

# Zachary Buchanan

---

---

## Education

- 2015–current **PhD in Physical Chemistry**, *University of California-Davis*, Davis, CA,  
Expected graduation Summer 2021.  
Advisor: Kyle Crabtree
- 2008–2009 **Bachelors of Science in Chemistry**, *Brigham Young University*, Provo, UT.  
2011–2015 Advisor: Eric Sevy

---

## Research Experience

- Jan **Chateaubriand Fellow**, *Institut des Sciences Moléculaires d'Orsay*, Orsay, France.
- 2019–June Performed molecular spectroscopy in the mm-wave through mid-IR regions. Constructed  
2019 2 multiplication chain mm-wave spectrometers used for characterizing molecules such  
as cyanophenylacetylene and 1-cyanoadamantane. Trained three intern students on lab  
equipment. Developed new experimental techniques using heterodyne mixing for high  
resolution broadband IR spectroscopy at the AILES beamline of the synchrotron SOLIEL.
- 2015–current **Graduate Student Researcher**, *University of California-Davis*, Davis, CA.  
*Thesis Title: Laboratory Astrochemistry: Instrumentation for characterization and kinetics  
of low temperature small molecules.*  
Constructed an instrument for the study of rates of chemical reactions for low temperature  
molecules using the CRESU technique. Helped build and test a Ka band(26–40 GHz)  
chirped-pulse microwave spectrometer and a laser induced fluorescence spectrometer. Used  
CAD to design and machine or 3D print parts for custom instruments in the lab. Used  
python to create a program for calculating parameterized de Laval nozzles. Helped mentor  
and train 3 junior graduate students, and several undergraduate students
- 2013–2015 **Student Research Assistant**, *Brigham Young University*, Provo, UT.  
Studied gas phase collisional dynamics of N2O with pyrazine using rotationally resolved in-  
frared laser spectroscopy. Aligned and manipulated UV and IR laser beams for measurements  
in a 3m gas flow cell. Wrote MATLAB software for analyzing the results of experiments,  
and performing comparisons between different data.

---

## Awards

- 2018 **Chateaubriand Fellowship** *Office for Science and Technology of the Embassy of  
France*
- 2018 **Edmund and Wilma Fink Memorial Award** *University of California, Davis*
- 2013, 2014 **Undergraduate Research Award** *Brigham Young University, Provo, UT*

---

## Teaching Experience

- Spring 2021 **Scientific Programming for Chemistry**, *University of California-Davis*, Davis, CA.  
Aided in the launch of a new python programming course for chemistry undergraduate  
students. Responsible for grading and holding weekly office hours to tutor students in the  
curriculum.

3024 Albany Ave – Davis, CA 95618

☎ (503) 312 6321 • ✉ zsbuchanan@ucdavis.edu • in zsb1010

- 2016–2020 **Analytical Chemistry**, *University of California-Davis*, Davis, CA.  
W2016, W2017, S2017, S2018, F2019, W2020, S2020, F2020 Laboratory instructor responsible to enforce safety in the lab and train students on the instruments (HPLC, cyclic voltammetry, fluorometer, FTIR, GC-MS, capillary electrophoresis, flame AA, MP-AES and UV-Vis). Trained in analysis of data using excel and MATLAB. Graded lab reports and exams. In W2020, wrote a revised lab manual for the first quarter of instrumental analysis lab. During 2020, co-developed new curriculum for facilitating teaching analytical chemistry labs through online platforms (Zoom).
- Spring 2016 **Physical Chemistry: Quantum Mechanics**, *University of California-Davis*, Davis, CA.  
Aided in teaching che110a physical chemistry course by preparing a 1 hour review each week, grading, and holding regular office hours for students.
- 2015–2021 **Physical Chemistry: Atoms and Molecules**, *University of California-Davis*, Davis, CA.  
F2015, F2016, F2017, W2018, F2018, W2021 Aided in teaching che110b physical chemistry course by preparing a 1 hour review each week, substituting for professor in regular lectures, grading, and holding regular office hours for students.
- 2013–2015 **Analytical Chemistry**, *Brigham Young University, Department of Chemistry and Biochemistry*, Provo, UT.  
Laboratory assistant sophomore analytical chemistry. Responsible for up to 40 students at a time. Worked with course professor to improve curriculum and materials, including producing teaching videos for MATLAB and Excel, coauthoring programming assignments, and updating data acquisition software in LabVIEW and updating data acquisition hardware.
- 2013–2015 **General Chemistry**, *Brigham Young University, Department of Chemistry and Biochemistry*, Provo, UT.  
Laboratory assistant freshman general chemistry. Responsible for supervising and training up to 30 students at a time in the basic lab techniques: spectrophotometry, titration, qualitative analysis.

---

## Community Outreach and Service

- 21 June 2020 **Session Chair**, *Not Intentional Seminars on Molecular Spectroscopy*.  
Served as a session chair during the community organized virtual replacement for the canceled 2020 international symposium on molecular spectroscopy.
- 2018–2020 **Python Bootcamp**, *University of California, Davis*.  
Co-organized and taught a python workshop for teaching incoming graduate students on the basics of coding in preparation for classes/research. In 2020, over 200 students registered for the workshop.
- 2014–2015 **YChem presidency member**, *Brigham Young University*, Provo, UT.  
Responsible for organizing and presenting Chemistry shows for children in elementary, middle and high schools to promote STEM fields. Organized or participated in over 30 of these outreach events.
- 2011–2015 **YChem Member**, *Brigham Young University*, Provo, UT.  
YChem is the BYU student chapter of the American Chemical society. Participated in community outreach events to promote STEM fields, as well as raise funds for club activities.

---

## Other Experience

- 2014–2015 **Software Developer**, *Wasatch Education LLC*, Provo, UT.  
Developed a new version of Organic Virtual ChemLab Software.

3024 Albany Ave – Davis, CA 95618

☎ (503) 312 6321 • ✉ zsbuchanan@ucdavis.edu • in zsb1010

2013–2015 **Stockroom Assistant**, *Brigham Young University, Department of Chemistry and Biochemistry*, Provo, UT.

Assisted students, teachers and TA's with supplies for the teaching laboratories. Prepared chemicals and standardized them with high precision for use in student's calculations. Prepared unknown samples for 500 students a week. Trained 3 new employees in stockroom procedures.

---

## References

### Peer-Reviewed Publications

Olivia Chitarra, Marie-Aline Martin-Drumel, Zachary Buchanan, and Olivier Pirali. Rotational and vibrational spectroscopy of 1-cyanoadamantane and 1-isocyanoadamantane. *Journal of Molecular Spectroscopy*, Accepted for publication - 2021.

Zachary Buchanan, Kin Long Kelvin Lee, Olivia Chitarra, Michael C. McCarthy, Olivier Pirali, and Marie Aline Martin-Drumel. A rotational and vibrational investigation of phenylpropionitrile (C<sub>6</sub>H<sub>5</sub>C<sub>3</sub>N). *Journal of Molecular Spectroscopy*, 377:111425, 2021.

Jean-François Lampin, Olivier Pirali, Zachary Buchanan, Sophie Eliet, Marie-Aline Martin-Drumel, Joan Turut, P. Roy, Francis Hindle, and Gaël Mouret. Broadband terahertz heterodyne spectrometer exploiting synchrotron radiation at megahertz resolution. *Optics Letters*, 44(20):4985, oct 2019.

### Invited Talks

Zachary Buchanan\*, Olivia Chitarra, Kin Long Kelvin Lee, Michael C. McCarthy, Olivier Pirali, and Marie-Aline Martin-Drumel. Vibrational and rotational characterization of phenylpropionitrile to facilitate astrochemical surveys. *Astrochemistry Discussions*, 2021.

### Conference Talks

Zachary Buchanan\*, Olivia Chitarra, Kin Long Kelvin Lee, Michael McCarthy, Olivier Pirali, and Marie-Aline Martin-Drumel. Pure rotational study of cyanophenylacetylene. *International Symposium on Molecular Spectroscopy*, 2019.

Olivier Pirali\*, Zachary Buchanan, Sophie Eliet, Joan Turut, Marie-Aline Martin-Drumel, Francis Hindle, Robin Bocquet, P. Roy, Jean-François Lampin, and Gaël Mouret. Progress around the high resolution heterodyne spectrometer of the AILES beamline. *International Symposium on Molecular Spectroscopy*, 2019.

Zachary Buchanan\*, Marie-Aline Martin-Drumel, Sophie Eliet, Joan Turut, Gaël Mouret, Francis Hindle, Jean-François Lampin, and Olivier Pirali. Building a database for QCL pumped far-IR lasers. *International Symposium on Molecular Spectroscopy*, 2019.

Zachary Buchanan\*, Kyle Crabtree, and Marie-Aline Martin-Drumel. Strategies for interpreting two dimensional microwave spectra. In *Proceedings of the 72nd International Symposium on Molecular Spectroscopy*, Urbana, Illinois, 2017. University of Illinois at Urbana-Champaign.

3024 Albany Ave – Davis, CA 95618

☎ (503) 312 6321 • ✉ [zsbuchanan@ucdavis.edu](mailto:zsbuchanan@ucdavis.edu) • in [zsb1010](#)