Brian J. Drouin

Research Scientist – Jet Propulsion Laboratory

Education: Ph.D., Chemistry, University of Arizona (1999); B.S., Chemistry, University of Wisconsin (1995); B.S., Mathematics, University of Wisconsin (1995)

Professional Experience

Jet Propulsion Laboratory (1999 – present)
- Research Scientist, Earth and Space Sciences Division (2005- present)
- Scientist, Earth and Space Sciences Division (2001–2005)

Editor, Journal of Molecular Spectroscopy (2010-present)
Member of HITRAN steering committee (2010-present)
Member of HITRAN committee (2010-present)
Member of Virtual Atomic and Molecular Data Centre (VAMDC) (2010-present)
California Institute of Technology Postdoctoral Scholar at JPL (1999-2001)
University of Arizona, Department of Chemistry, (1995–1999)

A strong background in chemistry and mathematics has driven a career in molecular spectroscopy. Beginning with microwave spectroscopy of organometallic compounds, his Ph. D. work involved measurement and analyses of highly precise rotational transition frequencies of molecules in cold molecular beams. At JPL he has recorded and analyzed millimeter and submillimeter spectra of both astrophysical and atmospheric molecules while incorporating state-of-the-art hardware and software to the spectrometer. He has participated in seven field campaigns for deployment of submillimeter instruments onboard stratospheric balloons. He is responsible for measurements of molecular line-shape parameters for earth science sensing and astro-chemicals. He has built a field ready THz spectrometer for in-situ gas sensing. He is the currently the primary contributor to the JPL spectral line catalog used throughout the spectroscopy and remote sensing communities.

Principle Investigator Experience

ASTID – Submillimeter Spectroscopic Gas Analysis for Life Detection (2008 – date)

UARP/ACLAB – Millimeter & Submillimeter Spectroscopy for Atmospheric Research (2005 – date)

APRA – Measurements of State-to-State Collision Rates for Water (2006 – date)

ADAP – Millimeter and Submillimeter Spectral Line Catalog (2008 – 2011)

Herschel – Laboratory Spectroscopy and Analysis for Herschel (2008 – 2010)

Research Interests: Quantitative spectral analysis; Instrumentation for laboratory; field and space application; Atmospheric chemistry; Climate change and pollution; Molecular spectra and structure.

Project Highlights

Astrobiology Instrument Development: Development of brass-board heterodyne THz spectrometer
Astrophysics Data: Built and configured MySQL spectral database and protocols for usage
Astrophysics Research and Analysis: Measurement and analysis of complex interference spectra (weeds)
Astrophysics Research and Analysis: First measurements of rotational spectra of ions at JPL (HCO^+, H_3O^+)

Brian Drouin - Refereed Publications (27 first author, 96 total)

1. Drouin, B.J. H. Gupta, S. Yu, C.E. Miller, H.S.P. Mueller, “High resolution spectral analysis of oxygen. II. Rotation al spectra of a a $^1\Delta_g$ O_2 isotopologues”, J. Chem. Phys. 136, 2012.
2. Drouin B.J., S. Yu, J. C. Pearson, H. Gupta, “Terahertz Spectroscopy for Space Applications, 2.5-2.7: THz Spectra of HD, H_2O and NH_3” *Journal of Molecular Structure* Special Issue on THz Spectroscopy, 1006, 2-12, 2011.
3. Drouin B.J., S. Yu, “Acetylene Spectra near 2.6 THz” *Journal of Molecular Spectroscopy* 269(2), 254-256, 2011.
4. Drouin B.J., J.C. Pearson, M.J. Dick, Reply to "Comment on ‘Collisional cooling investigation of THz rotational transitions of water'" *Physical Review* A, 82(3) 036704, 2010.
5. Drouin B.J., S. Yu, C.E. Miller, H.S.P. Mueller, F. Lewen, S.Bruenken, H. Habara, “Terahertz spectroscopy of oxygen,O_2, $^3\Sigma_g$ and $^1\Delta$ electronic states”, *Journal of Quantitative Spectroscopy and Radiative Transfer*, 111, 1167–1173, 2010.
6. Drouin B.J., S. Yu, J.C. Pearson, H.S.P. Mueller, “High resolution spectroscopy of CH_3D and $^{13}CH_3D$”, *Journal of Quantitative Spectroscopy and Radiative Transfer* 110(18) 2077-2081, 2009.
7. Drouin, B.J., R. R. Gamache, "Temperature Dependent Air Broadened Linewidths of Ozone Rotational Transitions" *Journal of Molecular Spectroscopy*, 251(1-2), 1-3, 2008.
8. Drouin, B.J., "Temperature dependent pressure induced linewidths of O_2 and $^{18}O^{16}O$ transitions in nitrogen, oxygen and air", *Journal of Quantitative Spectroscopy and Radiative Transfer*, 105 (3): 450-458, 2007.
9. Drouin, B.J., "Submillimeter measurements of N_2 and air broadening of hypochlorous acid," *Journal of Quantitative Spectroscopy and Radiative Transfer*, 103 (3): 558-564, 2007.
10. Drouin, B.J., J. C. Pearson, A. Walters, V. Lattanzi "THz Measurements of Propane" *Journal of Molecular Spectroscopy*, 240 (2): 227-237, 2006.
11. Drouin, B. J., F.W. Maiwald, "Extended THz measurements of nitrous oxide, N_2O," *Journal of Molecular Spectroscopy*, 236 (2): 260-262, 2006.
12. Drouin, B. J., C. E. Miller, J. L. Fry, D. T. Petkie, P. Helminger, I. Medvedev, "Submillimeter measurements of isotopes of nitric acid," *Journal of Molecular Spectroscopy*, 236 (1): 29-34, 2006.
13. Drouin B. J., F.W. Maiwald, J. C. Pearson, "Application of cascaded frequency multiplication to molecular spectroscopy," *Review of Scientific Instruments*, 76 (9): Art. No. 093113, 2005.
14. Drouin B.J., J. L. Fry, C. E. Miller, “Rotational spectrum of cis-cis HOONO”, *Journal of Chemical Physics*, 120 (12): 5505-5508, 2004.
15. Drouin B.J., “Temperature dependent pressure-induced lineshape of the HCl $J = 1 \leftarrow 0$ rotational transition in nitrogen and oxygen”, *Journal of Quantitative Spectroscopy and Radiative Transfer*, 83 (3-4): 321-331, 2004.

16. Drouin B.J., J. Fischer, R. R. Gamache, “Temperature dependent pressure induced lineshape of O_3 rotational transitions in air”, *Journal of Quantitative Spectroscopy and Radiative Transfer*, 83 (1): 63-81, 2004.
17. Drouin B.J., C. E. Miller and E. A. Cohen, “Further investigations of the submillimeter spectrum of ClO”, *Journal of Molecular Spectroscopy*, 207(1), 4-9, 2001.
18. Drouin B.J., C. E. Miller, H. S. P. Muller and E. A. Cohen, “The rotational spectra, isotopically independent parameters, and interatomic potentials for the X_1 $^2\Pi_{3/2}$ and X_2 $^2\Pi_{1/2}$ states of BrO”, *Journal of Molecular Spectroscopy*, 205(1), 128-138, 2001.
19. Drouin B.J., J. J. Dannemiller and S. G. Kukolich, “Structural characterization of 'syn' and 'anti' - allyltricarbonylbromide, analyses of rotational spectra, quadrupole coupling and density functional calculations”, *Inorganic Chemistry*, 39(4), 827-835, 2000.
20. Drouin B.J., J. J. Dannemiller and S. G. Kukolich, “The gas-phase structure of chloroferrocene from microwave spectra”, *Journal of Chemical Physics*, 112(2), 747-751, 2000.
21. Drouin B.J. and S. G. Kukolich, “Microwave spectra and the molecular structure of tetracarbonylethyleneiron”, *Journal of the American Chemical Society*, 121(16), 4023-4030, 1999.
22. Drouin B.J. P.A. Cassak and S. G. Kukolich, “Microwave measurements of rhenium quadrupole coupling in cyclopentadienyl rhenium tricarbonyl”, *Journal of Chemical Physics*, 108(21), 8878-8883, 1998.
23. Drouin B.J. S.G. Kukolich, “Molecular structure of tetracarbonyldihydroiron: Microwave measurements and density functional theory calculations”, *Journal of the American Chemical Society*, 120(27), 6774-6780, 1998.
24. Drouin B.J. N. E. Gruhn, J. F. Madden, S.G. Kukolich, M. Barfield, R.S. Glass, “Gas-phase conformational analysis of 1,4,7-trithiacyclononane”, *Journal of Physical Chemistry A*, 101(48), 9180-9184, 1997.
25. Drouin B.J. T. G. Lavaty, P. A. Cassak , S.G. Kukolich “Measurements of structural and quadrupole coupling parameters for bromoferrocene using microwave spectroscopy”, *Journal of Chemical Physics*, 107(17) 6541-6548, 1997.
26. Drouin B.J. P. A. Cassak, P. M. Briggs, S.G. Kukolich “Determination of structural parameters for the half-sandwich compounds cyclopentadienyl thallium and cyclopentadienyl indium and indium quadrupole coupling for cyclopentadienyl indium using microwave spectroscopy”, *Journal of Chemical Physics*, 107(10), 3766-3773, 1997.
27. Drouin B.J. P. A. Cassak, S. G. Kukolich, “Measurements of structural and quadrupolar coupling parameters for chloroferrocene using microwave spectroscopy”, *Inorganic Chemistry*, 36(13), 2868-2871, 1997.

Brian Drouin - Peer-reviewed Non-first Author Publications (Spectroscopy)

1. S. Yu, C.E. Miller, B.J. Drouin, H.S.P. Mueller, “High resolution spectral analysis of oxygen. I. Isotopically Invariant Dunham Fit for the X $^3\Sigma_g^-$, a $^1\Delta_g$, b$^1\Sigma_g^+$ States”, J. Chem. Phys. 136, 2012.

2. De Luca, M, H. Gupta, D. Neufeld, M. Gerin, D. Teyssier, B.J. Drouin, J.C. Pearson, D.C. Lis, R. Monje, T.G. Phillips, J.R. Goicoechea, B. Godard, E. Falgarone, A. Coutens, T.A. Bell, "Herschel/HIFI Discovery of HCl+ in the Interstellar Medium" Ap. J. Lett. 751(2) L37, 2012.
3. Gupta, H. B.J. Drouin, J.C. Pearson "The Rotational Spectrum of HCl+" Ap. J. Lett. 751(2) L38, 2012.
4. Ramos M., B. J. Drouin, "Submillimeter Spectrum of Methyl Bromide (CH_3Br)" *Journal of Molecular Spectroscopy,* 269(2), 187-192, 2011.
5. Pearson J.C., B.J. Drouin, S. Yu, H. Gupta "Microwave Spectroscopy of Methanol between 2.48 and 2.77 THz" *Journal of the Optical Society of America,* 28(10), 2549-2577, 2011.
6. Pearson J., B. Drouin, A. Maestrini, I. Mehdi, J. Ward, R. Lin, S. Yu, J. Gill, B. Thomas, C. Lee, G. Chattopadhyay, E. Schlecht, F. Maiwald, P. Goldsmith, P. Siegel "Demonstration of a room temperature 2.48-2.75 THz coherent spectroscopy source", *Review of Scientific Instruments* 82(9), 093105, 2011.
7. Krasnicki A., Z. Kisiel, B. J. Drouin, J. C. Pearson, "Terahertz spectroscopy of isotopic acrylonitrile" *Journal of Molecular Structure* Special Issue on THz Spectroscopy, 1006, 20-27, 2011.
8. Cohen, E.A., B.J. Drouin, "THz spectra of Formyl Fluoride, HFCO", *Journal of Molecular Spectroscopy*, 267, 67–70 2011.
9. Pracna P., Urban J., Votava O., Meltzerova Z., Urban S., Horneman V.M., Drouin B.J., "Rotational and rovibrational spectroscopy of CH_3NC of the ground and ν_4=1 vibrational States." *Journal of Physical Chemistry A* 115(6) 1063-1068, 2011.
10. Pearson J.C., Mueller H.S.P., Pickett H.M., Cohen E.A., Drouin B.J., "Introduction to submillimeter, millimeter and microwave spectral line catalog", *Journal of Quantitative Spectroscopy and Radiative Transfer* 111(11), 1614-1616, 2010.
11. Yu S., Pearson J.C., Drouin B.J., Sung K., Pirali O., Vervloet M., Martin-Drumel M.A., Endres C.P., Shiraishi T., Kobayashi K., Matsushima F., "Submillimeter-wave and far-infrared spectroscopy of high-J transitions of the ground and ν_2=1 states of ammonia." *Journal of Chemical Physics* 133(17) 174317, 2010.
12. Mueller H.S.P., Drouin B.J., Pearson J.C., "Rotational spectra of isotopic species of methyl cyanide, CH_3CN, in their ground vibrational states up to terahertz frequencies." *Astronomy and Astrophysics,* 506(3) 1487-1499, 2009.
13. Carroll P.B., Drouin B.J., Weaver S.L.W., "The submillimeter spectrum of glycolaldehyde", *Astrophysical Journal,* 723(1) 845-849, 2010.
14. Braakman R., Drouin B.J., Weaver S.L.W., Blake G.A., "Extended analysis of hydroxyacetone in the torsional ground state", *Journal of Molecular Spectroscopy* 264(1), 43-49, 2010.
15. Kisiel Z., Dorosh O., Maeda O., Medvedev I.R., De Lucia F.C., Herbst E., Drouin B.J., Pearson J.C., Shipman, S.T., "Determination of precise relative energies of

conformers of *n*-propanol by rotational spectroscopy", *Physical Chemistry and Chemical Physics*, 12, 8329–8339, 2010.
16. Dick M.J., Drouin B.J., Pearson J.C., "Collisional cooling investigation of THz rotational transitions of water." *Physical Review A* 81(2), 2010.
17. Cohen E.A., Drouin B.J., Valenzuela E.A, Woods R.C., Caminati W., Maris A., Melandri S., "The rotational spectrum of tertiary-butyl alcohol." *Journal of Molecular Spectroscopy*, 260(1) 77-83, 2010.
18. Kisiel Z., Pszczolkowski L., Drouin B.J., Brauer C.S., Yu S., Pearson J.C., "The rotational spectrum of acrylonitrile up to 1.67 THz", *Journal of Molecular Spectroscopy*, 258(1-2) 26-34, 2009.
19. Muller H.S.P., Drouin B.J., Pearson J.C., "Rotational spectra of isotopic species of methyl cyanide, CH_3CN, in their ground vibrational states up to terahertz frequencies", *Astronomy and Astrophysics*, 506 (3) 1487-1499, 2009.
20. Yu S., Drouin B.J., Pearson J.C., "Terahertz spectroscopy of the bending vibrations of acetylene C_2H_2", *Astrophysical Journal*, 705(1) 786-790, 2009.
21. Endres C.P., Drouin B.J., Pearson J.C., Mueller H.S.P., Lewen F., Schlemmer S., Giesen T.F., Dimethyl ether: laboratory spectra up to 2.1 THz Torsion-rotational spectra within the vibrational ground state, *Astronomy and Astrophysics*, 504(2) 635-640, 2009.
22. Pearson J.C., Brauer C.S., Drouin B.J., Xu L.H., "The rotational spectrum of methanol in the third excited torsional state", *Canadian Journal of Physics*, 87(5) 449-467, 2009.
23. Brauer C.S., Pearson J.C., Drouin B.J., Yu S., "New Ground-State Measurements of Ethyl Cyanide", *Astrophysical Journal Supplement*, 184(1) 133-137, 2009.
24. Yu S., Drouin B.J., Pearson J.C., Pickett H.M., Lattanzi V., Walters A., "Terahertz spectroscopy and global analysis of the bending vibrations of acetylene C_2D_2", *Astrophysical Journal*, 698(2) 2114-2120, 2009.
25. Dick, M. J., B. J.Drouin, T. J. Crawford, J. C. Pearson, "Pressure broadening of the J = 5 - 4 transition of carbon monoxide from 17 to 200 K: A new collisional cooling experiment.", *Journal of Quantitative Spectroscopy and Radiative Transfer*, 110(9-10), 628-638 2009.
26. Dick, M. J., B. J. Drouin, J. C. Pearson, "A collisional cooling investigation of the pressure broadening of the 1_{10} - 1_{01} transition of water from 17K to 200K". *Journal of Quantitative Spectroscopy and Radiative Transfer*, 110(9-10), 619-627 2009.
27. Yu S., B. J. Drouin, J. C. Pearson, H. M. Pickett, "Terahertz spectroscopy and global analysis of H_3O^+", *Astrophysical Journal Supplement Series*, 125:1-6, 2008.
28. Petkie D.T., M. Kipling, A. Jones, P. Helminger, I.R. Medvedev, A. Maeda, M. Behnke, B. J. Drouin, C.E. Miller. "The rotational spectra of the 6_1, 7_1, 8_1, 9_1 and $5_1/9_2$ vibrational states of $H_{15}NO_3$", *Journal of Molecular Spectroscopy*, 251(1-2), 1-3, 2008.
29. Halfen D.T., L. M. Ziurys, J. C. Pearson, B. J. Drouin, "Direct measurements of the fundamental rotational transitions of CD and ^{13}CH $X_2\Pi_{i(r)}$" *Astrophysical Journal*, 687(1), 731-736, 2008.

30. Lattanzi V., A. Walters, J.C. Pearson, B. J. Drouin, "THz spectrum of monodeuterated methane," *Journal of Quantitative Spectroscopy and Radiative Transfer*, 109 (4): 580-586, 2008.
31. Lattanzi V., A. Walters, B. J. Drouin, J. C. Pearson, "Submillimeter Spectrum of Formic Acid" *Astrophysical Journal Supplement Series*176(2), 536-542, 2008.
32. Xu L-H., J. Fisher, R.M. Lees, H.Y. Shi, J.T. Hougen, J.C. Pearson, B.J. Drouin, G.A. Blake, R. Braakman, "Torsion-Rotation Global Analysis of the First Three Torsional States (v_t = 0, 1, 2) and Terahertz Database for Methanol", *Journal of Molecular Spectroscopy*, 251(1-2), 1-3, 2008.
33. Pearson J.C., C. S. Brauer, B. J. Drouin, "The Asymmetric Top-Asymmetric Frame Internal Rotation Spectrum of Ethyl Alcohol", *Journal of Molecular Spectroscopy*, 251(1-2), 1-3, 2008.
34. Groner G., I. R. Medvedev, F. C. De Lucia, B. J. Drouin, "Rotational spectrum of acetone, CH3COCH3, in the ν_{17} torsional excited state", *Journal of Molecular Spectroscopy*, 251(1-2), 1-3, 2008.
35. Bruenken S., H. S. P. Mueller, C. Endres, F. Lewen, T. Giesen, B. Drouin, J. C. Pearson, H. Maeder, "High resolution rotational spectroscopy on D_2O up to 2.7 THz in its ground and first excited bending states", *Physical Chemistry and Chemical Physics*, 9 (17): 2103-2112, 2007.
36. Lattanzi, V., A. Walters, B. J. Drouin, J. C. Pearson, "Rotational spectrum of the formyl cation, HCO^+, to 1.2 THz", *Astrophysical Journal*, 662 (1): 771-778 Part 1, 2007.
37. Pearson J. C., B. J. Drouin "Laboratory measurement of the J=1-0 transition of CH^+" *Astrophysical Journal*, 647 (1): L83-L86, 2006.
38. Groner, P., E. Herbst, F. C. De Lucia, B. J. Drouin, H. Maeder, "Rotational spectrum of acetone, CH_3COCH_3, in the first torsional excited state," *Journal of Molecular Spectroscopy* 795 (1-3): 173-178, 2006.
39. Fry J. L., B. J. Drouin, C. E. Miller, "Rotational spectroscopy and dipole moment of cis-cis HOONO and DOONO," *Journal of Chemical Physics* 124 (8): Art. No. 084304, 2006.
40. Pearson, J.C., B. J. Drouin, "The ground state torsion-rotation spectrum of propargyl alcohol ($HCCCH_2OH$)," *Journal of Molecular Spectroscopy*, 234 (1), p. 149-156, 2005.
41. Oh J. J., B. J. Drouin, E. A. Cohen, "The rotational spectrum of perchloric acid, $HClO_4$," *Journal of Molecular Spectroscopy*, 234 (1), p. 10-24, 2005.
42. Subramanian R., C. Karunatilaka, R. O. Schock, B. J. Drouin, P. A. Cassak, S. G. Kukolich, "Determination of structural parameters for ferrocenecarboxaldehyde using Fourier transform microwave spectroscopy," *Journal of Chemical Physics* 123 (5): Art. No. 054317, 2005.
43. Weaver S. L. W., R. A. H. Butler, B. J. Drouin, D. T. Petkie, K. A. Dyl, F. C. De Lucia, G. A. Blake, "Millimeter-wave and vibrational state assignments for the rotational spectrum of glycolaldehyde," *Astrophysical Journal Supplement*, 158 (2): 188-192, 2005.
44. Yamada M. M., M. Kobayashi, T. Habara, T. Amano, B. J. Drouin, Submillimeter-wave measurements of the pressure broadening of BrO, *Journal of Quantitative Spectroscopy and Radiative Transfer*, 82 (1-4): 391-399, 2003.

45. Widicus S. L., B. J. Drouin, K. A. Dyl, G. A. Blake, Millimeter wavelength measurements of the rotational spectrum of 2-aminoethanol, *Journal of Molecular Spectroscopy*, 217 (2): 278-281, 2003.
46. Groner P., S. Albert, E. Herbst, F. C. De Lucia, F. J. Lovas, B. J. Drouin, J. C. Pearson, Acetone: Laboratory assignments and predictions through 620 GHz for the vibrational-torsional ground state, *Astrophysical Journal Supplement*, 142 (1): 145-151, 2002.
47. Toon G. C., J.-F. Blavier, B. Sen and B. J. Drouin, Atmospheric $COCl_2$ measured by solar occultation spectrometry, *Geophysical Research Letters*, 28 (14): 2835-2838, 2001.
48. Miller C. E. and B. J. Drouin, "The $X_1\ ^2\Pi_{3/2}$ and $X_2\ ^2\Pi_{1/2}$ Potential Energy Surfaces of FO". *The Journal of Molecular Spectroscopy*, 205(2), 312-318, 2001.
49. Kukolich S. G., B. J. Drouin, O. Indris and J. J. Dannemiller, J. P. Zoller and W. A. Herrmann, "Microwave spectra, DFT calculations and molecular structure of acetylenemethyldioxorhenium", *Journal of Chemical Physics*, 113, 7891-7900, 2000.
50. Lavaty T. G., P. Wikrent, B. J. Drouin, S.G. Kukolich, "Microwave measurements and calculations on the molecular structure of tetracarbonyldihydroruthenium", *Journal of Chemical Physics*, 109(21), 9473-9478, 1998.
51. Kukolich S. G., B. J. Drouin, P. Cassak, J.L. Hubbard, "Microwave measurements and calculations on cyclopentadienylrhodium dicarbonyl, a V-10 hindered rotor", *Organometallics*, 17(18), 4105-4109, 1998.
52. Wikrent P., B. J. Drouin, S. G. Kukolich, J.C. Lilly, M.T. Ashby, W.A. Herrmann, W. Scherer, "Measurements of the structure of methyltrioxorhenium using microwave spectroscopy", *Journal of Chemical Physics*, 107(7), 2187-2192, 1997.
53. Sickafoose S. M., P. Wikrent, B. J. Drouin, S.G. Kukolich, "Microwave spectra and quadrupole coupling measurements for methyl rhenium trioxide", *Chemical Physics Letters*, 263(1-2), 191-196, 1996.

Brian Drouin - Peer-reviewed Non-first Author Publications (MLS validation)

1. S. Wang, H. M. Pickett, T. J. Pongetti, R. Cheung, Y. L. Yung, C. Shim, Q. Li, T. Canty, R. J. Salawitch, K. W. Jucks, B. Drouin, S. P. Sander, "Validation of Aura Microwave Limb Sounder OH measurements with Fourier Transform Ultra-Violet Spectrometer total OH column measurements at Table Mountain", California, *Journal of Geophysical Research - Atmospheres*, 113, D22301, 2008.
2. Pickett H. M., B. J. Drouin, T. Canty, R.J. Salawitch, R.A. Fuller, V.S. Perun, N.J. Livesey, J.W. Waters, R.A. Stachnik, S.P. Sander, W.A. Traub, K.W. Jucks, K. Minschwaner, "Validation of Aura Microwave Limb Sounder OH and HO_2 measurements", *Journal of Geophysical Research – Atmospheres*, 113(D16) D16S30, 2008.
3. Santee M. L., A. Lambert, W. G. Read, N.J. Livesey, G.L. Manney, R.E. Cofield, D.T. Cuddy, W.H. Daffer, B.J. Drouin, L. Froidevaux, R.A. Fuller, R.F. Jarnot, B.W. Knosp, V.S. Perun, W.V. Snyder, P.C. Stek, R.P. Thurstans, P.A. Wagner,

J.W. Waters, B. Connor, J. Urban, D. Murtagh, P. Ricaud, B. Barret, A. Kleinbohl, J. Kuttippurath, H. Kullmann, M. von Hobe, G.C. Toon, R.A. Stachnik, "Validation of the Aura Microwave Limb Sounder ClO measurements", *Journal of Geophysical Research – Atmospheres,* 113(D15) D15S22, 2008.

4. Froidevaux L., Y. B. Jiang, A. Lambert, N.J. Livesey, W.G. Read, J.W. Waters, R.A. Fuller, T.P. Marcy, P.J. Popp, R.S. Gao, D.W. Fahey, K.W. Jucks, R.A. Stachnik, G.C. Toon, L.E. Christensen, C.R. Webster, P.F. Bernath, C.D. Boone, K.A. Walker, H.C. Pumphrey, R.S. Harwood, G.L. Manney, M.J. Schwartz, W.H. Daffer, B.J. Drouin, R.E. Cofield, D.T. Cuddy, R.F. Jarnot, B.W. Knosp, V.S. Perun, W.V. Snyder, P.C. Stek, R.P. Thurstans, P.A. Wagner, "Validation of Aura Microwave Limb Sounder HCl measurements", *Journal of Geophysical Research – Atmospheres,* 113(D15) D15S25, 2008.
5. Froidevaux L., Y. B. Jiang, A. Lambert, N.J. Livesey, W.G. Read, J.W. Waters, E.V. Browell, J.W. Hair, M.A. Avery, T.J. Mcgee, L.W. Twigg, G.K. Sumnicht, K.W. Jucks, J.J. Margitan, B. Sen, R.A. Stachnik, G.C. Toon, P.F. Bernath, C.D. Boone, K.A. Walker, M.J. Filipiak,, R.S. Harwood, R.A. Fuller, G.L. Manney, M.J. Schwartz, W.H. Daffer, B.J. Drouin, R.E. Cofield, D.T. Cuddy, R.F. Jarnot, B.W. Knosp, V.S. Perun, W.V. Snyder, P.C. Stek, R.P. Thurstans, P.A. Wagner, "Validation of Aura Microwave Limb Sounder stratospheric ozone measurements", *Journal of Geophysical Research – Atmospheres,* 113(D15) D15S20, 2008.
6. Schwartz M. J., A. Lambert, G. L. Manney, W.G. Read, N.J. Livesey, L. Froidevaux, C.O. Ao, P.F. Bernath, C.D. Boone, R.E. Cofield, W.H. Daffer, B.J. Drouin, E.J. Fetzer, R.A. Fuller, R.F. Jarnot, J.H. Jiang, Y.B. Jiang, B.W. Knosp, K. Kruger, J.-L.F. Li, M.G. Mlynczak, S. Pawson, J.M. Russell, M.L. Santee, W.V. Snyder, P.C. Stek, R.P. Thurstans, A.M. Tompkins, P.A. Wagner, K.A. Walker, J.W. Waters, D.L. Wu, "Validation of the aura microwave limb sounder temperature and geopotential height measurements", *Journal of Geophysical Research – Atmospheres,* 113 (D15) D15S11, 2008.
7. Livesey N. J., M. J. Filipiak, L. Froidevaux, W.G. Read, A. Lambert, M.L. Santee, J.H. Jiang, H.C. Pumphrey, J.W. Waters, R.E. Cofield, D.T. Cuddy, W.H. Daffer, B.J. Drouin, R.A. Fuller, R.F. Jarnot, Y.B. Jiang, B.W. Knosp, Q.B. Li, V.S. Perun, M.J. Schwartz, W.V. Snyder, P.C. Stek, R.P. Thurstans, P.A. Wagner, M. Avery, E.V. Browell, J.P. Cammas, L.E. Christensen, G.S. Diskin, R.S. Gao, H.J. Jost, M. Loewenstein, J.D. Lopez, P. Nedelec, G.B. Osterman, G.W. Sachse, C.R. Webster, "Validation of Aura Microwave Limb Sounder O_3 and CO observations in the upper troposphere and lower stratosphere", *Journal of Geophysical Research – Atmospheres,* 113 (D15) D15S02, 2008.
8. Santee M. L., A. Lambert, W. G. Read, N.J. Livesey, R.E. Cofield, D.T. Cuddy, W.H. Daffer, B.J. Drouin, L. Froidevaux, R.A. Fuller, R.F. Jarnot, B.W. Knosp, G.L. Manney, V.S. Perun, W.V. Snyder, P.C. Stek, R.P. Thurstans, P.A. Wagner, J.W. Waters, G. Muscari, R.L. de Zafra, J.E. Dibb, D.W. Fahey, P.J. Popp, T.P. Marcy, K.W. Jucks, G.C. Toon, R.A. Stachnik, P.F. Bernath, C.D. Boone, K.A. Walker, J. Urban, D. Murtagh, "Validation of the Aura Microwave Limb Sounder HNO_3 measurements", *Journal of Geophysical Research – Atmospheres,* 112 (D24) D24S40, 2007.

9. Read W. G., A. Lambert, J. Bacmeister, R.E. Cofield, L.E. Christensen, D.T. Cuddy, W.H. Daffer, B.J. Drouin, E. Fetzer, L. Froidevaux, R. Fuller, R. Herman, R.F. Jarnot, J.H. Jiang, Y.B. Jiang, K. Kelly, B.W. Knosp, L.J. Kovalenko, N.J. Livesey, H.C. Liu, G.L. Manney, H.M. Pickett, H.C. Pumphrey, K.H. Rosenlof, X. Sabounchi, M.L. Santee, M.J. Schwartz, W.V. Snyder, P.C. Stek, H. Su, L.L. Takacs, R.P. Thurstans, H. Vomel, P.A. Wagner, J.W. Waters, C.R. Webster, E.M. Weinstock, D.L. Wu, "Aura Microwave Limb Sounder upper tropospheric and lower stratospheric H_2O and relative humidity with respect to ice validation", *Journal of Geophysical Research – Atmospheres,* 112 (D24) D24S35, 2007.
10. Kovalenko L. J., N. L. Livesey, R. J. Salawitch, C. Camy-Peyret, M.P. Chipperfield, R.E. Cofield, M. Dorf, B.J. Drouin, L. Froidevaux, R.A. Fuller, F. Goutail, R.F. Jarnot, K. Jucks, B.W. Knosp, A. Lambert, I.A. MacKenzie, K. Pfeilsticker, J.P. Pommereau, W.G. Read, M.L. Santee, M.J. Schwartz, W.V. Snyder, R. Stachnik, P.C. Stek, P.A. Wagner, J.W. Waters, "Validation of Aura Microwave Limb Sounder BrO observations in the stratosphere", *Journal of Geophysical Research – Atmospheres,* 112 (D24) D24S41, 2007.
11. Jiang Y. B., L. Froidevaux, A. Lambert, N.J. Livesey, W.G. Read, J.W. Waters, B. Bojkov, T. Leblanc, I.S. McDermid, S. Godin-Beekmann, M.J. Filipiak, R.S. Harwood, R.A. Fuller, W.H. Daffer, B.J. Drouin, R.E. Cofield, D.T. Cuddy, R.F. Jarnot, B.W. Knosp, V.S. Perun, M.J. Schwartz, W.V. Snyder, P.C. Stek, R.P. Thurstans, P.A. Wagner, M. Allaart, S.B. Andersen, G. Bodeker, B. Calpini, H. Claude, G. Coetzee, J. Davies, H. De Backer, H. Dier, M. Fujiwara, B. Johnson, H. Kelder, N.P. Leme, G. Konig-Langlo, E. Kyron, G. Laneve, L.S. Fook, J. Merrill, G. Morris, M. Newchurch, S. Oltmans, M.C. Parrondos, F. Posny, F. Schmidlin, P. Skrivankova, R. Stubi, D. Tarasick, A. Thompson, V. Thouret, P. Viatte, H. Vomel, P. von Der Gathen, M. Yela, G. Zablocki, "Validation of Aura Microwave Limb Sounder Ozone by ozonesonde and lidar measurements", *Journal of Geophysical Research – Atmospheres,* 112 (D24) D24S34, 2007.
12. Lambert A., W. G. Read, N. J. Livesey, M.L. Santee, G.L. Manney, L. Froidevaux, D.L. Wu, M.J. Schwartz, H.C. Pumphrey, C. Jimenez, G.E. Nedoluha, R.E. Cofield, D.T. Cuddy, W.H. Daffer, B.J. Drouin, R.A. Fuller, R.F. Jarnot, B.W. Knosp, H.M. Pickett, V.S. Perun, W.V. Snyder, P.C. Stek, R.P. Thurstans, P.A. Wagner, J.W. Waters, K.W. Jucks, G.C. Toon, R.A. Stachnik, P.F. Bernath, C.D. Boone, K.A. Walker, J. Urban, D. Murtagh, J.W. Elkins, E. Atlas, "Validation of the Aura Microwave Limb Sounder middle atmosphere water vapor and nitrous oxide measurements", *Journal of Geophysical Research – Atmospheres,* 112 (D24) D24S36, 2007.
13. Froidevaux, L., N. J. Livesey, W. G. Read, R. J. Salawitch, J. W Waters, B. Drouin, I. A. MacKenzie, H. C. Pumphrey, P. Bernath, C. Boone, R. Nassar, S. Montzka, J. Elkins, D. Cunnold, D. Waugh, "Temporal decrease in upper atmospheric chlorine," *Geophysical Research Letters,* 33 (23): L32812, 2006.
14. Froidevaux L., N. J. Livesey, W. G. Read, Y. B. Jiang, C. C. Jimenez, M. J. Filipiak, M. J. Schwartz, M. L. Santee, H. C. Pumphrey, J. H. Jiang, D. L. Wu, G. L. Manney, B. J. Drouin, J. W. Waters, E. J. Fetzer, P. F. Bernath, C. D. Boone, K. A. Walker, K. W. Jucks, G. C. Toon, J. J. Margitan, B. Sen, C. R. Webster, L. E. Christensen, J. W. Elkins, E. Atlas, R. A. Lueb, R. Hendershot, "Early

validation analyses of atmospheric profiles from EOS MLS on the Aura satellite," *IEEE Transactions on Geoscience and Remote Sensing*, 44 (5): 1106-1121, 2006.

15. Pickett, H.M.,B. J. Drouin, T. Canty, L. J. Kovalenko, R. J. Salawitch, K. W. Jucks, W. A. Traub, "Validation of Aura MLS HO_x measurements with remote-sensing balloon instruments," *Geophysical Research Letters*, 33 (1): Art. No. L01808, 2006.
16. Pickett, H. M., B. J. Drouin, T. Canty, L. J. Kovalenko, R. J. Salawitch, N. J. Livesey, W. G. Read, J. W. Waters, K. W. Jucks and W. A. Traub, "Validation of Aura MLS HO_x Measurements with Remote-Sensing Balloon Instruments", *Geophysical Research Letters*, 33(1), L01808, 2006

Brian Drouin - Non-refereed First Author Publications

1. Drouin B.J., H.S.P. Muller "Special issue dedicated to the pioneering work of Drs. Edward A. Cohen and Herbert M. Pickett on spectroscopy relevant to the Earth's atmosphere and astrophysics," *J. Mol. Spec.* , 251(1-2), 1-3, 2008.
2. Drouin, B. J. "Rotational spectroscopy at the Jet Propulsion Laboratory," Proceedings of the NATO Advanced Research Workshop on Remote Sensing for Environmental Security, held in Rabat, Morocco, November 17-November 19, 2005, *NATO Security through Science Series C: Environmental Security*, Vol. 10.
3. Drouin B. J., G. Wlodarczak , J.-M. Colmont, F. Rohart, "Current status of quantitative rotational spectroscopy for atmospheric research," *Proc. Int. Workshop Crit. Eval. mm-/sub-mm- Spectrosc. Data Atmos. Obs*, Ibaraki, Mito, Japan, January 2004.
4. Drouin B. J., H. M. Pickett, "Laboratory and field studies in rotational spectroscopy at the Jet Propulsion Laboratory," *Proc. Int. Workshop Crit. Eval. mm-/sub-mm- Spectrosc. Data Atmos. Obs*., Ibaraki, Mito, Japan, January 2004:
5. Drouin B. J., W. R. Read, "Microwave session, rapporteur summary," NASA workshop on Future Needs for Atmospheric Remote Sensing, San Diego, California, USA, October 2001.