Zachary Buchanan

Education

2015– Expected 2021 **PhD in Physical Chemistry**, *University of California-Davis*, Davis, CA.
Advisor: Kyle Crabtree

2008–2009 2011-2015 **Bachelors of Science in Chemistry**, *Brigham Young University*, Provo, UT.

Research Experience

2015–current **Graduate Student Researcher**, *University of California-Davis*, Davis, CA.
Constructed an instrument for the study of rates of chemical reactions for low temperature molecules. Used python to create a program for calculating parameterized de Laval nozzles. Worked in the design (CAD) as construction of the kinetics reaction chamber that employs the CRESU technique. Helped build and test a Ka band (26.40 GHz) chirped-pulse microwave spectrometer and a laser induced fluorescence spectrometer. As a senior grad student, helped mentor and train 3 younger graduate students, and several undergraduate students

Jan 2019–June 2019 **Chateaubriand Fellow**, *Institut des Sciences Moléculaires d'Orsay*, Orsay, France.
Visiting researcher at the institute. Work here was focused on molecular spectroscopy in the mm-wave through mid-IR regions. Constructed 2 multiplication chain mm-wave spectrometers which were used for characterizing molecules such as cyanophenylacetylene and 1-cyanoadamantane, and trined 3 intern students on their use. Also performed research at the AILES beamline at the synchotron SOLIEL, working on developing new experimental techniques using heterodyne mixing for high resolution broadband IR spectroscopy.

2013–2015 **Student Research Assistant**, *Brigham Young University*, Provo, UT.
Studied gas phase dynamics of N2O with pyridine using rotationally resolved infrared laser spectroscopy. Worked under the supervision of a graduate student for a year, then spent a year largely independent.

Awards

2018 **Chateaubriand Fellowship** *Office for Science and Technology of the Embassy of France*

2018 **Edmund and Wilma Fink Memorial Award** *Univeristy of California, Davis*

2013, 2014 **Undergraduate Research Award** *Brigham Young University, Provo, UT*

Teaching Experience

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.

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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.

2016–2020 **Analytical Chemistry**, *University of California-Davis*, Davis, CA.

W2016, W2017, S2017, S2018, F2019, W2020, S2020, F2020 Laboratory instructor responsible for enforcing safety in the lab and training students on the instruments (HPLC, cyclic voltammetry, fluorometer, FTIR, GC-MS, capillary electrophoresis, flame AA, MP-AES and UV-Vis), as well as training in analysis of the data using excel and MATLAB, and grading lab reports. In W2020, wrote a revised lab manual for the first quarter of instrumental analysis lab. During 2020, also co-developed new curriculum for facilitating teaching analytical chemistry labs through online platforms (zoom).

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.

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 course curriculum and materials, including producing teach videos for MatLab and Excel, coauthoring programming assignments, and updating data aquisition software in LabVIEW and updating data aquisition 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

2018–2020 **Python Bootcamp**, *Univeristy of California, Davis*.

Co-organized and taught a python workshop for teaching incoming graduate students the basics of coding, in preparation for classes/research. In 2020, we had over 200 students registered for the worksho.p

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.

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 Univeristy*, Provo, UT.

YChem is the BYU student chapter of the American Chemical society. They participate 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.

Worked in a team of 2 to develop a new version of Organic Virtual ChemLab Software.

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2013–2015 **Stockroom Asistant**, *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 phenylpropiolonitrile (C6H5C3N). *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 phenylpropiolonitrile 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.

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