". The Journal of Physical Chemistry A, Vol. 124, No. 18, 2020.

R. L. Caravan, M. F. Vansco, K. Au, M. A. H. Khan, Y. L. Li, **F.A.F. Winiberg**, K. L. Zuraski, Y. H. Line, W. Chaoe, N. Trongsiriwat, P. J. Walsh, D. L. Osborn, C. J. Percival, J. Jr-Min Lin., D. E. Shallcrossd, L. Sheps, S. J. Klippenstein, C. A. Taatjes & M. I. Lester., "*First Direct kinetic measurements and theoretical predictions of an isoprene-derived Criegee intermediate"* PNAS, 117 (18) 9733-9740, 2020.

F.A.F. Winiberg, C. J. Percival, S. P. Sander, "*Quantification of Nitric Acid Using Photolysis Induced Fluorescence for use in Chemical Kinetic Studies*", Chem. Phys. Lett.:X, 3, 100029, doi: 0.1016/j.cpletx.2019.100029, 2019 (**Selected for Editors pick**).

F.A.F. Winiberg, C. J. Percival, R. Shannon, M. A. Khan, D. E. Shallcross, Y. Liu, S. P. Sander, "*Reaction Kinetics of OH + HNO_3 under conditions relevant to the Upper Troposphere/Lower Stratosphere.*" Phys. Chem. Chem. Phys., 20, 24652-24664, doi: 10.1039/C8CP04193H, 2018. (**Selected for Hot Topic of 2018**)

I. Bejan, **F. A. F. Winiberg**, N. Mortimer, D.J Medeiros, C. A. Brumby, S.C. Orr, J. Kelly and P. W. Seakins, "*Gas-phase Rate Coefficients for a Series of Alkyl Cyclohexanes with OH Radicals and Cl Atoms*", Int J Chem Kinet. 2018;50:544–555. doi: 10.1002/kin.21179, 2018.

F.A.F. Winiberg, T. J. Dillon, S. C. Orr, C. B. M. Groß, I. Bejan, C. A. Brumby, M. J. Evans, S. C. Smith, D. E. Heard and P. W. Seakins, *"Direct measurements of OH and other product yields from the HO_2 + $CH_3C(O)O_2$ reaction"*, Atmos. Chem. Phys., 16, 4023-4042, doi:10.5194/acp-16-4023-2016, 2016.

F.A.F. Winiberg, S.C. Smith, I. Bejan, C.A. Brumby, T. Ingham, T.L. Malkin, S.C. Orr, D.E. Heard and P.W. Seakins, *"Pressure-dependent calibration of the OH and HO_2 channels of a FAGE HO_x instrument using the Highly Instrumented Reactor for Atmospheric Chemistry (HIRAC)"*, Atmos. Meas. Tech., 8, 523-540, 2015, doi:10.5194/amt-8-523-2015

Technical Reports:

T.J. Dillon, S.C. Orr, **F.A.F Winiberg**, I. Bejan, P.W. Seakins, Eurochamp2 project report, "*T & P-dependent product yields for reactions of HO_2 with isoprene-derived RO_2*", 2013, (http://www.eurochamp.org/icg-2/eurochamp_php_skripte/eurochamp/pdfs/E2-2013-05-15-0092_report.pdf).

M.T.B. Romero, **F.A.F. Winiberg**, L.N. Farrugia, S.C. Orr, A. Rickard, A. Munoz, P. Sanchez, X. Pang, A. Lewis, D.E. Heard, P.W. Seakins, Eurochamp2 project report "*A study of isoprene chemistry under low NO_x*", 2012, (http://www.eurochamp.org/icg-2/eurochamp_php_skripte/eurochamp/pdfs/E2-2012-04-09-0071_report.pdf).

T.J. Dillon, S.C. Smith, C.B.M Groß, **F.A.F Winiberg**, L.N. Farrugia, D.E. Heard, P.W. Seakins, Eurochamp2 project report "*OH regeneration in reactions of HO2 with some important C2 peroxy radicals*", 2010, (http://www.eurochamp.org/icg-2/eurochamp_php_skripte/eurochamp/pdfs/E2-2010-08-13-0042_report.pdf).

PRESENTATIONS

Invited Talks:

F.A.F. Winiberg, W. Chao, G. Jones, C.J. Percival, M. Okumura, S.P. Sander, L. Christensen, N. Livesey, L. Millan-Valle "*In-situ and Remote Sensing Techniques Applied to the Lab, the Stratosphere and the International Space Station.*" QUADMARTS, Lille, June 2022.

F.A.F. Winiberg, C.J. Percival, K. Zuraski, C. Markus, M. Okumura, S.P. Sander, "*The Importance of Water in Tropospheric Chemistry*", New Insights in Atmospheric Chemisty, Telluride CO, 2022.

F.A.F. Winiberg, C.J. Percival, R. Shannon, A. Khan, D. Shallcross, Y. Liu, S.P. Sander, "*Study of key OH + NO_x/NO_z reactions under upper troposphere/lower stratosphere conditions.*", oral presentation at the University of York, Dec 2018.

Conferences:

F.A.F. Winiberg, A. Hui, K. Zuraski, M.D. Smarte, R.L. Caravan, G. Jones, J. Messinger, M. Okumura, D. Osborn, C.J. Percival, C. Taatjes, S.P. Sander., "*Effect of water complexation on the chemical kinetics of the β-hydroxyethylperoxy radical.*", poster presentation at the American Chemical Society Summer Meeting, Aug 2019, San Diego, CA.

F.A.F. Winiberg, A. Hui, K. Zuraski, M.D. Smarte, R.L. Caravan, G. Jones, J. Messinger, M. Okumura, D. Osborn, C.J. Percival, C. Taatjes, S.P. Sander., "*Does water complexation affect the reaction of the β-hydroxyethylperoxy radical with NO?*", oral presentation at the Atmospheric Chemical Mechanisms Conference, Dec 2018, Davis, CA.

F.A.F. Winiberg, C.J. Percival, R. Shannon, A. Khan, D. Shallcross, Y. Liu, S.P. Sander, "*Study of key OH + NO_x/NO_z reactions under upper troposphere/lower stratosphere conditions.*", oral presentation at the 25th International Symposium on Gas Kinetics and Related Phenomena, July 2018, Lille, France.

F.A.F. Winiberg, C.J. Percival, R. Shannon, A. Khan, D. Shallcross, Y. Liu, S. P. Sander, "*Rate Coefficient for OH Radical Reaction with $HONO_2$ at Low Temperatures.*", poster presentation at the American Geophysical Union Fall Meeting, December 2017, New Orleans LA.

F.A.F. Winiberg, Y. Liu, S.P. Sander, "*Rate Coefficient for OH Radical Reaction with $HONO_2$ at Low Temperatures.*", poster presentation at the American Geophysical Union Fall Meeting, December 2016, San Francisco CA.

F.A.F. Winiberg, Y. Liu, S.P. Sander, "*Rate Coefficient for OH Radical Reaction with $HONO_2$ at Low Temperatures.*", oral presentation at the 24th International Symposium on Gas Kinetics and Related Phenomena, July 2016, York, UK.

F.A.F. Winiberg, Y. Liu, S.P. Sander, "*Rate Coefficient for OH Radical Reaction with $HONO_2$ at Low Temperatures.*", poster presentation at the 63rd Pacific Conference for Spectroscopy and Dynamics, January 2016, Asilomar CA.

F.A.F. Winiberg, I. Bejan, C.A. Brumby, S.C. Smith, T. Malkin, L.N. Farrujia, T. Ingham, D.E. Heard, P.W. Seakins, "*Pressure and Temperature Dependence of OH and HO_2 Detection sensitivities for an LIF based FAGE instrument - a comparison of calibration methods.*", oral presentation at the American Geophysical Union Fall Meeting, December 2015, San Francisco CA.

F.A.F. Winiberg, T.J. Dillon, S.C. Smith, C.B.M Gross, S. Orr, T. Ingham, D.E. Heard, P.W. Seakins, "*Pressure and Temperature Dependent Product Study of the $CH_3C(O)O_2$ + HO_2 Reaction using HIRAC*", Oral presentation at the 8th International Conference of Chemical Kinetics, July 8 – 12, 2013, Sevilla, Spain.

F.A.F. Winiberg, T.J. Dillon, S.C. Smith, C.B.M Gross, S. Orr, T. Ingham, D.E. Heard, P.W. Seakins, "*Pressure and Temperature Dependent Product Study of the $CH_3C(O)O_2$ + HO_2 Reaction using HIRAC*", poster presentation at Atmospheric Chemical Mechanisms Meeting, December 10 – 13, 2012, Davis CA.

F.A.F. Winiberg, S.C. Smith, T. Malkin, L.N. Farrujia, T. Ingham, D.E. Heard, P.W. Seakins, "*Pressure Dependent OH and HO_2 Calibration of the Fluorescence Assay by Gas Expansion (FAGE) Instrument Using the Highly Instrumented Reactor for Atmospheric Chemistry (HIRAC)*", poster presentation at the American Geophysical Union Fall Meeting, December 3 – 7 2012, San Francisco CA.

F.A.F. Winiberg, T.J. Dillon, S.C. Smith, C.B.M Gross, T. Ingham, D.E. Heard, P.W. Seakins, "*Preliminary results from the Product Study of $CH_3C(O)O_2$ + HO_2 using HIRAC (the Highly Instrumented Reactor for Atmospheric Chemistry)*", poster presentation at 22nd International Symposium on Gas Kinetics, June 18 – 22, 2012, Boulder CO.

F.A.F. Winiberg, S.C. Smith, T. Malkin, T. Ingham, D.E. Heard, P.W. Seakins, "*A New Pressure Dependent HO_2 Calibration Method for the Fluorescence Assay by Gas Expansion (FAGE) Instrument*", poster presentation at 22nd International Symposium on Gas Kinetics, June 18 – 22, 2012, Boulder CO.