Dr. Joshua Laughner
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Education:

University of California, Berkeley; Berkeley, CA, USA — Aug 2018
Ph.D., Chemistry
Concentrations: atmospheric chemistry, physical chemistry
Dissertation: Space-based constraints on NO_x emissions and lifetime using high-resolution NO_2 retrievals

The Pennsylvania State University; University Park, PA, USA — May 2013
The Schreyer Honors College — With Highest Distinction
B.S. Chemistry with Honors
Thesis: Synthesis and Transport Studies of a Delivery Mechanism for Oxidative In-Situ Remediation of Groundwater
B.M. Music Composition with Honors
Thesis: Virtual Evolving and Self-Producing Rapid Audio (V.E.S.P.R.A.)

Selected Research Experience:

Wennberg Group, Caltech — Oct 2018–present
Retrieval development for TCCON; validation of OCO-3. Studying the diurnal pattern of biospheric CO_2 uptake.

Cohen Research Lab, UC Berkeley — Oct 2013–Oct 2018
NO_2 remote sensing retrieval development and space-based NO_x emissions and lifetime constraints. Developer on the BEHR retrieval (http://behr.cchem.berkeley.edu/).

Mallouk Research Group, Penn State — June 2012–May 2013
Development of oxidative groundwater remediation using peroxide microcapsules

Merck Pharmaceuticals (Internship), Danville, PA, USA — June 2011–Aug 2011
Process optimization of crystal size for product yield and purity at the Danville, PA site

Curriculum development research w/ Dr. Katherine Masters, Penn State — Jan 2011–Dec 2012
Design of new curriculum for honors organic chemistry lab course

Cherokee Pharmaceuticals (Internship), Danville, PA, USA — June 2010–Aug 2010
Study of the effect of antisolvent addition on product yield and purity

Publications:

J. L. Laughner and R. C. Cohen (2019). "Direct observation of changing NO_x lifetime in North American cities". *Science* 366, pp. 723–727. DOI: 10.1126/science.aax6832

R. F. Silvern, D. J. Jacob, L. J. Mickley, M. P. Sulprizio, K. R. Travis, E. A. Marais, R. C. Cohen, **J. L. Laughner**, S. Choi, J. Joiner, and L. N. Lamsal (2019). "Using satellite observations of tropospheric NO_2 columns to infer long-term trends in US NO_x emissions: the importance of accounting for the free tropospheric NO_2 background". *Atmos. Chem. Phys.* 19.13, pp. 8863–8878. DOI: 10.5194/acp-19-8863-2019

J. L. Laughner, Q. Zhu, and R. Cohen (2019). "Evaluation of version 3.0B of the BEHR OMI NO_2 product". *Atmos. Meas. Tech.* 12, pp. 129–146. DOI: 10.5194/amt-12-129-2019

J. L. Laughner, Q. Zhu, and R. C. Cohen (2018). "The Berkeley High Resolution Tropospheric NO_2 Product". *Earth System Science Data* 10, pp. 2069–2095. DOI: 10.5194/essd-10-2069-2018

R. F. Silvern, D. J. Jacob, K. R. Travis, T. Sherwen, M. J. Evans, R. C. Cohen, **J. L. Laughner**, S. R. Hall, K. Ullmann, J. D. Crounse, P. O. Wennberg, J. Peischl, and I. B. Pollack (2018). "Observed NO/NO_2 Ratios in the Upper Troposphere Imply Errors in $NO\text{-}NO_2\text{-}O_3$ Cycling Kinetics or an Unaccounted NO_x Reservoir". *Geophys. Res. Lett.* 45, pp. 4466–4474. DOI: 10.1029/2018GL077728

J. Lapierre, **J. Laughner**, J. Geddes, W. Koshack, R. Cohen, and S. Pusede (2018). "Observing regional variability in lightning NO_x production rates". *J. Geophys. Res. Atmos.* submitted

J. L. Laughner and R. C. Cohen (2017). "Quantification of the effect of modeled lightning NO_2 on UV-visible air mass factors". *Atmos. Meas. Tech.* 10, pp. 4403–4419. DOI: 10.5194/amt-10-4403-2017

B. A. Nault, **J. L. Laughner**, P. J. Wooldridge, J. D. Crounse, J. Dibb, G. Diskin, J. Peischl, J. R. Podolske, I. B. Pollack, T. B. Ryerson, E. Scheuer, P. O. Wennberg, and R. C. Cohen (2017). "Lightning NO_x Emissions: Reconciling Measured and Modeled Estimates With Updated NO_x Chemistry". *Geophys. Res. Lett.* 44, pp. 9479–9488. DOI: 10.1002/2017GL074436

J. L. Laughner, A. Zare, and R. C. Cohen (2016). "Effects of daily meteorology on the interpretation of space-based remote sensing of NO_2". *Atmos. Chem. Phys.* 16.23, pp. 15247–15264. DOI: 10.5194/acp-16-15247-2016

K. R. Travis, D. J. Jacob, J. A. Fisher, P. S. Kim, E. A. Marais, L. Zhu, K. Yu, C. C. Miller, R. M. Yantosca, M. P. Sulprizio, A. M. Thompson, P. O. Wennberg, J. D. Crounse, J. M. St. Clair, R. C. Cohen, **J. L. Laughner**, J. E. Dibb, S. R. Hall, K. Ullmann, G. M. Wolfe, I. B. Pollack, J. Peischl, J. A. Neuman, and X. Zhou (2016). "Why do models overestimate surface ozone in the Southeast United States?" *Atmos. Chem. Phys.* 16.21, pp. 13561–13577. DOI: 10.5194/acp-16-13561-2016

S. E. Pusede, K. C. Duffey, A. A. Shusterman, A. Saleh, **J. L. Laughner**, P. J. Wooldridge, Q. Zhang, C. L. Parworth, H. Kim, S. L. Capps, L. C. Valin, C. D. Cappa, A. Fried, J. Walega, J. B. Nowak, A. J. Weinheimer, R. M. Hoff, T. A. Berkoff, A. J. Beyersdorf, J. Olson, J. H. Crawford, and R. C. Cohen (2016). "On the effectiveness of nitrogen oxide reductions as a control over ammonium nitrate aerosol". *Atmos. Chem. Phys.* 16.4, pp. 2575–2596. DOI: 10.5194/acp-16-2575-2016

Selected presentations:

Laughner, J. and Cohen, R.C. (15 Dec 2017) *The Next-generation Berkeley High Resolution NO_2 (BEHR NO_2) Retrieval: Design and Preliminary Emissions Constraints*, Poster at American Geophysical Union Fall Meeting, New Orleans, LA, 11–15 Dec 2017.

Laughner, J. and Canfield-Dafilou, E. (22 June 2017) *Illustrating trends in nitrogen oxides across the United States using sonification,* Talk at International Conference for Auditory Display, University Park, PA, 20–23 June 2017.

Laughner, J., Zare, A., and Cohen, R.C. (3 Feb 2017) *Effects of daily, high resolution* a priori *profiles on satellite-derived NO_x emissions and lifetime*, Poster at Berkeley Atmospheric Science Symposium, Berkeley, CA, 2–3 Feb 2017.

Laughner, J., Zare, A., and Cohen, R.C. (16 Dec 2016) *Effects of daily, high resolution* a priori *profiles on satellite-derived NO_x emissions and lifetime*, Poster at American Geophysical Union Fall Meeting, San Francisco, CA, 12–16 Dec 2016.

Laughner, J., Zare, A., and Cohen, R.C. (30 Aug 2016) *Effects of daily meteorology on satellite* a priori *and implications for constraint of NO_x chemistry from space*, Talk at Aura Science Team Meeting, Rotterdam, Netherlands, 30 Aug–1 Sept 2016.

Laughner, J., Zare, A., and Cohen, R.C. (14 Dec 2015) *The impact of day-to-day variability in input*

assumptions on regional satellite retrievals of NO_2, Poster at American Geophysical Union Fall Meeting, San Francisco, CA, 14–18 Dec 2015.

Laughner, J. and Cohen, R.C. (7 May 2015) *Aerosol effects on NO_2 retrievals: an assessment using DISCOVER observations*, Talk at DISCOVER-AQ Science Team Meeting, Boulder, CO, 3–8 May 2015.

Laughner, J. and Mallouk, T. (Aug. 2012) *Synthesis of PLGA Microcapsules for Groundwater Remediation*, Presentation of research at conclusion of 3M Summer Fellowship.

Awards:

- NASA Earth and Space Science Fellowship, 2014–2017.
- Teas Scholarship, Penn State Department of Chemistry, 2012.
- 3M Fellowship, Penn State, 2012.
- Golumbic Scholarship, Penn State College of Arts & Architecture, 2012.

Teaching Experience:

NASA Global Learning and Observation to Benefit the Environment (GLOBE) *Visit high school classes to discuss my research and help students with their own research projects.*	Dec 2014–Feb 2018
Bay Area Scientists in Schools (BASIS) *Science lessons with elementary students in Oakland and Berkeley, CA, USA*	Jan 2014–Mar 2018
Graduate Student Instructor, Chem 15, UC Berkeley *Analytical chemistry: instructor for 25-student lab section; office hours on lab and lecture material*	Aug 2015–Dec 2015
Graduate Student Instructor, Chem 4A, UC Berkeley *General chemistry: instructor for 20-student lab section; office hours on lab and lecture material*	Aug 2013–Dec 2013 Aug 2014–Dec 2014
Tutor for undergraduate resource room, Penn State *Individual to small group tutoring on general and organic chemistry*	Sept 2010–May 2013
Mentor for high school student lab experience during summer leadership camp *Led high-school students in water filtration lab, discussion of relevance*	Aug 2012
Undergraduate Instrument Room TA, Penn State *Instructed student use of NMR, IR, GC, and data interpretation*	Aug 2011–Dec 2011

Skills:

- *Programming*: fluent in Matlab, Python, Julia, Bash, Git; conversant with Fortran, C, C++, C#, Supercollider.
- *Atmospheric remote sensing*: development of UV-visible retrieval algorithms; application of NO_2 remote sensing for emissions and lifetime constraints.
- *Atmospheric chemical transport modeling*: experienced with GEOS-Chem and WRF-Chem.
- *Radiative transfer modeling*: conversant with SCIATRAN.
- *Typesetting and visualization*: fluent with Latex, GIMP (GNU Image Manipulation Program), Inkscape (open source vector image editor), and Blender (open source 3D modeling program).

Selected programming examples:

- BEHR Retrieval: https://github.com/CohenBerkeleyLab/BEHR-core and dependencies
- Modification of WRF-Chem to automatically scale anthropogenic emissions to the run year: https://github.com/CohenBerkeleyLab/WRF-Chem-R2SMH/commits/conv_emiss_racm2-r2smh, esp. commits b7a4f62 & 64225f2
- Code to automate configuration, compilation, input preparation, and execution of WRF-Chem: https://github.com/CohenBerkeleyLab/AutoWRFChem-Base
- Matlab-Python data type interface: https://github.com/firsttempora/MatlabPythonInterface