

Brett A. McGuire

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Education

Ph.D. Physical Chemistry, California Institute of Technology, 2015
M.S. Physical Chemistry, Emory University, 2011
B.S. Chemistry (*Highest Distinction*), University of Illinois at Urbana-Champaign, 2009
Charleston High School (*Valedictorian*); Charleston, IL, 2005

Research Experience

Hubble Postdoctoral Fellow September 2017 –
National Radio Astronomy Observatory Collaborator: Anthony J. Remijan
Harvard-Smithsonian Center for Astrophysics Collaborator: Michael C. McCarthy

Research Area: Interstellar reaction screening and unbiased molecular discovery via laboratory Microwave Spectral Taxonomy and AMDOR spectroscopy. ALMA, SOFIA, and GBT investigations of molecular inventories and chemical evolution in exotic chemical environments.

Jansky Postdoctoral Fellow September 2014 – September 2017
National Radio Astronomy Observatory Collaborator: Anthony J. Remijan
Harvard-Smithsonian Center for Astrophysics Collaborator: Michael C. McCarthy

Research Area: Technique development and microwave spectroscopy of van der Waals complexes and astrochemically-relevant radicals and ions. Radioastronomical observational searches for new molecular species and investigations of complex molecular evolution in the interstellar medium.

Graduate Research Assistant September 2011 – September 2014
California Institute of Technology Advisor: Geoffrey A. Blake

Research Area: Ultrafast terahertz time-domain spectroscopy of astrophysical ice analogs, and far-infrared astronomical observations of the same. Radioastronomical observations of molecular masers and exotic cations.

Graduate Research Assistant July 2009 – September 2011
Emory University Advisor: Susanna L. Widicus Weaver

Research Area: Investigations of high-Q optical cavities in the millimeter and submillimeter wavelength ranges for the development of high-sensitivity submillimeter spectroscopy methods.

Undergraduate Research Assistant October 2006 – June 2009
University of Illinois at Urbana-Champaign Advisor: Benjamin J. McCall

Research Area: Design and development of a hollow-cathode ion discharge source for the infrared study of spin-exchange interactions in the reaction of $\text{H}_3^+ + \text{H}_2$.

Academic Appointments

- (2017 - Present) Visiting Scholar, Department of Astronomy, University of Virginia
- (2015 - Present) Visiting Scientist, Atomic and Molecular Physics, Harvard-Smithsonian Center for Astrophysics
- (2011 - 2014) NSF Graduate Research Program Fellow, California Institute of Technology
- (2011) Curriculum Development Fellow, Emory University
- (2009 - 2011) Robert W. Woodruff Fellow, Emory University

Honors and Awards

- 2016 NASA Astrobiology Institute Early Career Collaboration Award
- 2015 ACS Astrochemistry Award for Best Doctoral Dissertation
- APS DCP New Investigator Award
- AAS Rodger Doxsey Dissertation Prize
- 2014 NASA Astrobiology Institute Early Career Collaboration Award
- Everhart Lectureship Award
- 2013 Rao Prize at the 68th International Symposium on Molecular Spectroscopy
- 2007-2009 List of Teachers Ranked as Excellent by Their Students, University of Illinois (4 Semesters)
- 2005-2009 University of Illinois James Scholar

Refereed Publications As Senior Author (2)

Blue numbers are active links to full article pdfs (in most PDF viewers).

- [38] Burkhardt, A.M., Herbst, E., Kalenskii, S., McCarthy, M.C., Remijan, A. J., & McGuire, B.A., "Detection of HC₅N and HC₇N isotopologues in TMC-1 with the Green Bank Telescope," **2018**, *MNRAS*, 474, 5068.
- [37] Burkhardt, A.M., Dollhopf, N., Corby, J.F., Carroll, P.B., Shingledecker, C.N., Loomis, R.A., Booth, S.T., Blake, G.A., Remijan, A.J., & McGuire, B.A. "CSO and CARMA observations of L1157. II. Chemical complexity in the shocked outflow," **2016**, *Astrophysical Journal*, 827, 21.

Refereed Publications As First (16) or Second (8) Author

- [36] McGuire, B.A., Martin-Drumel, M.-A., Lee, K.L.K., Stanton, J.F., Gottlieb, C.A., & McCarthy, M.C., "Vibrational satellites of C₂S, C₃S, and C₄S: Microwave spectral taxonomy as a stepping stone to the millimeter-wave band," **2018**, *Physical Chemistry Chemical Physics*, submitted.
- [35] Bøgelund, E.G., McGuire, B.A., Ligterink, N., Taquet, V., Brogan, C.L., Hunter, T.R., Hogerheidjge, M., & van Dishoeck, E., "Low levels of methanol deuteration in the high-mass star-forming region NGC 6334I," **2018**, *Astronomy & Astrophysics*, submitted.
- [34] McGuire, B.A., Burkhardt, A.M., Kalenskii, S., Shingledecker, C.N., Remijan, A.J., Herbst, E., & McCarthy, M.C., "Detection of the aromatic molecule benzonitrile (*c*-C₆H₅CN) in the interstellar medium," **2018**, *Science*, 359, 202.
- [33] McGuire, B.A., Burkhardt, A.M., Shingledecker, C.N., El-Abd, S., Motiyenko, R., Margulés, L., Brogan, C.L., Hunter, T.R., Herbst, E., & Remijan, A.J., "ALMA discovery of interstellar methoxymethanol (CH₃OCH₂OH) in NGC 6334I," **2017**, *Astrophysical Journal Lett.*, 851, L46.
- [32] Corby, J.F., McGuire, B.A., Herbst, E., & Remijan, A.J., "The molecular chemistry of diffuse and translucent clouds in the line-of-sight to Sgr B2 – Absorption by simple organic and inorganic molecules in the GBT PRIMOS survey," **2017**, *Astronomy & Astrophysics*, in press.
- [31] McGuire, B.A., Martin-Drumel, M.-A., & McCarthy, M.C., "Electron donor-acceptor nature of the ethanol-CO₂ dimer," **2017**, *Journal of Physical Chemistry A*, 121, 6283.
- [30] McGuire, B.A., Burkhardt, A.M., Shingledecker, C.N., Kalenskii, S., Remijan, A.J., & McCarthy, M.C., "Detection of interstellar HC₅O in TMC-1 with the Green Bank Telescope," **2017**, *Astrophysical Journal Lett.*, 843, L28.
- [29] Margulés, L., McGuire, B.A., Senent, M.L., Motiyenko, R.A., Remijan, A.J., & Guillemin, J.C., "Sub-millimeter wave spectra of 2-hydroxyacetone nitrile (glycolonitrile) and its searches in GBT PRIMOS observations of Sgr B2(N)," **2017**, *Astronomy & Astrophysics*, 601, A50.

- [28] McGuire, B.A., Martin-Drumel, M.-A., Thorwirth, S., Brinken, S., Lattanzi, V., Neill, J.L., Spezzano, S., Yu, Z., Zaleski, D.P., Remijan, A.J., Pate, B.H., & McCarthy, M.C., "Molecular polymorphism: microwave spectra, equilibrium structures, and an astronomical investigation of the HNCS isomeric family," **2016**, *Physical Chemistry Chemical Physics*, 18, 22693.
- [27] McGuire, B.A., Carroll, P.B., Loomis, R.A., Finneran, I.A., Jewell, P.R., Remijan, A.J., & Blake, G.A., "Discovery of the interstellar chiral species propylene oxide," **2016**, *Science*, 352, 1449.
- [26] McGuire, B.A., Allodi, M.A., Ioppolo, S., & Blake, G.A., "THz time-domain spectroscopy of mixed CO₂-CH₃OH interstellar ice analogs," **2016**, *Physical Chemistry Chemical Physics*, 18, 20199.
- [25] McGuire, B.A., Carroll, P.B., Dollhopf, N., Crockett, N., Corby, J.F., Loomis, R., Burkhardt, A., Dollhopf, N., Shingledecker, C., Blake, G.A., & Remijan, A.J., "CSO and CARMA observations of L1157. I. A deep search for hydroxylamine (NH₂OH)," **2015**, *Astrophysical Journal*, 812, 76.
- [24] McGuire, B. A., Carroll, P.B., Boynton, A.N., Mendenz, J.M., & Blake, G.A., "The ignition of thermite using the potassium chlorate "rocket" reaction: a systematic demonstration of reaction chemistry," **2015**, *Journal of Chemical Education*, 92, 1117.
- [23] Loomis, R.A., McGuire, B.A., Shingledecker, C., Burkhardt, A., Johnson, C.H., Blair, S., Robertson, A., & Remijan, A.J., "Investigating the minimum energy principle in searches for new molecular species – the case of H₂C₃O isomers," **2015**, *Astrophysical Journal*, 799, 34.
- [22] Carroll, P.B., McGuire, B.A., Remijan, A.J., Apponi, A.J., Ziurys, L.M., Lovas, F.J., & Blake, G.A., "The search for a complex molecule in a selected hot core region: a rigorous attempt to confirm trans-ethyl methyl ether toward W51 e1/e2," **2015**, *Astrophysical Journal*, 799, 15.
- [21] Ioppolo, S., McGuire, B.A., Allodi, M.A., & Blake, G.A., "THz and mid-IR spectroscopy of interstellar ice analogs: methyl and carboxylic acid groups," **2014**, *Faraday Discussions*, 168, 461.
- [20] McGuire, B.A., Carroll, P.B., Sanders, J.L. III, Widicus Weaver, S.L., Blake, G.A. & Remijan, A.J., "A CSO search for *l*-C₃H⁺: Detection in the Orion Bar PDR," **2014**, *MNRAS*, 442, 2901.
- [19] McGuire, B.A., Carroll, P.B., Gratier, P., Guzmán, V., Pety, J., Roueff, E., Gerin, M., Blake, G.A., and Remijan, A.J., "An observational investigation of the identity of B11244 (*l*-C₃H⁺/C₃H⁻)," **2014**, *Astrophysical Journal*, 783, 36.
- [18] McGuire, B.A., Carroll, P.B., Blake, G.A., Hollis, J.M., Lovas, F., Jewell, P.R. & Remijan, A.J., "A search for *l*-C₃H⁺ in Sgr B2(N), Sgr B2(OH) and the dark cloud TMC-1," **2013** *Astrophysical Journal*, 774, 56.
- [17] Carroll, P.B., McGuire, B.A., Zaleski, D.P., Neill, J.L., Pate, B.H., and Widicus Weaver, S.L., "The rotational spectra of glycolaldehyde isotopologues measured in natural abundance by chirped-pulse Fourier transform microwave spectroscopy," **2013** *J. Mol. Spec.*, 284-285, 21.
- [16] McGuire, B.A., Loomis, R.A., Charness, C.M., Corby J.F., Blake, G.A., Hollis, J.M., Lovas, F.J., Jewell, P.R., & Remijan, A.J., "Interstellar carbodiimide (HNCNH) - A new astronomical detection from the GBT PRIMOS survey via maser emission features," **2012** *Astrophysical Journal Lett.*, 758, L33.
- [15] Pulliam, R., McGuire, B.A., and Remijan, A.J., "A search for interstellar hydroxylamine (NH₂OH) toward select astronomical sources," **2012** *Astrophysical Journal*, 751, 1.
- [14] McGuire, B.A., Wang, Y., Bowman, J.M., and Widicus Weaver, S.L., "Do H₃⁺ and its isotopologues have rotational spectra?" **2011** *J. Phys. Chem. Lett.*, 2, 1405-1407.

Refereed Publications As Contributing Author (13)

- [13] Cordiner, M.A., Charnley, S.B., Kisiel, Z., McGuire, B.A., & Kuan, Y.-J., “Deep K-band observations of TMC-1 with the Green Bank Telescope: Detection of HC₇O, non-detection of HC₁₁N, and a search for new organic molecules,” **2017**, *Astrophysical Journal*, 850, 187.
- [12] Widicus Weaver, S.L., Laas, J.C., Zou, L., Kroll, J.A., Rad, M.L., Hays, B.M., Sanders, J.L., Lis, D.C., Cross, T.N., Wehres, N., McGuire, B.A., & Sumner, M.C., “Deep, broadband spectral line surveys of molecule-rich interstellar clouds,” **2017**, *Astrophysical Journal Suppl.*, 232, 3.
- [11] Towner, A.P.M., Brogan, C.L., Hunter, T.R., Cyganowski, C.J., McGuire, B.A., Indebetouw, R., Friesen, R.K., & Chandler, C.J., “VLA survey of dense gas in extended green objects: prevalence of 25 GHz methanol masers,” **2017**, *Astrophysical Journal Supplements*, 230, 22.
- [10] Loomis, R.A., Shingledecker, C., Langston, G., McGuire, B.A., Dollhopf, N., Loomis, R., Burkhardt, A., Corby, J.F., Carroll, P.B., Mennicke, C., Woolard, K., Turner, B., & Remijan, A.J., “Non-detection of HC₁₁N toward TMC-1: constraining the formation chemistry of large carbon-chain molecules,” **2016**, *MNRAS*, 463, 4175.
- [9] Martin-Drumel, M.-A., McCarthy, M.C., Patterson, D., McGuire, B.A., and Crabtree, K.N., “Automated two-dimensional rotational spectroscopy to identify and characterize individual chemical compounds,” **2016**, *Journal of Chemical Physics*, 144, 124202.
- [8] McCarthy, M.C., Martinez Jr., O., McGuire, B.A., Crabtree, K.N., Martin-Drumel, M.-A., & Stanton, J.F., “Isotopic studies of *trans*- and *cis*-HOCO using rotational spectroscopy: formation, chemical bonding, and molecular structures,” **2016**, *Journal of Chemical Physics*, 144, 124304.
- [7] McCarthy, M.C., Crabtree, K.N., Martin-Drumel, M.-A., Martinez, O. Jr., McGuire, B. A., & Gottlieb, C.A., “A laboratory study of C₃H⁺ and the C₃H radical in three new vibrationally excited ²Σ states using a pin-hole nozzle discharge source,” **2015**, *Astrophysical Journal Suppl.*, 217, 10.
- [6] Neill, J.L., Bergin, E.A., Lis, D.C., Schilke, P., Crockett, N.R., Favre, C., Emprechtinger, M., Comito, C., Qin, S.-L., Anderson, D., Burkhardt, A.M., Chen, J.-H., Harris, B.J., Lord, S.D., McGuire, B.A., McNeill, T.D., Monje, R.R., Phillips, T.G., Steber, A.L., Vasyunina, T., & Yu, S., “*Herschel* observations of EXtraOrdinary Sources: Analysis of the full *Herschel*/HIFI molecular line survey of Sagittarius B2(N),” **2014**, *Astrophysical Journal*, 789, 8.
- [5] Crockett, N.R., Bergin, E.A., Neill, J.L., Favre, C., Schilke, P., Lis, D.C., Bell, T.A., Blake, G.A., Cernicharo, J., Emrpechtinger, M., Esplugues, G.B., Gupta, H., Kleshcheva, M., Lord, S., Marcelino, N., McGuire, B.A., Pearson, J., Phillips, T.G., Plume, R., van der Tak, F., Tercero, B., & Yu, S., “*Herschel* observations of EXtraOrdinary Sources: Analysis of the HIFI 1.2 THz wide spectral survey toward Orion KL I. methods,” **2014**, *Astrophysical Journal*, 787, 112.
- [4] Remijan, A.J., Snyder, L.E., McGuire, B.A., Kuo, H., Looney, L.W., Friedel, D.N., Golubiatnikov, G.Y., Lovas, F.J., Ilyushin, V.V., Alekseev, E.A., Dyubko, S.F., McCall, B.J., & Hollis, J.M., “Observational results of a multi-telescope campaign in search of interstellar urea [(NH₂)₂CO],” **2014**, *Astrophysical Journal*, 783, 77.
- [3] Allodi, M.A., Ioppolo, S., Kelley, M.J., McGuire, B.A., & Blake, G.A., “The structure and dynamics of carbon dioxide and water containing ices investigated via THz and mid-IR spectroscopy,” **2014**, *Physical Chemistry Chemical Physics*, 16, 3442.
- [2] Crabtree, K.N., Kauffman, C.A., Tom, B.A., Bečka, E., McGuire, B.A., and McCall, B.J., “Nuclear spin dependence of the reaction of H₃⁺ with H₂ II. Experimental measurements,” **2011** *Journal of Chemical Physics.*, 134, 194311.
- [1] Lovas, F.J., Plusquellic, D.F., Widicus Weaver, S.L., McGuire, B.A., and Blake, G.A., “Organic compounds in the C₃H₆O₃ family: Microwave spectrum of *cis-cis* dimethyl carbonate,” **2010** *Journal of Molecular Spectroscopy*, 264, 10-18.

Book Chapters, Conference Proceedings, Research Notes, and Other Publications

- [8] McGuire, B.A. & Carroll, P.B., “The final integrations of the Caltech Submillimeter Observatory,” **2017** *Research Notes of the American Astronomical Society* 1, 4.
- [7] McGuire, B.A. & Carroll, P.B., “Mirror asymmetry in life and in space,” **2016** *Physics Today* 69(11), 86-87.
- [6] McGuire, B.A., Corby, J.F., Carroll, P.B., & Remijan, A. J., “Sgr B2,” *Encyclopedia of Astrobiology*, Gargaud, M., Ed.; Springer Reference (**2015**).
- [5] McGuire, B.A. & Remijan, A. J., “Molecular line surveys,” *Encyclopedia of Astrobiology*, Gargaud, M., Ed.; Springer Reference (**2015**).
- [4] McGuire, B.A., “Time-domain TeraHertz spectroscopy and observational probes of prebiotic interstellar gas and ice chemistry,” *Ph.D. Thesis*, California Institute of Technology (**2014**).
- [3] McGuire, B.A., Carroll, P. B., & Remijan, A. J., “A CSO broadband spectral line survey of Sgr B2(N)-LMH from 260 - 286 GHz,” **2013** *arXiv/astro-ph: 1306.0927*
- [2] Lovas, F.J., Plusquellic, D.F., Widicus Weaver, S.L., McGuire, B.A., & Blake, G.A., “Organic compounds in the C₃H₆O₃ family: Microwave spectrum of cis-cis dimethyl carbonate,” **2011** *Proc. of: The 2010 NASA Laboratory Astrophysics Workshop*.
- [1] Carroll, P.B., McGuire, B.A., & Widicus Weaver, S.L., “Construction of a high-resolution TeraHertz cavity ringdown spectrometer,” **2011** *Proc. of: The 2010 NASA Laboratory Astrophysics Workshop*.

Selected Recent and Upcoming Invited Talks (29 Total From 2012 - Present)

- McGuire, B.A., “From one to two dimensional interstellar carbon: A synthesis of laboratory, observations, and theory.”
University of Maryland, April 25, 2018.
- McGuire, B.A., “From one to two dimensional interstellar carbon: A synthesis of laboratory, observations, and theory.”
University of Wisconsin, March 1, 2018.
- McGuire, B.A., “Interstellar PAHs: A combined laboratory, observational, and modeling approach.”
University of Illinois, October 6, 2017.
- McGuire, B.A., “The diverse impact of chemical environment on interstellar molecular evolution.”
Columbia University, March 8, 2017.

Teaching Experience

- Designed and co-Taught Graduate Course: Cosmochemistry and Extraterrestrial Life
California Institute of Technology, 2014
- Completed Caltech Project for Effective Teaching Pedagogy Workshop Series
California Institute of Technology, 2011 – 2013
- Curriculum Development Fellow, Physical Chemistry Lab
Emory University, 2011
- Teaching Assistant, General Chemistry Labs I & II
Emory University, 2009 – 2010
- Head Teaching Assistant, Accelerated General Chemistry Labs I & II
University of Illinois, 2008 – 2009
- Teaching Assistant, Accelerated General Chemistry Labs I & II
University of Illinois, 2007 – 2008

Mentoring Experience

- Graduate Students Mentored
 - Dr. Joanna Corby, Mr. Andrew Burkhardt, Mr. Ryan Loomis, Mr. Christopher Shingledecker
- Undergraduate Students Mentored
 - Mr. Niklaus Dollhopf, Mr. Daniel Guth, Mr. Jerry Feng, Ms. Mary Rad, Mr. Jay Kroll, Ms. Sophie Lang, Mr. Patrick Lanter, Mr. Daniel Sudrzynski, Mr. Shawn Booth, Mr. Samer El-Abd, Mr. Eric Rohr

Successful Proposals as Principle/Senior Investigator (26 Total; \$348,000 Total Funding)

- 2017 Astrobiology Graduate Conference (\$112,000 Funding)
- Stratospheric Observatory for Infrared Astronomy (SOFIA) - 4 (\$236,000 Funding)
- Atacama Large Millimeter/submillimeter Array (ALMA) - 6
- Green Bank Telescope (GBT) - 10
- Very Large Array (VLA) - 2
- Combined Array for Research in Millimeter-wave Astronomy (CARMA) - 3
- Caltech Submillimeter Observatory (CSO) - 6
- Parkes Telescope - 1
- IRAM 30-m Telescope - 1
- Australian Telescope Compact Array (ATCA) - 1

Service & Outreach

- Panelist for NASA ROSES, NASA Fellowship Programs
- Referee for *Angewandte Chemie*, *Nature Communications*, *Nature Astronomy*, *Physical Chemistry Chemical Physics*, *Journal of Physical Chemistry A*, *Journal of Chemical Physics*, *ACS Earth and Space Chemistry*, *Journal of Molecular Spectroscopy*, *The Astrophysical Journal Letters*, *The Astrophysical Journal*, and *Astronomy & Astrophysics*
- Conference Chair, 2017 Astrobiology Graduate Conference
National Radio Astronomy Observatory, June 2017
- Co-Organizer, “ALMA’s Molecular Universe” Mini-Symposium
International Symposium on Molecular Spectroscopy, June 2017
- Chair, Scientific Organizing Committee, Astrobiology Graduate Conference (2014 – 2016)
- Conference Chair, “Molecular Gas in Galactic Environments”
National Radio Astronomy Observatory, April 2016
- AskScience Panelist in Chemistry, Astronomy, & Physics; 2014 – Present
Interacting with an audience of more than 14 million members of the global public by answering user-submitted inquiries, and engaging them in meaningful discussions, in the fields of chemistry, astronomy, astrochemistry, and physics to promote a better public awareness of science. AskScience is accessible at www.reddit.com/r/askscience.
- Student Representative, Chemistry Graduate Studies Committee
California Institute of Technology, 2013 – 2015

Professional Societies

American Chemical Society (2010 - Present) · American Association for the Advancement of Science (2016 - Present) · American Astronomical Society (2012 - Present) · Royal Society of Chemistry (2014 – 2016) · American Physical Society (2014 – 2016)