GARRY S. GRUBBS II, PH.D.

Missouri University of Science and Technology (MS&T) • Department of Chemistry
400 W. 11th Street Rolla, MO • (573)341-6281
Email: grubbsg@mst.edu

EDUCATION

Doctor of Philosophy | May 2011 | University of North Texas

- Division of Physical Chemistry
- Major field: Physical Chemistry/Microwave Spectroscopy
- Major Professor: Dr. Stephen Cooke
- Dissertation: "Investigating Molecular Structures: Rapidly Examining Molecular Fingerprints Through Fast Passage Broadband Fourier Transform Microwave Spectroscopy."
- Defended: November 2010
- Commencement: May 2011

Bachelor of Science, Chemistry | May 2006 | Texas A&M University

- Major: Chemistry
- American Chemical Society certified degree

PROFESSIONAL EXPERIENCE

Associate Department Chair, Dept. of Chemistry | Missouri University of Science and Technology | September 2022 – Present

Associate Professor, Dept. of Chemistry | Missouri University of Science and Technology | September 2019 – Present

Assistant Professor, Dept. of Chemistry | Missouri University of Science and Technology | August 2013 – September 2019, Granted Tenure April 2019

- Undergraduate Courses taught: 1) Quantum Chemistry, 2) Thermodynamics, 3) Physical Chemistry Lab, 4) General Chemistry II, 5) Analytical Chemistry II, 6) Intro to Chemical Analysis, 7) Upper-level Instrumental Analysis
- Graduate Courses taught: 1) Solution and Molecular Thermodynamics, 2) Spectroscopy, 3) Intro to Chemical Analysis, 4) Instrumental Analysis
- Research: Microwave/Rotational Spectroscopy
- Research advisor to undergraduate and graduate students
- Organizer of the Midwest Microwave Consortium

Postdoctoral Fellow | Wesleyan University | January 2011 - August 2013

- Advisor: Stewart E. Novick
- Research: Microwave/Rotational Spectroscopy
- National Science Foundation Grant (CHE-1011214) to study molecular hydrogen complexes of heavy metal containing salts as a model for hydrogen fuel storage in metal-organic frameworks.

Graduate Student | University of North Texas | August 2006 - December 2010

- Research Assistant under Steve Cooke: Responsibilities included laboratory management, collecting and analyzing data, and writing manuscripts.
- Lab Instructor: Courses were General Chemistry 1 and 2, Organic 1, and General Chemistry for Non-Majors.

- Lecture Teaching Assistant: Courses were General Chemistry 1 and Organic Chemistry 1 and 2.
- Covered in-class lectures when needed for these courses as well as for Physical Chemistry 1 when needed for my advisor. Made keys, graded assignments and kept up a website for professors in addition to providing instruction.
- Tutored in the Chemistry Resource Center where undergraduates came to receive help on coursework and curricula.

Summer Program Math Teacher | University of North Texas TRiO Upward Bound | Summer 2005 and 2006

- Taught high school level algebra, geometry, and pre-calculus to high school students.

Analytical Laboratory Prep | Talem, Inc. | May 2003 - August 2003

- Prepared water, soil and other type field samples for Metals, Total Organic Carbon (TOC), Total Kjeldahl Nitrogen (TKN), Total Nitrogen (TN), Biological Oxygen Demand (BOD), and Phosphorus analyses.

PUBLICATIONS AND CITATION METRICS

My **55 publications** are listed below (1 in revision and 2 just accepted). All have been published in peer-reviewed journals. My work has produced **646** citations with an *h*-index of **13** and *i*10-index of **28**. (Metrics provided by Google® Scholar on 10/7/2022).

Missouri S&T

1. Kevin Mayer, Channing West, Frank E. Marshall, Galen Sedo, G.S. Grubbs II, Luca Evangelisti, Brooks H. Pate. "Accuracy of Quantum Chemistry Structures of Chiral Tag Complexes and the Assignment of Absolute Configuration." *Physical Chemistry Chemical Physics*. **Revision Submitted**.
2. Galen Sedo, Amanda Duerden, Frank E. Marshall, Nicole Moon, and Garry S. Grubbs II. "Microwave spectra of two conformers of the (1R)-(-)-nopol monomer." *Journal of Molecular Spectroscopy*. **Manuscript Accepted**. Virtual Special Issue in Honor of Norm Craig.
3. Lucas Licaj, Nicole Moon, Garry S. Grubbs II, Gamil Guirgis, Nathan A. Seifert. "Broadband Microwave Spectroscopy of Cyclopentylsilane and Trifluorocyclopentylsilane." *Journal of Molecular Spectroscopy*. **Manuscript Accepted**. Virtual Special Issue in Honor of Norm Craig.
4. Nicole T. Moon, Klaus Woelk, and G. S. Grubbs II. "Construction and Demonstration of a 6-18 GHz Microwave Three-Wave Mixing Experiment using Multiple Synchronized Arbitrary Waveform Generators." *Symmetry*. **14** (2022) 848. Special Issue on Asymmetric Molecules and Chirality Recognition. DOI: https://doi.org/10.3390/sym14050848. **Front Cover Article**
5. Thomas M. C. McFadden, Nicole Moon, Frank E. Marshall, Amanda J. Duerden, Esther J. Ocola, Jaan Laane, Gamil A. Guirgis, and G. S. Grubbs II. "The molecular structure and curious motions in 1,1-difluorosilacyclopent-3-ene and silacyclopent-3-ene as determined by microwave spectroscopy and quantum chemical calculations." *Physical Chemistry Chemical Physics.* **24** (2022) 2454-2464. DOI: 10.1039/D1CP04286F.
6. Nicole Moon, Frank Marshall, Thomas McFadden, Esther Ocola, Jaan Laane, Gamil Guirgis, and Garry S. Grubbs II. "Pure rotational spectrum and structural determination of 1,1-difluoro-1-silacyclopentane." *Journal of Molecular Structure*. **1249** (2022) 131563. Virtual Special Issue on Rotational Spectroscopies. DOI: 10.1016/j.molstruc.2021.131563.
7. Amanda Duerden, Nicole Moon, and G. S. Grubbs II. "A Low-Cost, Balle-Flygare type Cavity Fourier Transform Microwave Spectrometer and Pure Rotational Spectroscopy Laboratory for Teaching Physical Chemistry and Astronomy." *Journal of Chemical Education*. **98** (2021) 1008. DOI: 10.1021/acs.jchemed.0c00934.
8. Amanda Duerden, Frank E. Marshall, Nicole Moon, Christian Swanson, Kristen M. Donnell, and G. S. Grubbs II. "A chirped pulse Fourier transform microwave spectrometer with multi-antenna detection." *Journal of Molecular Spectroscopy*. **376** (2021) 111396. DOI: 10.1016/j.jms.2020.111396.

9. Thomas M. C. McFadden, Frank E. Marshall, Esther J. Ocola, Jaan Laane, Gamil A. Guirgis, and G. S. Grubbs II. "Theoretical Calculations, Microwave Spectroscopy, and Ring-Puckering Vibrations of 1,1-Dihalosilacyclopent-2-enes." *Journal of Physical Chemistry A*. **124** (2020) 8254-8262. DOI: 10.1021/acs.jpca.0c07250.
10. Atef Jabri, Frank Marshall, William Raymond Neal Tonks, David J. Gillcrist, Charles J. Wurrey, Isabelle Kleiner, Gamil A. Guirgis, and G. S. Grubbs II. "The Conformational Landscape, Internal Rotation, and Structure of 1,3,5-Trisilapentane using Broadband Rotational Spectroscopy and Quantum Chemical Calculations." *Journal of Physical Chemistry A*. **124** (2020) 3825. Virtual Special Issue in Celebration of the 75th Annual International Symposium on Molecular Spectroscopy. DOI: 10.1021/acs.jpca.0c01100.
11. Joshua E. Isert, Frank E. Marshall, William C. Bailey, and G. S. Grubbs II. "Dipole forbidden, nuclear electric quadrupole allowed transitions and chirality: the broadband microwave spectrum and structure of 2-bromo-1,1,1,2-tetrafluoroethane." *Journal of Molecular Structure*. **1216** (2020) 128277. Virtual Special Issue in Honor/Memory of Jon Hougen. DOI: 10.1016/j.molstruc.2020.128277.
12. G. S. Grubbs II, A. Mirala, D. Bischof, M. T. Ghasr, and K. M. Donnell. "Measurement of the Molecular Dipole Moment Using Active Microwave Thermography (AMT)." *Journal of Chemical Thermodynamics*. **151** (2020) 106245. DOI: 10.1016/j.jct.2020.106245.
13. Frank E. Marshall, Nicole Moon, Thomas D. Persinger, David J. Gillcrist, Nelson E. Shreve, William C. Bailey, G. S. Grubbs II. "High-Resolution Spectroscopy Near the Continuum Limit: The Microwave Spectrum of 3-Bromo-1,1,1,2,2-pentafluoropropane." *Molecular Physics*. (2019) **Special Issue in Memoriam of Dieter Cremer.** Invited by Elfi Kraka to Submit. DOI: 10.1080/00268976.2018.1547845.
14. Galen Sedo, Frank E. Marshall, Garry S. Grubbs II. "Rotational Spectra of the Low Energy Conformers Observed in the (1R)-(-)-Myrtenol Monomer." *Journal of Molecular Spectroscopy*. **356** (2018) 32. **Special Issue on Chirality**. DOI: 10.1016/j.jms.2018.12.005.
15. Frank E. Marshall, Rachel Dorris, Sean A. Peebles, Rebecca A. Peebles, G. S. Grubbs II. "The Microwave Spectrum and Structure of Ar-1,3-Difluorobenzene." *Journal of Physical Chemistry A*. **122** (2018) 7385. DOI: 10.1021/acs.jpca.8b05282.
16. Frank E. Marshall, Justin L. Neill, Matt T. Muckle, Brooks H. Pate, Z. Kisiel, and G. S. Grubbs II. "Observation of $^{36}ArH^{37}Cl$, $^{38}ArH^{35}Cl$, and $^{38}ArH^{37}Cl$ in Natural Abundance using CP-FTMW Spectroscopy." *Journal of Molecular Spectroscopy*. **344** (2018) 34. DOI: 10.1016/j.jms.2017.10.009.
17. Frank E. Marshall, Galen Sedo, Channing West, Brooks H. Pate, Stephanie M. Allpress, Corey J. Evans, Peter D. Godfrey, Don McNaughton, and G. S. Grubbs II. "The Rotational Spectrum and Complete Heavy Atom Structure of the Chiral Molecule Verbenone." *Journal of Molecular Spectroscopy*. **342** (2017) 109. DOI: 10.1016/j.jms.2017.09.003. Spectroscopy of Large Amplitude Vibrational Motions on the Occasion of Jon Hougen's 80th Birthday.
18. Daniel Obenchain, Derek Frank, G. S. Grubbs II, Herbert M. Pickett, and Stewart Novick. "The Covalent Interaction Between Dihydrogen and Gold: A Rotational Spectroscopic Study of H_2-AuCl." *Journal of Chemical Physics*. **146** (2017) 204302. DOI: 10.1063/1.4983042.
19. G. S. Grubbs II. "The Carbon Mainframe Structure of *Cis*-*Trans*-1,3-Difluoroacetone." *Journal of Molecular Structure*. **1128** (2017) 263. DOI: 10.1016/j.jms.2016.04.001.
20. Frank E. Marshall, David J. Gillcrist, Thomas D. Persinger, Stephen Jaeger, Cassandra C. Hurley, Nelson E. Shreve, Nicole Moon, and G. S. Grubbs II. "The CP-FTMW Spectrum of Bromoperfluoroacetone." *Journal of Molecular Spectroscopy*. **328** (2016) 59. DOI: 10.1016/j.jms.2016.07.014.
21. G. S. Grubbs II, Derek S. Frank, Daniel A. Obenchain, S. A. Cooke, and Stewart E. Novick. "The pure rotational spectrum of a Claisen rearrangement precursor Allyl Phenyl Ether using CP-FTMW spectroscopy." *Journal of Molecular Spectroscopy*. **324** (2016) 1. DOI: 10.1016/j.jms.2016.04.001.
22. G. S. Grubbs II, Daniel A. Obenchain, Derek S. Frank, Stewart E. Novick, S. A. Cooke, Agapito Serrato III, and Wei Lin. "A Study of the Monohydrate and Dihydrate Complexes of Perfluoropropionic Acid

using Chirped-Pulse Fourier Transform Microwave (CP-FTMW) Spectroscopy." *Journal of Physical Chemistry A*. **119** (2015) 10475. DOI: http://dx.doi.org/10.1021/acs.jpca.5b08347.

23. G.S. Grubbs II, Daniel A. Obenchain, Herbert M. Pickett, and Stewart E. Novick. "Erratum: 'H_2—AgCl: A spectroscopic study of a dihydrogen complex'" [*J. Chem. Phys.* **141**, 114306 (2014)]. *Journal of Chemical Physics*. **143** (2015) 029901. DOI: http://dx.doi.org/10.1063/1.4926540.
24. G. S. Grubbs II, Daniel A. Obenchain, Herbert M. Pickett, and Stewart E. Novick. "H_2—AgCl: a spectroscopic study of a dihydrogen complex." *Journal of Chemical Physics*. **141** (2014) 114306. DOI: http://dx.doi.org/10.1063/1.4895904.
25. James Brown, Xiao-Gang Wang, Tucker Carrington Jr., G. S. Grubbs II, Richard Dawes. "Computational study of the rovibrational spectrum of CO_2—CS_2." *Journal of Chemical Physics*. **140** (2014) 114303. DOI: http://dx.doi.org/10.1063/1.4867792. Editors' Pick on August 8, 2014.

Wesleyan University (Postdoctoral Fellowship)

26. Daniel J. Frohman, G. S. Grubbs II, Zhenhong Yu, and Stewart E. Novick. "Probing the chemical nature of dihydrogen complexation to transition metals, a case study: H_2-CuF." *Inorganic Chemistry*. **52** (2013) 816. DOI: http://dx.doi.org/10.1021/ic301941k.
27. G. S. Grubbs II, Stewart E. Novick, W. C. Pringle, Jr., Jaan Laane, Esther J. Ocola, and S. A. Cooke. "A Bis-trifluoromethyl Effect: Doubled Transitions in the Rotational Spectra of Hexafluoroisobutene, $(CF_3)_2C=CH_2$." *Journal of Physical Chemistry A*. **116** (2012) 8169. DOI: http://dx.doi.org/10.1021/jp305812z.
28. G. S. Grubbs II, P. Groner, Stewart E. Novick, S. A. Cooke. "Methyl group internal rotation and the choice of Hamiltonian for the pure rotation spectrum of 1,1-difluoroacetone." *Journal of Molecular Spectroscopy*. **280** (2012) 21. DOI: http://dx.doi.org/10.1016/j.jms.2012.07.004. Special Broadband Rotational Spectroscopy Issue.
29. G. S. Grubbs II, Daniel J. Frohman, Stewart E. Novick, S. A. Cooke. "Measurement and Analysis of the Pure Rotational Spectra of Tin Monochloride, SnCl, using Laser Ablation equipped Chirped Pulse and Cavity Fourier Transform Microwave Spectroscopy." *Journal of Molecular Spectroscopy*. **280** (2012) 85. DOI: http://dx.doi.org/10.1016/j.jms.2012.07.013. Special Broadband Rotational Spectroscopy Issue.
30. G. S. Grubbs II, A. Serrato III, Daniel. A. Obenchain, S. A. Cooke, Stewart. E. Novick, and W. Lin. "The rotational spectrum of perfluoropropionic acid." *Journal of Molecular Spectroscopy*. **275** (2012) 1. DOI: http://dx.doi.org/10.1016/j.jms.2012.04.003.
31. B. E. Long, G. S. Grubbs II, J. D. Langridge, and S. A. Cooke. "Rotational Spectra, Nuclear Quadrupole Coupling Tensors, and Structures for CF_3CF_2X, X=Cl, Br." *Journal of Molecular Structure*. **1023** (2012) 55. DOI: http://dx.doi.org/10.1016/j.molstruc.2012.02.064. Special issue for Jaan Laane's 70th birthday.
32. W. C. Bailey, R. K. Bohn, C. T. Dewberry, G. S. Grubbs II, and S. A. Cooke. "The structure and helicity of perfluoroocatanonitrile, CF_3-$(CF_2)_6$-CN." *Journal of Molecular Spectroscopy*. **270** (2011) 61. DOI: http://dx.doi.org/10.1016/j.jms.2011.09.001.
33. Daniel J. Frohman, G. S. Grubbs II, and Stewart E. Novick. "Microwave spectroscopy, Dunham analysis, and hyperfine splittings of the isotopomers of zinc monosulfide, ZnS." *Journal of Molecular Spectroscopy*. **270** (2011) 40. DOI: http://dx.doi.org/10.1016/j.jms.2011.08.007.

University of North Texas (Doctoral Student)

34. B.E. Long, G. S. Grubbs II, and S. A. Cooke. "The pure rotational spectra of the two lowest energy conformers of the asymmetric ether $C_4H_9OC_2H_5$." *Journal of Molecular Spectroscopy*. **269** (2011) 113. DOI: http://dx.doi.org/10.1016/j.jms.2011.05.008.
35. B.E. Long, R. A. Powoski, G. S. Grubbs II, W. C. Bailey and S. A. Cooke. "The microwave spectrum of methyl chlorodifluoroacetate: methyl internal rotation and chlorine nuclear electric quadrupole coupling." *Journal of Molecular Spectroscopy*. **266** (2011) 21. DOI: http://dx.doi.org/10.1016/j.jms.2011.01.001.

36. G.S. Grubbs II and S. A. Cooke. "Structure and Barrier to Methyl Group Internal Rotation for $(CF_3)_2CFCF_2OCH_3$ and its Isomer n-$C_4F_9OCH_3$ (HFE-7100)." *Journal of Physical Chemistry A*. **115** (2011) 1086. DOI: http://dx.doi.org/10.1021/jp110390y.
37. G. S. Grubbs II, W. C. Bailey and S. A. Cooke. "Concerning the Electronic and Geometric Structure of Bromodifluoroacetonitrile, $CBrF_2CN$." *Journal of Molecular Structure*. **987** (2011) 255. DOI: http://dx.doi.org/10.1016/j.molstruc.2010.12.035.
38. G. S. Grubbs II, C. T. Dewberry, A. King, Wei Lin, W. C. Bailey and S. A. Cooke. "Chlorine Nuclear Quadrupole Coupling in Chlorodifluoroacetyl Chloride: Theory and Experiment." *Journal of Molecular Spectroscopy*. **263** (2010) 127. DOI: http://dx.doi.org/10.1016/j.jms.2010.07.001.
39. G. S. Grubbs II and S. A. Cooke. "Conformational Energies of $C_4F_9OC_2H_5$ (HFE-7200)."*Chemical Physics Letters*. **495** (2010) 182. DOI: http://dx.doi.org/10.1016/j.cplett.2010.07.004.
40. G. S. Grubbs II, R. A. Powoski, D. Jojola and S. A. Cooke. "Some Geometric and Electronic Structural Effects of Perfluorinating Propionyl Chloride." *Journal of Physical Chemistry A*. **114** (2010) 8009. DOI: http://dx.doi.org/10.1021/jp103966e.
41. G. S. Grubbs II, C. T. Dewberry, S. A. Cooke and Wei Lin. "The Shape of Perfluorobutyryl Fluoride, C_3F_7COF, in the Gas Phase." *Journal of Molecular Structure*. **973** (2010) 190. DOI: http://dx.doi.org/10.1016/j.molstruc.2010.03.069.
42. G. S. Grubbs II, G. Kadiwar, W. C. Bailey, and S. A. Cooke. "The Complete Iodine and Nitrogen Nuclear Electric Quadrupole Coupling Tensors for Fluoroiodoacetonitrile Determined by Chirped Pulse Fourier Transform Microwave Spectroscopy." *Journal of Chemical Physics*. **132** (2010) 024310. DOI: http://dx.doi.org/10.1063/1.3291619.
43. G. S. Grubbs II and S. A. Cooke. "^{117}Sn and ^{119}Sn Hyperfine Structure in the Rotational Spectrum of Tin Monosulfide Using Laser Ablation-Source Equipped, Chirped-Pulse Fourier Transform Microwave Spectroscopy." *Journal of Molecular Spectroscopy*. **259** (2010) 120. DOI: http://dx.doi.org/10.1016/j.jms.2009.12.003.
44. R. A. Powoski, G. S. Grubbs II, and S. A. Cooke. "A Conformational Study of Butyryl Chloride Using Chirped Pulse Fourier Transform Microwave Spectroscopy and Quantum Chemical Calculations." *Journal of Molecular Structure*. **963** (2010) 106. DOI: http://dx.doi.org/10.1016/j.molstruc.2009.10.020.
45. G. S. Grubbs II and S. A. Cooke. "Chirped-Pulse Fourier Transform Microwave Spectroscopy of Perfluoroiodoethane." *Journal of Molecular Structure*. **963** (2010) 87. DOI: http://dx.doi.org/10.1016/j.molstruc.2009.10.019.
46. G. S. Grubbs II and S. A. Cooke. "The Gas Phase Characterization of Perfluorobutyryl Chloride, C_3F_7COCl, Using Chirped Pulse Fourier Transform Microwave Spectroscopy." *Chemical Physics Letters*. **483** (2009) 21. DOI: http://dx.doi.org/10.1016/j.cplett.2009.10.043.
47. G.S. Grubbs II, B. E. Long, R. A. Powoski and S. A. Cooke. "Chirped-Pulse Fourier Transform Microwave Spectroscopy of the Simple Chiral Compound Bromofluoroacetonitrile, CHBrFCN." *Journal of Molecular Spectroscopy*. **258** (2009) 1. DOI: http://dx.doi.org/10.1016/j.jms.2009.08.010.
48. G. S. Grubbs II, W. C. Bailey and S. A. Cooke. "Chirped Pulse Fourier Transform Microwave Spectroscopy of 1,1,2,2-Tetrafluoro-3-iodopropane." *Molecular Physics*. **107** (2009) 2221. DOI: http://dx.doi.org/10.1080/00268970903228741.
49. G. S. Grubbs II, W. C. Bailey and S. A. Cooke. "Changes at the iodine nucleus in 1-iodopropane when one hydrogen at the carbon-3 position is replaced by fluorine." *Chemical Physics Letters*. **477** (2009) 37. DOI: http://dx.doi.org/10.1016/j.cplett.2009.06.059.
50. C. T. Dewberry, G. S. Grubbs II, and S. A. Cooke. "A Molecule with Small Rotational Constants Containing an Atom with a Large Nuclear Quadrupole Moment: The Microwave Spectrum of Trans-1-Iodoperfluoropropane." *Journal of Molecular Spectroscopy*. **257** (2009) 66. DOI: http://dx.doi.org/10.1016/j.jms.2009.06.008.
51. G. S. Grubbs II, C. T. Dewberry, K. C. Etchison, M. M. Serafin, S. A. Peebles, and S. A. Cooke. "The Pure Rotational Spectrum of Pivaloyl Chloride, $(CH_3)_3CCOCl$, between 800 MHz and 18800 MHz.

Journal of Molecular Spectroscopy. **251** (2008) 378. DOI: http://dx.doi.org/10.1016/j.jms.2008.04.010. Special issue dedicated to Edward Cohen and Herb Pickett.

52. C. T. Dewberry, K. C. Etchison, G. S. Grubbs II, R. A. Powoski, M. M. Serafin, S. A. Peebles, and S. A. Cooke. "The ^{115}Sn, ^{117}Sn, ^{119}Sn nuclear spin-rotation constants in stannous monoxide, SnO, and a new multi-isotopomer analysis." *Journal of Molecular Spectroscopy*. **248** (2008) 20. DOI: http://dx.doi.org/10.1016/j.jms.2007.11.009.
53. M. M. Serafin, S. A. Peebles, C. T. Dewberry, K. C. Etchison, G. S. Grubbs II, R. A. Powoski, and S. A. Cooke. "Concerning the electron density at the Pb nucleus in PbO as a function of bond length." *Chemical Physics Letters*. **449** (2007) 33. DOI: http://dx.doi.org/10.1016/j.cplett.2007.10.031.
54. C. T. Dewberry, K. C. Etchison, G. S. Grubbs II, R. A. Powoski, M. M. Serafin, S. A. Peebles, and S. A. Cooke. "Oxygen-17 Hyperfine Structures in the Pure Rotational Spectra of SrO, SnO, BaO, HfO, and ThO." *Physical Chemistry Chemical Physics*. **9** (2007) 5897. DOI: http://dx.doi.org/10.1039/B712798G. Inside front cover article.
55. G. S. Grubbs II, C. T. Dewberry, K. C. Etchison, K. Kerr and S. A. Cooke. "A Search Accelerated Correct Intensity Fourier Transform Microwave Spectrometer with Pulsed Laser Ablation Source." *Review of Scientific Instruments*. **78** (2007) 096106. DOI: http://dx.doi.org/10.1063/1.2786022.

RESEARCH FUNDING / GRANTS

Current Funding:

September 2020 – August 2023

NSF MRI Track 2, 80% PI. "MRI: Development of a Broadband Spectrometer with Multiple Antenna Detection and Chiral Coherent Quantum Control for Rotational Spectroscopy." 3 years. **Amount: $1,500,000** from NSF **$508,320** MS&T Cost Share.

September 2022 – August 2025

DOE Heavy Element Chemistry Program, Collaborative Proposal with SUNY-Purchase College, but Sole PI at MS&T. "Studying *f*-Electron Contributions in Thorium- and Uranium-Containing Molecules." 3 years. **Amount: $558,549; MS&T Amount: $451,101**

Pending Funding and to be Submitted:

September 2023 – August 2026

NSF CSDM-A, Collaborative Proposal with James Madison University, "Collaborative Proposal: Microwave Spectroscopy of Atmospherically Relevant Oxygen-Bearing Molecular Complexes." **Amount: $603,467; MS&T Amount: $515,664**

September 2023 – August 2026

NSF Undergraduate Programs in CHEM, Co-PI. "REU Site: Undergraduate Chemical Research at the Missouri University of Science and Technology with an emphasis on Instrumentation." 3 years. Submitted August 2021. **Amount: $487,369**

Completed Funding Projects:

July 2016 - June 2021 (3 year no cost extension)

NSF ECCS. 10% Co-PI. "A Multi-Physics-Based Approach to Active Microwave Thermography" 3 years. **Amount: $362,513**. Supplemental Request Awarded 2018. **Amount: $8,000**.

August 2018 - August 2020 (1 year no cost extension)

NSF EAGER CSDM-A, Single PI. "Three-wave microwave mixing techniques to study and utilize nuclear quadrupole coupling effects in chiral molecules." 1 year. **Amount: $59,752**. Supplemental Request Awarded 2019. **Amount: $13,018**

October 2017 - May 2018

NASA Missouri EPSCoR. Single PI. "Van der Waals Interaction Studies of an Important Earth and Interstellar Molecule, O_2." 1 year. **Amount: $10,000**.

June 2017

DARPA DSO Days, Invited to join a sidebar with a program manager.

January 2017 - December 2017

MO Research Board. Single PI. "Structural Investigations of Noble Metal Clusters." 1 year. **Amount: $28,000**.

January 2014 - December 2014

MO Research Board. Single PI. "Investigations into a He Bond with MX (M=Ag or Au; X=F or Cl)." 1 year. **Amount: $22,000**.

June 2013

Wesleyan University Distinctive Project Grant (Internal Grant). Co-PI with Stewart E. Novick and Daniel A. Obenchain, "Chirped-Pulse Fourier Transform Microwave Spectroscopy of Controlled Gas Mixtures." FY2013, **Amount: $8,826**.

October 2011 - July 2012

Wesleyan University Project Grant (Internal Grant). Co-PI with Stewart E. Novick, "Understanding Chemical Reactions at Room Temperature via Chirped-Pulse Waveguide Spectroscopy." FY2012, **Amount: $2,350**.

Previously Submitted:

September 2022 – August 2025

NSF CSDM-A, Collaborative Proposal with James Madison University, "Collaborative Proposal: Structural Determinations and Implications of Fundamental Oxygen-Containing Molecular Complexes and Reactions." **Amount: $603,467; MS&T Amount: $445,632**

September 2022 – August 2025

NSF Undergraduate Programs in CHEM, Co-PI. "REU Site: Undergraduate Chemical Research at the Missouri University of Science and Technology with an emphasis on Instrumentation." 3 years. Submitted August 2021. **Amount: $338,494**

September 2022 – August 2027

US Dept of Education, Lead PI. Missouri S&T Upward Bound Program. 5 years. Submitted January 31, 2022. **Amount: $257,537 annual, $1,287,685 minimum**

September 2021 – August 2023

DOE Heavy Element Chemistry Program, Collaborative Proposal, but Sole PI at MS&T. "Studying *f*-Electron Contributions in Thorium- and Uranium-Containing Molecules." Submitted January 2021. **Amount: $553,253; MS&T Amount: $448,730**

May 2021 – April 2024

NSF CSDM-A, 50% PI. "Geometric and Electronic Structure Investigations of the Gas Phase Reaction Products of Lewis Bases with the Lewis Acid, BF_3." 3 years. Submitted October 2020. **Amount: $557,098**

June 2021 – May 2023

NASA LUSTR Program, Collaborative Research PI, Sole at MS&T. "Rover-Mounted Localization and Volumetric Assessment of Lunar Water-Bearing Regolith – An Innovative and Integrated Microwave Approach." 2 years. **Total Amount: $1,468,138**. **Amount MS&T: $291,491**. Submitted August 2020.

September 2020 – August 2023

NSF Galactic Astronomy Program, Collaborative Research PI. "Collaborative Research: Experimental and Theoretical Investigation of New Astronomically Relevant Molecules." 3 years. **Amount: $261,758**. Submitted November 2019.

May 2020 – April 2023

NSF CSDM-A, 50% PI. "Geometric and Electronic Structure Investigations of the Gas Phase Reaction Products of Lewis Bases with the Lewis Acid, BF_3." 3 years. **Amount $473,466**. Submitted September 2019.

August 2019 – July 2022

NSF AAG, 20% PI. "Theoretical and Experimental Investigation of New Astronomically Relevant Molecules." 3 years. **Amount: $899,850**. Submitted 2018.

June 2019 – May 2022

NSF CMI, 80% PI. "Instrument Development of a Multi-Detection CP-FTMW/3WM Spectrometer with Single-Source Sensitivity for Exploration of Exotic Ions, Complexes, and Chiral Species." 3 years. **Amount: $477,710**. Submitted 2018.

September 2018 - September 2021

NASA ROSES Laboratory Astrophysics, Single PI."Finding the Missing Oxygen: Rotational Spectroscopy Data and Analyses for the Detection of Probable Oxygen-Containing Species in the Interstellar Medium." 3 years. **Amount: $544,251**. Submitted 2018.

September 2018 - August 2023

DOE Heavy Elements Program, Single PI. "Studying *f*-Electron Contributions in Thorium and Uranium-Containing Molecules and Complexes." 5 years. **Amount: $750,000**. Submitted 2018.

September 2018 - August 2020

ACS Petroleum Research Fund. Co-PI (Main PI). "Early Chemical Pathway Investigations of Terpenoids to Petroleum using Fourier Transform Microwave Spectroscopic Techniques on Terpenoid van der Waals Complexes." 2 years. **Amount: $110,000**. Submitted 2017.

June 2018 - May 2021

NSF- Chemical Measurement and Imaging. 80% PI. "The Instrument Development of a CP-FTMW Spectrometer with Unprecedented Sensitivity for Problems in Chemical Research." 3 years. **Amount: $586,162**. Submitted 2017.

March 2018 - February 2023

NSF CAREER. Single PI. "CAREER: Solving and Utilizing Multiple Spin Couplings in van der Waals Systems using Gas Phase Microwave Spectroscopic Techniques." 5 years. **Amount: $549,689**. Submitted 2017.

September 2017 - August 2021

Beckman Young Investigators Program, Single PI. "Resolution and Sensitivity: Chirped-Pulse Fourier Transform Microwave (CP-FTMW) Spectroscopy based on Optical Detection." 4 years. **Amount: $750,000**. Submitted 2017.

February 2017 - January 2022

NSF CAREER. 100% PI. "CAREER: High-resolution microwave studies of the geometric, spin, and large amplitude motion effects in systems containing a crucial van der Waals interaction partner, O_2" 5 years. **Amount: $727,885**. Submitted 2016.

July 2016 - June 2021

NSF Faculty Early Career Development Program. Single PI. "CAREER: Microwave Spectroscopic Investigations of Metal Clusters and Their Interactions" 5 years. **Amount: $787,864**. Submitted 2015

January 2017 - December 2021

NSF S-STEM Strand 2. 80% Co-PI. "Enabling Underrepresented Student STEM Success Through Rigorous, State-of-the-Art Chemical Instrumentation Training" 5 years. **Amount: $999,065**. Submitted 2015.

September 2015 - August 2020

Department of Energy Early Career Research Grant. Single PI. "High-Resolution Microwave Spectroscopy of Actinide-Containing Molecules and Complexes" 5 years. **Amount: $750,000**. Submitted 2014.

September 2015 - August 2020

Department of Energy Early Career Research Grant. Single PI. "Fundamental Investigations into Rare Gas-Metal Bonding Motifs" 5 years. **Amount: $750,000**. Submitted 2014.

September 2015 - August 2017

American Chemical Society Petroleum Research Fund Doctoral New Investigator Grant. Single PI. "Fundamental Investigations into Rare Gas-Metal Bonding Motifs" 2 years. **Amount: $110,000**. Submitted 2014.

September 2015 - August 2018

National Science Foundation CSDM-A. Single PI. "Fundamental Investigations into Rare Gas-Metal Bonding Motifs" 3 years. **Amount: $359,985**. Submitted 2014.

September 2014 - August 2017

NSF Program CSDM-A. Main PI (90%). "Investigations into the Existence of a He Bond with Coinage Metal Halides." 3 years. **Amount: $582,842**. Submitted 2013.

PRESENTATIONS (Personally Presented)

G. S. Grubbs II (2021, June: **INVITED LECTURE FOR RESEARCH WITH UNDERGRADUATES FH01**) *UNDERGRADUATE MOLECULAR SPECTROSCOPY APPROACHES IN RESEARCH AND TEACHING AS AN EXPERIENTIAL LEARNING ENTERPRISE AT MISSOURI S&T*. Presented at the 75th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G. S. Grubbs II (2021, May: **INVITED SEMINAR at California Polytechnic State University San Luis Obispo)** *Qualitative and Quantitative Studies of Chiral Species using Fundamental Interactions and Microwave Techniques*, Virtual Presentation

G. S. Grubbs II (2021, February: **INVITED SEMINAR at Olivet Nazarene University)** *Qualitative and Quantitative Studies of Chiral Species using Fundamental Interactions and Microwave Techniques*, Virtual Presentation

G. S. Grubbs II (2020, November: **INVITED SEMINAR at University of Texas Rio Grande Valley)** *Applying and Attending Graduate School at Missouri S&T Chemistry, an Overview*, Virtual Presentation

G. S. Grubbs II (2020, November: **INVITED SEMINAR at University of Texas Rio Grande Valley)** *Microwave Spectroscopy: Directionality, Chirality, and Reality*, Virtual Presentation

G. S. Grubbs II (2019, September 13: **INVITED SEMINAR**) *Understanding Bonding at the Bottom of the Periodic Table; f-Electron and Relativistic Effect Chemistries*. Western Illinois University, Macomb, IL.

G. S. Grubbs II (2019, June: **FLYGARE AWARD LECTURE**) *MICROWAVE SPECTROSCOPY AT MISSOURI S&T*. **MA04**. Presented at the 74th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G. S. Grubbs II (2019, March 7: **INVITED SEMINAR**) *Enhanced CP-FTMW Sensitivity for Qualitative and Quantitative Chiral Analysis*. Trinity University, San Antonio, TX.

G.S. Grubbs II (2018, November 8: **INVITED SEMINAR**) *Microwave Spectroscopy: Living at the Intersection of Space, Chirality, Quantum Chemistry, and Technology*. Western Illinois University, Macomb, IL.

G.S. Grubbs II (2018, September 28: **INVITED SEMINAR**) *Microwave Spectroscopy: Living at the Intersection of Space, Chirality, Quantum Chemistry, and Technology*. Baylor University, Waco, TX.

Frank E. Marshall, Nicole Moon, Amanda Jo Duerden, G. S. Grubbs II (2018, June: Talk). *ATTEMPTS TO SOLVE O_2-CONTAINING VAN DER WAALS INTERACTIONS USING SPFIT AND SPCAT WITH MICROWAVE MEASUREMENT PRECISION: PROBLEMS, PITFALLS, AND SUCCESSES*. **TH03**. Presented at the 73rd International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G.S. Grubbs II (2018, March: **INVITED TALK**). *The Structure Determination of O_2-Containing van der Waals Complexes Using Microwave Spectroscopy and an Asymmetric Hund's Case B Approach*. Presented at the 27th Austin Symposium on Molecular Structure and Dynamics at Dallas, Dallas, TX.

G. S. Grubbs II (2017, November: **INVITED SEMINAR**). *Using Fine and Hyperfine Effects to Provide Qualitative and Quantitative Insights into Molecular Structure and Chirality: A Game of Quantum Chemical Tag*. University of Missouri-St. Louis, St. Louis, MO.

Frank E Marshall, Nicole Moon, Thomas D. Persinger, Richard Dawes, G. S. Grubbs II (2017, June: Talk). *MICROWAVE OBSERVATION OF THE O_2-CONTAINING COMPLEX, O_2-HCl.* **TE04**. Presented at the 72nd International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

Frank E Marshall, Daniel V. Hickman, Gamil A. Guirgis, Michael H. Palmer, Charles J. Wurrey, Nicole Moon, Thomas D. Persinger, G. S. Grubbs II (2017, June: Talk). *MICROWAVE SPECTRUM OF 1-SILA-1-ISOCYANOCYCLOPENT-3-ENE.* **FB01**. Presented at the 72nd International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

Frank E Marshall, Nicole Moon, Thomas D. Persinger, David Joseph Gillcrist, N. E. Shreve, William C. Bailey, G. S. Grubbs II (2017, June: Talk). *AN INVESTIGATION OF THE DIPOLE FORBIDDEN TRANSITION EFFECTS IN BROMOFLUOROCARBONS AS IT PERTAINS TO 3-BROMO-1,1,2,2-PENTAFLUOROPROPANE USING CP-FTMW SPECTROSCOPY.* **FB05**. Presented at the 72nd International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G. S. Grubbs II (2017, April: **INVITED SEMINAR**). *FTMW Spectroscopy and the Fundamentals of Nature: A Window to Bonding, Structure, and Chirality*. Wesleyan University, Middletown, CT.

G. S. Grubbs II, Derek S. Frank, Daniel A. Obenchain, S. A. Cooke, Stewart E. Novick (2016, June: Talk). *CP-FTMW SPECTROSCOPY OF A CLAISEN REARRANGEMENT PRECURSOR ALLYL PHENYL ETHER.* **MI02**. Presented at the 71st International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

Frank E. Marshall, David Joseph Gillcrist, Thomas D. Persinger, Nicole Moon, G. S. Grubbs II (2016, June: Talk). *A CHIRPED PULSE FOURIER TRANSFORM MICROWAVE (CP-FTMW) SPECTROMETER WITH LASER ABLATION SOURCE TO SEARCH FOR ACTINIDE-CONTAINING MOLECULES AND NOBLE METAL CLUSTERS.* **MJ12**. Presented at the 71st International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

Frank E. Marshall, Thomas D. Persinger, David Joseph Gillcrist, Nicole Moon, Steve Alexandre Ndengue, Richard Dawes, G. S. Grubbs II (2016, June: Talk). *MICROWAVE OBSERVATION OF THE VAN DER WAALS COMPLEX O_2-CO.* **WG14**. Presented at the 71st International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G.S. Grubbs II (2016, March: **INVITED TALK**). *A Chirped Pulse Fourier Transform Microwave (CP-FTMW) Spectrometer with Laser Ablation Source to Search for Actinide-Containing Molecules and Noble Metal Clusters*. Presented at the 26th Austin Symposium on Molecular Structure and Dynamics at Dallas, Dallas, TX.

G. S. Grubbs II *et al* (2015, June: Talk). *THE CP-FTMW SPECTROSCOPY AND ASSIGNMENT OF THE MONO- AND DIHYDRATE COMPLEXES OF PERFLUOROPROPIONIC ACID.* **RH12**. Presented at the 70th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G. S. Grubbs II (2015, June: Talk). *UTILIZING SPECTROSCOPIC RESEARCH TOOLS AND SOFTWARE IN THE CLASSROOM*. **RC10**. Presented at the 70th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G. S. Grubbs II *et al* (2014, June: Talk). *THE CHIRPED PULSE AND CAVITY FOURIER TRANSFORM MICROWAVE (CP-FTMW AND FTMW) SPECTRUM OF BROMOPERFLUOROACETONE*. **WJ08**. Presented at the 69th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G. S. Grubbs II *et al* (2014, June: Talk). *CHIRPED PULSE AND CAVITY FOURIER TRANSFORM MICROWAVE (CP-FTMW AND FTMW) INVESTIGATIONS INTO 3-BROMO-1,1,2,2-PENTAFLUOROPROPANE; A MOLECULE OF ATMOSPHERIC INTEREST*. **TE05**. Presented at the 69th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL.

G. S. Grubbs II *et al* (2013, June: Talk). *FTMW OBSERVATION AND ANALYSIS OF THE p-H_2—AgCl AND o-H_2—AgCl COMPLEX*. **FC02**. Presented at the 68th International Symposium on Molecular Spectroscopy at The Ohio State University, Columbus, OH.

G. S. Grubbs II *et al* (2012, June: Talk). *THE CHIRPED-PULSE FOURIER TRANSFORM MICROWAVE (CP-FTMW) SPECTRUM AND POTENTIAL ENERGY CALCULATIONS FOR AN AROMATIC CLAISEN REARRANGEMENT MOLECULE, ALLYL PHENYL ETHER.* **TC11**. Presented at the 67th International Symposium on Molecular Spectroscopy at The Ohio State University, Columbus, OH.

G. S. Grubbs II *et al* (2011, June: Talk). *CAVITY AND CHIRPED PULSE ROTATIONAL SPECTRUM OF THE LASER ABLATION SYNTHESIZED, OPEN-SHELL MOLECULE TIN MONOCHLORIDE, SnCl*. **TC12**. Presented at the 66th International Symposium on Molecular Spectroscopy at The Ohio State University, Columbus, OH.

G. S. Grubbs II *et al* (2010, October: Poster). *OBSERVED DOUBLING IN THE PURE ROTATIONAL SPECTRA OF HEXAFLUOROISOBUTENE, $(CF_3)_2C=CH_2$, HEXAFLUOROACETONE IMINE, $(CF_3)_2C=NH$, AND ALSO 1-IODOPERFLUOROBUTANE, $C_4F_{11}I$*. **P18**. Presented at the University of North Texas Chemistry Centennial Celebration, Denton, TX.

G. S. Grubbs II *et al* (2010, June: Talk) *CHIRPED PULSE FOURIER TRANSFORM MICROWAVE SPECTROSCOPY OF SnCl*. **RC06**. Presented at the 65th International Symposium on Molecular Spectroscopy at The Ohio State University, Columbus, OH.

G. S. Grubbs II *et al* (2010, March: Poster). *OBSERVED SPLITTING IN THE CHIRPED-PULSE SPECTRUM OF PERFLUOROIODOBUTANE*. **PHYS 327**. Presented at the 239th American Chemical Society National Meeting & Exposition, San Francisco, CA.

G. S. Grubbs II *et al* (2010, March: Poster). *DETECTING LASER ABLATION PRODUCTS USING FAST PASSAGE FOURIER TRANSFORM MICROWAVE SPECTROSCOPY: THE EXAMINATION OF THE OPEN SHELL MOLECULE SnCl*. **K1**.00286. Presented at the 2010 American Physical Society National March Meeting, Portland, OR.

G. S. Grubbs II *et al* (2010, March: Poster). *OBSERVED DOUBLING IN THE PURE ROTATIONAL SPECTRA OF HEXAFLUOROISOBUTENE, $(CF_3)_2C=CH_2$, HEXAFLUOROACETONE IMINE, $(CF_3)_2C=NH$, AND ALSO 1-IODOPERFLUOROBUTANE, $C_4F_{11}I$*. **P18**. Presented at the 23rd Austin Symposium on Molecular Structure and Dynamics, Austin, TX.

G. S. Grubbs II *et al* (2009, June: Talk). *MEASUREMENT OF THE VIBRATIONAL POPULATION DISTRIBUTION OF BARIUM SULFIDE SEEDED IN AN ARGON SUPERSONIC EXPANSION FOLLOWING PRODUCTION THROUGH THE REACTION OF LASER ABLATED BARIUM WITH CARBONYL SULFIDE*. **WF13**. Presented at the 64th International Symposium on Molecular Spectroscopy at The Ohio State University, Columbus, OH.

G. S. Grubbs II *et al* (2008, June: Talk). *THE PURE ROTATIONAL SPECTRUM OF PIVALOYL CHLORIDE, $(CH_3)_3CCOCl$, BETWEEN 800 MHz AND 18800 MHz*. **FC08**. Presented at the 63rd International Symposium on Molecular Spectroscopy at The Ohio State University, Columbus, OH.

Advisee Given Presentations (Presenters Underlined)

W. H. Rice IV, Caitlyn Saiz, Amanda Duerden, Frank E. Marshall, G. S. Grubbs II (June 2022) *REINVESTIGATION OF THE MICROWAVE SPECTRUM OF THE O2-H2O VAN DER WAALS COMPLEX*. **FD09**. Presented at the 75th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Nicole Moon, G. S. Grubbs II (June 2022) *INTERNAL ROTATION ANALYSIS AND STRUCTURAL DETERMINATION OF R-CARVONE*. **RL03**. Presented at the 75th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Joshua E. Isert, Zayra Leticia Gonzalez, Karla V. Salazar, Diego Rodriguez, Nicole Moon, Wei Lin, and G. S. Grubbs II (June 2022) *THE ROTATIONAL SPECTRUM OF NONAFLUORO-TERT-BUTYL ALCOHOL*. **RL02**. Presented at the 75th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Nicole Moon, G. S. Grubbs II (October 2021) *A MICROWAVE THREE-WAVE MIXING SPECTROMETER WITH MULTIPLE ARBITRARY WAVEFORM GENERATORS*. Presented at the 55th Annual ACS Midwest Regional Meeting in Springfield, MO.

Nicole Moon, Amanda Duerden, Joshua E. Isert, G. S. Grubbs II (June 2021) *CONSTRUCTION AND DEMONSTRATION OF A MICROWAVE THREE-WAVE MIXING SPECTROMETER AT THE MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY*. **TI07**. Presented at the Virtual International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Amanda Duerden, Nicole Moon, Christian Swanson, Frank E. Marshall, Joshua E. Isert, Kristen Donnell, G. S. Grubbs II (June 2021) *A CHIRP PULSE FOURIER TRANSFORM MICROWAVE SPECTROMETER WITH MULTI-ANTENNA DETECTION (MAD-CP-FTMW)*. **TI10**. Presented at the Virtual International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Joshua E. Isert, Josie Glenn, Amanda Duerden, Nicole Moon, Frank E. Marshall, G. S. Grubbs II (June 2021) *A HEIGHT ADJUSTABLE LASER ABLATION SOURCE FOR A CP-FTMW SPECTROMETER AT THE MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY*. **TI11**. Presented at the Virtual International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Christian Swanson, Nicole Moon, Amanda Duerden, Joshua E. Isert, G. S. Grubbs II (June 2021) *PHASE DETERMINATION IN MULTI-ANTENNA DETECTION CHIRPED-PULSE MICROWAVE SPECTROSCOPY*. **RA05**. Presented at the Virtual International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Joshua E. Isert, Frank E. Marshall, G. S. Grubbs II (June 2019) *STRUCTURAL DETERMINATION OF THE CHIRAL MOLECULE 2-BROMO-1,1,1,2-TETRAFLUOROETHANE BY CP-FTMW SPECTROSCOPY*. **WI09**. Presented at the 74th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Nicole Moon, Amanda Jo Duerden, G. S. Grubbs II (June 2019) *ROTATIONAL SPECTROSCOPY: A LABORATORY FOR UNDERGRADUATE PHYSICAL CHEMISTRY*. **WC09**. Presented at the 74th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Amanda Jo Duerden, Nicole Moon, G. S. Grubbs II (June 2019) *A LOW-BUDGET, RESEARCH GRADE, BALLE-FLYGARE CAVITY FTMW SPECTROMETER IMPLEMENTED FOR THE TEACHING LABORATORY*. **WC08**. Presented at the 74th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Frank E. Marshall, Amanda Jo Duerden, Nicole Moon, Kristen Donnell, G. S. Grubbs II (June 2019) *MULTI-ANTENNAE DETECTION IN A CP-FTMW SPECTROMETER*. **WC05**. Presented at the 74th

International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Frank E. Marshall, Amanda Jo Duerden, Nicole Moon, David Joseph Gillcrist, Ivan Sedlacek, Grier Jones, Theodore Carrigan-Broda, Gamil A. Guirgis, G. S. Grubbs II (June 2018) *STRUCTURE DETERMINATION OF 5 MEMBERED SILANE RINGS USING MICROWAVE SPECTROSCOPY.* **TJ10**. Presented at the 73rd International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Joshua E. Isert, Frank E. Marshall, Garry Grubbs II (May 2018) *Chirality Determination Using Dipole-Forbidden Transitions.* Presented at the First Year Research Experiences (FYRE) Program Conclusion, Missouri University of Science and Technology, Rolla, MO. POSTER

Frank E. Marshall, Amanda Duerden, Nicole Moon, David Gillcrist, Ivan Sedlacek, Gamil A. Guirgis, G. S. Grubbs II (March 2018) *STRUCTURE DETERMINATION OF 5 MEMBERED SILANE RINGS USING MICROWAVE SPECTROSCOPY.* **P10**. Presented at the 27th Austin Symposium on Molecular Structure and Dynamics at Dallas, Dallas, TX. POSTER

Frank E. Marshall, William Raymond Neal Tonks, David Joseph Gillcrist, Charles J. Wurrey, Gamil A. Guirgis, G. S. Grubbs II (June 2017) *TUNNELING EFFECTS AND CONFORMATION DETERMINATION OF THE POLAR FORMS OF 1,3,5-TRISILAPENTANE.* **TI09**. Presented at the 72nd International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Frank E. Marshall, Channing West, Galen Sedo, Brooks Pate, G. S. Grubbs II (June 2017) *THE COMPLETE HEAVY-ATOM STRUCTURE OF A CP-FTMW CHIRAL TAG PRECURSOR, VERBENONE.* **RG12**. Presented at the 72nd International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Frank E. Marshall, Nicole Moon, Thomas D. Persinger, David Joseph Gillcrist, G. S. Grubbs II (June 2016) *CP-FTMW SPECTRUM OF BROMOPERFLUOROACETONE.* **WE05**. Presented at the 71st International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Frank Marshall, Michael A Pride, Michelle Rojo, Katelyn R. Brinker, Zachary Walker, Michael Storrie-Lombardi, Melanie R. Mormile, and G. S. Grubbs II (June 2015) *A SIMPLE, COST EFFECTIVE RAMAN-FLUORESCENCE SPECTROMETER FOR USE IN LABORATORY AND FIELD EXPERIMENTS*. **RC02**. Presented at the 70th International Symposium on Molecular Spectroscopy at the University of Illinois at Urbana-Champaign, Urbana, IL. TALK

Teresa Schneider, Hannah Schumaker, and G. S. Grubbs II (July 2014) *Laser Ablation System and Automation of a CP-FTMW Spectrometer*. MS&T Summer Research Academy Poster Session, Rolla, MO. POSTER

Nelson Shreve (April 2014) *RECONSTRUCTION OF A BALLE-FLYGARE TYPE FTMW SPECTROMETER*. 1st Annual Undergraduate Research Symposium on High Resolution Spectroscopy and Structure at Wesleyan University, Middletown, CT. TALK

Frank Marshall (April 2014) *PRELIMINARY TESTING, CIRCUIT DESIGN, AND CONSTRUCTION OF A CP-FTMW SPECTROMETER*. 1st Annual Undergraduate Research Symposium on High Resolution Spectroscopy and Structure at Wesleyan University, Middletown, CT. TALK

Cassandra Hurley (April 2014) *Construction and Implementation of a Fourier Transform Microwave (FTMW) Spectrometer*. MS&T Undergraduate Research Symposium, Rolla, MO. POSTER

David Gillcrist (April 2014) *Design and Construction of a Novel Chirped Pulse Fourier Transform Microwave (CP-FTMW) Spectrometer*. MS&T Undergraduate Research Symposium, Rolla, MO. POSTER

TEACHING EXPERIENCE (All Effectiveness Scores out of 4.00)

Fall 2022 CHEM 3459 Accelerated Physical Chemistry Laboratory (3 students)
Teaching Effectiveness: Not Rated

Fall 2022 CHEM 6101 Intro to Chemistry Research (5 students)
Teaching Effectiveness: Not Rated

Spring 2022 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (1/16 students)
Teaching Effectiveness: 3419 (1 student Not Eval)/2.50 3459 **(COVID)**

Spring 2022 CHEM 4510/5510 Instrumental Methods of Chemical Analysis (2/5 students) LEC
Teaching Effectiveness: 4510 3.50/3.40 5510 **(COVID)**

Fall 2021 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (12 students)
Teaching Effectiveness: 3419 3.00/2.89 3459 **(COVID)**

Fall 2021 CHEM 3510 Analytical Chemistry II (14 students) LEC & LAB
Teaching Effectiveness: LEC 2.43/1.88 LAB **(COVID)**

Spring 2021 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (9 students)
Teaching Effectiveness: 2.80 **(COVID)**

Spring 2021 CHEM 4510/5510 Instrumental Methods of Chemical Analysis (2/9 students) LEC & LAB
Teaching Effectiveness: LEC 3.50/3.11 LAB NR(too few reviews)/3.12 **(COVID)**

Fall 2020 CHEM 3510 Analytical Chemistry II (21 students) LEC & LAB
Teaching Effectiveness: 3.09 **(COVID)**

Spring 2020 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (24 students)
Teaching Effectiveness: 3.33 **(COVID)**

Spring 2020 CHEM 4510/5510 Instrumental Methods of Chemical Analysis (12 students) LEC & LAB
Teaching Effectiveness: 3.00/3.00 (4510 LEC/LAB) 3.14/3.57 (5510 LEC/LAB) **(COVID)**
Accolade: Received 2021 "Tappemeyer Teaching Excellence Award"

Fall 2019 CHEM 3510 Analytical Chemistry II (21 students) LEC & LAB
Teaching Effectiveness: 3.21

Spring 2019 CHEM 6450/6550 Spectroscopy/Chemical Spectroscopy (8 Students)
Teaching Effectiveness (Rating out of 4.00): 6450 – 4.00; 6550 – 3.33

Spring 2019 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (18 students)
Teaching Effectiveness: 3.64

Fall 2018 CHEM 3410 Physical Chemistry I: Thermodynamics (34 students)
Teaching Effectiveness: 2.82

Summer 2018 CHEM 1320 General Chemistry II Lecture (8 students)
Teaching Effectiveness: Not Rated

Spring 2018 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (10 students)
Teaching Effectiveness: 3.43

Fall 2017 CHEM 3410 Physical Chemistry I: Thermodynamics (87 students)
Teaching Effectiveness: 2.54

Spring 2016 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (12 students)
Teaching Effectiveness: 3.17

Fall 2016 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (4 students)
Teaching Effectiveness: 3.33
CHEM 6450 Spectroscopy (7 students)
Teaching Effectiveness: 3.67

Spring 2016 CHEM 3419/3459 Accelerated Physical Chemistry Laboratory (3 students)
Teaching Effectiveness: 4.0

Fall 2015	CHEM3419/ 3459 Accelerated Physical Chemistry Laboratory (9 students), Revamped Physical Chemistry Lab
	Teaching Effectiveness: 3.75
Spring 2015	CHEM 3410 Physical Chemistry I: Thermodynamics (67 students)
	Teaching Effectiveness: 2.49
Fall 2014	CHEM 5410/4410 Solution and Molecular Thermodynamics/Chemical Thermodynamics (5 students)
	Teaching Effectiveness: 3.7/4.0
	Accolade: Received "Tappemeyer Teaching Excellence Award"
Fall 2013	CHEM 343 Introduction to Quantum Chemistry (19 students)
	Teaching Effectiveness: 2.7/4.0

SERVICE, COMMUNITY AND VISIBILITY ACTIVITIES

Department:

August 2022 – Present, Personnel Committee

June 2022 - Present, Budget Committee Chair

June 2022 - Present, FCR Missouri Donald L. Castleman Endowed Professorship of Discovery in Chemistry Search Committee Member

May/June 2022, Internal Department Chair Search Committee Chair

June 2020, Vadym Mochalin Tenure Subcommittee Member

August 2019 – July 2021, Personnel Committee, AY 20-21 *Chair*

August 2019 – Present, *Colloquium Series Chair*, https://chem.mst.edu/seminars/colloquium/

September 2018 - Present, Graduate Affairs Committee Member

September 2018 - Present, Undergraduate Recruitment & Scholarship Committee

September 2017 - Present, Faculty Senate Substitute

March 2017 - April 2018, Fluorescence Spectrometer Committee Chair

September 2016 - September 2017, Graduate Recruitment Committee Member

May 2016, Leader of Department Instrumentation Grant

September 2015 - September 2016, Undergraduate Affairs and Scholarship Committee

September 2014 - August 2015, Graduate Affairs Committee

March 2014 - September 2016, Personnel Committee Member, Elected to Committee 3 straight years

September 2013 - Present, American Chemical Society South Central Missouri Local Section Executive Committee, **2015** *Chair-Elect*, **2016** *Chair*, **2017** *Immediate Past Chair and Treasurer*, **2018-2019** *Treasurer*

September 2013 - Present, Various Ad-Hoc Committees

September 2013 - August 2014, Graduate Affairs Committee *Chair*

Campus or College Level:

October 2022-Present, Associate Deans (Research and Academic) Search Committee for CASE

Summer 2022, 6 STEM Outreach Activities for Missouri S&T Child Development Center's Schoolers Class (Ages 5-10)

May 2021 - June 2022, Organizer of University's Application for Dept. of Education TRiO Upward Bound Grant

August 2020 - Present, 5-year Roadmap for S&T Research Committee Member

September 2019 - Present, CASB Safety Committee

September 2019 - Present, CASB Graduate Student Recruitment Day Co-Organizer with Melanie Mormile

January 2018 - Present, CASB First Year Research Experiences Faculty

April 2016 - Present, Campus Faculty Recruitment and Retention Committee

June 2014 - July 2014, Missouri S&T Summer Research Academy Faculty Mentor

March 2014 - Present, Mars Rover Design Team Associate Faculty Advisor, 2017 *URC CHAMPIONS*

Local Community:

October 2022, Missouri S&T TedX Talk: Eliciting a Reaction Chemistry Demo Show

September 2022, Chemistry Demo Show for Expanding Your Horizons (7th and 8th Grade STEM Program for Girls)

April 2022, Chemistry Demo Show for Black Girls Do STEM Organization

February 2022, Chemistry Demo Show for Local 6th and 8th graders

August 2014 - Present, American Chemical Society South Central Missouri Local Section National Chemistry Week Organizing Committee

August 2014 - Present, American Chemical Society South Central Missouri Local Section Excellence in Teaching Award Selection Committee

August 2014 - Present, American Chemical Society South Central Missouri Local Section Fall and Spring BBQ Organizer

Field Service and Visibility:

September 2022 – Present, Review Editor on the Editorial Board of Physical Chemistry and Chemical Physics (specialty section of *Frontiers in Chemistry* and *Frontiers in Physics*)

August 2022 – Present, Member of the Editorial Board for the *Journal of Molecular Structure*

June 2022, Host for Isabelle Kleiner (CNRS Director of Research at the LISA at Université Paris-Est Créteil (UPEC) and Université de Paris) in order to work on collaboration for molecules exhibiting internal rotation.

June 2022, Session Chair for session TM. Clusters/Complexes at the 75th International Symposium on Molecular Spectroscopy.

June 2022, Host for Galen Sedo (Associate Professor at University of Virginia at Wise) and 1 student to work on heated molecular beam sourcing techniques for microwave spectroscopy.

October 2021 – July 2022, Guest Editor for Virtual Special Issue of the *Journal of Molecular Spectroscopy* in Honor of Norm Craig

August 2021, Host for Galen Sedo (Associate Professor at University of Virginia at Wise) and 1 student to work on heated molecular beam sourcing techniques for microwave spectroscopy.

July-August 2021, Host for Paul Raston (Assistant Professor at James Madison University) and 1 student to work on DC discharge sources and open-shell/radical van der Waals complex spectroscopy and structures

July 2021, Host for Wei Lin (Professor at University of Texas-Rio Grande Valley) Research Visit with 2 students to study structures of carboxylic acids and complexes

June 2021, Session Chair for session RA. Rotational Structure/Frequencies at the 75th International Symposium on Molecular Spectroscopy.

July 2019-July 2022, Member of the Editorial Board of the *Journal of Molecular Spectroscopy*

June 2019, Session Chair for session RI. Rotational Structure/Frequencies at the 74th International Symposium on Molecular Spectroscopy.

June 2014 - Present, Editor (2017-Present) and Editor-in-Training (2014-2017) for the Microwave Spectroscopy letter, the premier source for current research in the field

August 2013 - Present, Organizer of the Midwest Microwave Consortium

9 Universities, 1 High School - Missouri S&T, Eastern Illinois University, University of Missouri-Kansas City, University of Virginia's College at Wise, College of Charleston, University of Texas-Rio Grande Valley, SUNY-Purchase College, James Madison University, Wesleyan University, Harvey Mudd College, and Louisiana School for Math, Science, and the Arts (LSMSA)

12 Investigators - Garry Grubbs II (MS&T), Kristen Donnell (MS&T), Sean Peebles (EIU), Rebecca Peebles (EIU), Peter Groner (UMKC), Galen Sedo (UVa-Wise), Gamil Guirgis (CoC), Lindsay Zack (LMSA), Wei Lin (UTRGV), Stephen Cooke (SUNY-Purchase), Paul Raston (JMU), Stewart Novick (Wes), Alicia Hernandez-Castillo (Harvey Mudd College)

June 2018, Session Chair for session FA. Vibrational Structure/Frequencies at the 73rd International Symposium on Molecular Spectroscopy.

June 2017, Session Chair for session WD. Clusters/Complexes at the 72nd International Symposium on Molecular Spectroscopy.

September 2016 - December 2016, Host for Galen Sedo (University of Virginia at Wise) Sabbatical

April 2014, Session Chair for the 1st Annual Undergraduate Research Symposium on High Resolution Spectroscopy and Structure

June 2012, Session Chair for session MH. MICROWAVE at the 67th Ohio State University International Symposium on Molecular Spectroscopy.

Reviewing Activities:

NSF MRI Program Ad-Hoc and Panel Reviewer

Cottrell Scholar Reviewer

UTSA ORAU Proposal Reviewer

NSF CSDM-A Program Ad-Hoc and Panel Reviewer

South Carolina Experimental Program to Stimulate Competitive Research and Institutional Development

Canadian Journal of Physics

ChemPhysChem

Chemistry-A European Journal

Journal of Chemical Physics

Journal of Molecular Spectroscopy

Inorganic Chemistry

Journal of Physical Chemistry A

Journal of Molecular Structure

Journal of the American Chemical Society

Journal of Pharmaceuticals and Biomedical Analysis

Journal of Physical Chemistry Letters

RESEARCH ADVISEES

Current Graduates

Amanda Duerden (Fall 2017 - Present) B.S. 2017 Chemistry, Missouri University of Science and Technology
2017 - 2018 TA Award Winner

2018 - 2019 TA Award Winner

2020 Department of Chemistry Outstanding Graduate Student Service Award

Currently ABD

Nicole Moon (Fall 2019 – Present) B.S 2019 Chemistry, Missouri University of Science and Technology

2019 Missouri S&T Chancellor's Fellow

2020 Department of Chemistry Outstanding Graduate Student Teaching Assistant Award

2021 Department of Chemistry Outstanding Graduate Student Service Award

Josh Isert (Fall 2020 - Present) B.S. 2020 Chemistry, Missouri University of Science and Technology

Billy Rice (Fall 2021 - Present) B.S. 2021 Chemistry, Missouri University of Science and Technology

Current Undergraduates

Josie Glenn (Spring 2021 - Present) Chemistry Major

FYRE Project (2021): Actinide chemistry: Understanding bonding at the bottom of the periodic table and accepting the *f*-electron challenge

2021 Department of Chemistry Outstanding Sophomore Award

2021-2022 OURE Project: Actinide chemistry: Understanding bonding at the bottom of the periodic table and accepting the *f*-electron challenge

Summer 2022 Bottom Scholar in Undergraduate Research

Harrison Hauxby (Fall 2021 - Present) Chemistry Major

FYRE Project (2022): Microwave Pulse Schemes for Chiral Coherent Quantum Control

Former Graduates

Frank Marshall (Fall 2015 – Fall 2019) Ph.D. 2019 Chemistry, B.S. 2015 Physics and Applied Mathematics, Missouri University of Science and Technology, Defended July 2019, Currently at ThermoFisher Scientific

2016 – 2017 TA Award Winner

2017 – 2018 TA Award Winner

2018 – 2019 TA Award Winner

2018 – 2019 Excellence in Graduate Research Award Winner

Rebekah Penn (Spring 2021 – Spring 2022) B.S. 2020 Chemistry, Old Dominion University

Former Undergraduates

Caitlyn Saiz (Fall 2021 – Present) Chemistry Major

Summer Research 2022

Andrew Webb (Fall 2021 – Summer 2022) Chemistry and Chemical Engineering Double Major

Employed at Epic

Henry Politte (Fall 2021) Chemistry Major

Christian Swanson (Spring 2020 – Summer 2021) Chemistry Major

FYRE Project (2020): Quadrature Detection Schemes in Chirped Pulse Fourier Transform Microwave (CP-FTMW) Spectroscopy

Dept. of Chemistry UG Research Scholarship Project (2020-2021): Quadrature Detection Schemes in Chirped Pulse Fourier Transform Microwave (CP-FTMW) Spectroscopy

OURE Project (2020-2021): Quadrature Detection Schemes in Chirped Pulse Fourier Transform Microwave (CP-FTMW) Spectroscopy

Tiara Pulliam (Fall 2019 – Fall 2020) Chemistry Major

Josh Isert (Spring 2018 – Spring 2020) Chemistry Major

FYRE Project (2018): Chirality Determination using Dipole Forbidden Transitions

2020 ACS South Central Missouri Local Section Undergraduate Research Award

Continued Graduate Studies at Missouri S&T

Nicole Moon (Spring 2016 – Spring 2019) Chemistry Major

OURE Project (2016): Insights into the Pt-Catalyzed Hydrogenation of Acetylene and Ethylene

OURE Project (2017): O_2 Complexation

OURE Project (2018): O_2 Complexation

2016 Department of Chemistry Outstanding Freshman Award

2017 Department of Chemistry Outstanding Sophomore Award

2018 Department of Chemistry Outstanding Junior Award

2018 Missouri University of Science and Technology Physical Chemistry Award

2018 ACS South Central Missouri Local Section Undergraduate Research Award

2019 Department of Chemistry Outstanding Senior Award

2019 Missouri University of Science and Technology Chancellor's Fellow 2019

Continued Graduate Studies at Missouri S&T

Bethany Paramathas (Spring 2019) Chemistry Major

FYRE Project (2019): Actinides, Ions, and *f*-Electrons: Understanding Chemical Bonding when Chemical Models Break Down

David Gillcrist (Spring 2014 - Spring 2018) B.S. Physics and Applied Mathematics;

OURE Project (2014 - Present): High Resolution Spectroscopy of Lanthanide and Actinide Molecules, Graduate Student in Physics at University of Alberta

Ivan Sedlacek (Fall 2017 - Spring 2018) B.S. Chemistry, Employed at Brewer Science, Inc.

Thomas Persinger (Spring 2014 - Spring 2017) B.S. Chemistry

OURE Project (2015 - 2017): Rg-Noble Metal Bonding

2016 University of Illinois-Urbana-Champaign REU Student

2017 University of Utah REU Student

Missouri University of Science and Technology Physical Chemistry Award 2017

PhD with Michael Heaven at Emory University

Staff Scientist, Argonne National Laboratory

Nicholas Force (Spring 2014 - Fall 2014) Chemistry Major

Cassandra Hurley (Spring 2014 - Spring 2015) Ceramics Engineering, B.S.

2014-2015 OURE Project: Fundamental Investigations of III-V Semiconductor Molecules

Graduate Student at Missouri S&T in Ceramics Engineering

Frank Marshall (Spring 2014 - Summer 2015) B.S. 2015 Physics and Applied Mathematics

OURE Project (2014 - 2015): Rg-Noble Metal Bonding

Continued Graduate Studies at Missouri S&T

Nicholas Payton (Spring 2014 - Fall 2014) Chemistry Major

Nelson Shreve (Spring 2014 - Spring 2015) B.S. Physics and Philosophy

2014-2015 OURE Project: Insights into the Pt-Catalyzed Hydrogenation of Acetylene and Ethylene

Medical Doctorate at St. Louis University

Stephen Jaeger (Spring 2015 – Fall 2015) B.S. Chemistry, working in industry

Missouri S&T Summer Research Academy (High School Students)

Jisu Eo (June 2015 - July 2015) Undergraduate (Unknown)

Alexander Bradley (June 2015 - July 2015) Undergraduate Student at Trinity University in San Antonio, TX

Hannah Shumaker (June 2014 - July 2014) Undergraduate (Unknown)

Teresa Schneider (June 2014 - July 2014) Undergraduate at Missouri S&T

PROFESSIONAL MEMBERSHIPS

2007 - Present, American Chemical Society Member. South Central Missouri Local Section Executive Committee - *2015 Chair-Elect, 2016 Chair, 2017 Immediate Past Chair and Treasurer, 2018 Treasurer, 2019 Treasurer, 2020 Treasurer, 2022 Chair-Elect*

2009 - Present, Alpha Chi Sigma Professional Chemistry Fraternity Member, Beta Eta Chapter

2010 - Present, American Physical Society Member.

AWARDS

June 2022, Coblentz Award Nominee

April 2021, 2021 Chemistry Department Tappemeyer Teaching Excellence Award

June 2019, International Symposium on Molecular Spectroscopy's Flygare Award Recipient

February 2019, 2019 Texas TRIO Achiever

February 2018, American Chemical Society National Nominee for the *Fall 2018 Kavli Foundation Emerging Leader in Chemistry Lecture*

April 2016, 2015-16 Service to the Department, Campus, and Discipline Award

April 2015, 2014 Chemistry Department Tappemeyer Teaching Excellence Award

July 2014 - May 2015, University of Missouri Faculty Scholar

Fall 2010 - Spring 2011, Thesis Dissertation Fellowship Recipient (Full Tuition, Fees and Stipend for One Academic Year), University of North Texas.

Spring 2010 - Summer 2010, Graduate Tuition Waiver Scholarship Recipient, University of North Texas

Spring 2010, *UNT Research* Magazine Selected Student for Science, Scholarship, and the Arts Piece.

Summer 2009, ORAU Fellow to attend the 59th Meeting of Nobel Laureates in Lindau, Germany.

Fall 2008 - Spring 2009, Welch Foundation Research Fellow, University of North Texas.

Spring 2009, Toulouse Graduate School Travel Award.

Fall 2008 and Spring 2010, College of Arts and Sciences Travel Grant, University of North Texas.

Spring 2008, Spring 2009, and Spring 2010, Raupe Travel Grant Award Winner, University of North Texas.

Fall 2001 - Spring 2005, Terry Scholarship Recipient (Full Tuition, Fees and Stipend Scholarship), Texas A&M University.