

# CURRICULUM VITAE

J.A. MacAskill

May 2012

## PERSONAL INFORMATION

NAME: John Alexander MacAskill, Jr.  
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CITIZENSHIP: Canadian  
DATE OF BIRTH: August 16, 1974

## CURRENT POSITION:

2005-present Staff Research Scientist, Atomic and Molecular Collisions Group, Astrophysics and Space Sciences Division, Jet Propulsion Laboratory

## EDUCATION:

1999-2003 Doctor of Philosophy (*Atomic, Molecular, and Optical Physics*)  
Awarded August, 2003.  
Department of Physics, University of Windsor, Windsor, Ontario, CANADA  
1996-1999 Bachelor of Science, Honours First Class (*Physics*)  
Awarded May, 1999.  
Department of Physics, St. Francis Xavier University, Antigonish, Nova Scotia, CANADA

## AWARDS:

2012 NTR 48724 - *Miniature Universal Sampling System.*  
2011 NTR 48286 - *A practical implementation of constant amplitude, inverse quadratic frequency modulated rf for ion trap mass spectrometry.*  
2011 NTR 48274 - *Ultrahigh Resolution Mass Spectrometry Using an Electrostatic Ion Bottle with Coupling to a Quadrupole Ion Trap.*  
2010 NASA Technical Brief Award.  
2009 Mariner Award.  
2009 NTR 47217 - *Histogrammatic method for determining relative abundance of input gas pulse in the presence of obscuring gas background.*  
2009 NTR 46956 - *Performing Major Constituents Analysis (MCA) on the VCAM instrument including automated mass calibration using global optimization.*  
2006 Team Bonus Award – VCAM Digital rf Development.  
2006 Team Bonus Award – VCAM Instrument Team.  
2003-2005 California Institute of Technology Postdoctoral Research Fellow.  
2000-2002 Natural Sciences and Engineering Research Council of Canada Post-Graduate Scholarship B.  
1999-2003 University of Windsor Post-Graduate Tuition Scholarship.

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## MEMBERSHIPS:

2001-present Canadian Association of Physicists  
2001-present American Physical Society

## OTHER RELEVANT ACTIVITIES:

2001-2002 Member of General Appointments Committee, Physics Dept., University of Windsor.

## TEACHING EXPERIENCE:

2000-2003 Supervising three high-school co-op students as part of collaborative effort between University of Windsor and Windsor-Essex District School Board to create advanced learning environment for students. I was responsible for supervising these students on research projects for presentation at regional, provincial and national science fairs.

1999-2003 University of Windsor teaching assistant for various first- and second-year undergraduate physics courses. Responsibilities included preparing equipment, overseeing lab sessions, and marking lab reports, assignments and examinations.

1997-1999 St. Francis Xavier University teaching assistant for various first- and second-year undergraduate physics courses. Responsibilities included assisting lab supervisor during lab sessions and marking lab reports.

## RESEARCH EXPERIENCE:

2007-present Developing and coupling novel ionization sources such as micro-capillary electrospray, laser ablation, and inductively-coupled plasma ion sources to a quadrupole ion trap mass spectrometer. The goal of this research is to improve conventional mass spectrometer designs by implementing each of these novel ionizers (e.g. "lab on a chip") to simultaneously improve mass spectrometer performance while decreasing the physical size and power consumption of the entire system.

2005-present Performing measurements of fundamental processes involving fast (i.e. super-thermal energies) atomic species. This research employs atomic beams of normally-unstable atomic species, namely atomic-hydrogen and atomic-oxygen, which are produced with JPL's Fast Atom Facility and used to study fundamental physical processes, such as dissociative attachment cross sections, and molecule formation. This research has recently demonstrated the ability to form molecules such as carbon dioxide, formaldehyde, and simple alcohols in interstellar media (ISM) and cometary environments through fast-O and -H atom bombardment of ices on dust grains.

2005-present Developing a quadrupole ion trap mass spectrometer system for the purpose of performing isotopic abundance measurements, *in-situ*, for species of astro-biological, astro-chemical, and geological relevance. This research is aimed at improving the ion trap's mass resolving power to levels comparable to larger, high-precision, lab-based systems used for measuring isotopic ratios.

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- 2004-present      Developing a miniature gas chromatograph mass spectrometer (GCMS) system, primarily for real-time, air-quality sampling, that can identify atmospheric contaminants at the sub-ppm level. The ultimate goal of this research is to develop a portable unit that can perform real time sampling and analysis of low-mass (<360 amu), volatile organic compounds with precision and sensitivity comparable to a sophisticated lab-based GCMS system. A first-generation GCMS system, the Vehicle Cabin Atmosphere Monitor was selected as a technology demonstration for use on the International Space Station and was in operation from 2010-2011. An improved version of this GCMS is currently being developed.
- 2004-present      Performing lab-based measurements for interactions of electrons and highly charged ions, using JPL's Highly Charged Ion Facility, with gaseous and solid targets of astrophysical significance. These measurements are used for comparison with astronomical observations and theoretical modeling. These measurements include inelastic electron scattering cross sections for highly charged iron ions, as well as charge-exchange cross sections for multiple targets.
- 2007-2009        Developing a field-portable, mass spectrometer system for the detection and quantification of impurities in fuel-cell hydrogen. This work was aimed both at developing a new set of ASTM standards for establishing fuel-cell hydrogen quality, as well as providing an engineering model of an analytical field system for use by the Department of Energy (DOE)/ National Renewable Energy Laboratory (NREL), and hydrogen fuel manufacturers and vendors.
- 2003-2004        Developing a novel technique for performing mass spectrometry of biological samples using a quadrupole ion trap. Ultra-low energy electrons are attached to bio-molecules of interest to form negative ions, which are then transported to a Paul ion trap using time resolved electron and ion optics.
- 1999-2003        Research for Doctoral degree that involved application of a cesium magneto-optical trap (MOT) for electron scattering measurements. I was responsible for the design and construction of two cesium MOT's, with incorporated electron-beam systems. During this period, I measured total and ionization cross sections for electron impact for cesium in its ground and excited states
- 1997-1999        Research for Bachelor degree that involved the application of a CO<sub>2</sub> laser to perform laser-assisted electron-impact studies of molecular nitrogen in the vicinity of its low-energy (2.3 eV) shape resonance. I was responsible for incorporating a new pulsed, 5 Joule TEA CO<sub>2</sub> into the experiment.

### **PUBLICATIONS:**

#### ***Refereed Publications***

1) "Measuring Cesium Electron Impact Cross-Sections Using a Magneto-Optical Trap", J. A. MacAskill, W. Kedzierski, J. W. McConkey, J. Domyslowska, I. Bray, *Journal of Electron Spectroscopy and Related Phenomena*, **123**, (2002), pp 173-184.

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2) “*New Measurements of Absolute Total Cross Sections for Electron Impact on Cesium Using a Magneto Optical Trap*”, M. Lukomski, J.A. MacAskill, D.P. Seccombe, C. McGrath, S. Sutton, J. Teeuwen, W. Kedzierski, T.J. Reddish, J.W. McConkey and W.A. van Wijngaarden, *Journal of Physics B: Atomic, Molecular and Optical Physics*, **38**, (2005), pp 3535-3545.

3) “*Measurements of polyatomic molecule formation on an icy grain analog using fast atoms*”, Madzunkov, S. B. J. Shortt, J. A. MacAskill, M. R. Darrach, and A. Chutjian, *Physical Review A*, **73**, 020901 (2006).

4) “*Absolute Single and Multiple Charge Exchange Cross Sections for Highly Charged C, O, and Ne ions, H<sub>2</sub>O, CO, and CO<sub>2</sub>*”, R. J. Mawhorter, A. Chutjian, T. E. Cravens, N. Djuric, S. Hossain, C. M. Lisse, J. A. MacAskill, S. J. Smith, J. Simcic, and I. D. Williams, *Physical Review A*, **75**, 032704, (2007).

5) “*Different isotope and chemical patterns of pyrite oxidation related to lag and exponential growth phases of Acidithiobacillus ferrooxidans reveal a microbial growth strategy*”, B. Brunner, J-Y. Yu, R. E. Mielke, J. A. MacAskill, S. Madzunkov, T. J. McGenity, M. Coleman, *Earth and Planetary Science Letters* (2008), doi: [10.1016/j.epsl.2008.03.019](https://doi.org/10.1016/j.epsl.2008.03.019).

6) “*Digitally Synthesized High Purity, High Voltage Radiofrequency Drive Electronics For Mass Spectrometry*”, R. T. Schaefer, J. A. MacAskill, M. Mojarradi, A. Chutjian, M. R. Darrach, S. Madzunkov, and B. J. Shortt, *Review of Scientific Instruments*, **79**, 095107 (2008).

7) “*Formation of Formaldehyde and Carbon Dioxide on an Icy Grain Analog Using Fast Hydrogen Atoms*”, S. Madzunkov, J. A. MacAskill, and A. Chutjian, *Physical Review A*, **697**, 801 (2009).

8) “*Formation of Carbon Dioxide, Methanol, Ethanol, and Formic Acid on an Icy Grain Analog Using Fast Oxygen Atoms*”, S. M. Madzunkov, J. A. MacAskill, and A. Chutjian, *Astrophysical Journal*, **712**, 194 (2010).

9) “*Validation Test Results from the Vehicle Cabin Atmosphere Monitor*”, M. R. Darrach, A. Chutjian, B. J. Bornstein, A. P. Croonquist, V. Garkanian, V. R. Haemmerle, W. M. Heinrichs, D. Karmon, J. Kenny, R. D. Kidd, S. Lee, J. A. MacAskill, S. M. Madzunkov, L. Mandrake, T.M. Rust, R. T. Schaefer, J. L. Thomas, and N. Toomarian, *Fortieth International Conference on Environmental Systems (ICES), AIAA Conference Proceedings, AIAA 2010-6094* (2010).

10) “*Dipole Excitation with a Paul Ion Trap Mass Spectrometer*”, J.A. MacAskill, S. M. Madzunkov, and A. Chutjian, *Application of Accelerators in Research and Industry: Twenty-First International Conference. AIP Conference Proceedings*, **1336**, 127 (2011).

11) “*On-Orbit Measurements of the ISS Atmosphere by the Vehicle Cabin Atmosphere Monitor*” M. R. Darrach, A. Chutjian, B. J. Bornstein, A. P. Croonquist, V. Garkanian, V. R. Haemmerle, J. Hofman, W. M. Heinrichs, D. Karmon, J. Kenny, R. D. Kidd, S. Lee, J. A. MacAskill, S. M. Madzunkov, L. Mandrake, and T. M. Rust, *Forty-First International Conference on Environmental Systems (ICES), AIAA Conference Proceedings, AIAA 2011-5214* (2011).

12) “*Trace Chemical and Major Constituents Measurements of the International Space Station Atmosphere by the Vehicle Cabin Atmosphere Monitor*” M. R. Darrach, A. Chutjian, B. J. Bornstein, A. P. Croonquist, V. Garkanian, J. Hofman, D. Karmon, J. Kenny, R. D. Kidd, S. Lee, J. A. MacAskill, S. M. Madzunkov, L. Mandrake, R. T. Schaefer, and N. Toomarian, *Forty-Second International Conference on Environmental Systems (ICES), AIAA*

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Conference Proceedings, AIAA 2012-3432 (2012).

### Conference Presentations

1) "*Optical Manipulation of Cesium Atoms for Electron Collision Experiments*", J. MacAskill, J. Domyslawska, W. Kedzierski, J. W. McConkey, Annual Meeting of the Canadian Institute for Photonics Innovation (CIPI), (2000).

2) "*Optical Manipulation of Cesium Atoms for Electron Collision Experiments*", J. MacAskill, J. Domyslawska, W. Kedzierski, J. W. McConkey, Congress of the Canadian Association of Physicists (CAP), (2000).

3) "*Laser-Assisted Electron-N<sub>2</sub> Scattering*", Cooke, D. G., MacAskill, J. A., Holmes, J. K., and Wallbank, B., International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC), (2001).

4) "*Optical Manipulation of Cesium Atoms for Electron Collision Experiments*", J. MacAskill, J. Domyslawska, W. Kedzierski, J. W. McConkey, Annual Meeting of the Canadian Institute for Photonics Innovation (CIPI), (2001).

5) "*Electron Scattering Cross Sections in Cs Using an MOT*", J. A. MacAskill, J. Domyslawska, M. Sak, W. Kedzierski, J. W. McConkey, Congress of the Division of Atomic, Molecular and Optical Physics (DAMOP) of the American Physical Society (APS), (2001).

6) "*Cs Electron Impact Cross-Sections Measured Using a Magneto Optical Trap*", J. A. MacAskill, J. Borbely, M. Sak, J. Domyslawska, W. Kedzierski, I. Bray and J. W. McConkey, Congress of the Canadian Association of Physicists (CAP), (2002).

7) "*Cs Electron Scattering Cross Sections Measured Using an MOT*", J. MacAskill, W. Kedzierski, W. McConkey, J. Domyslawska, I. Bray, Congress of the Division of Atomic, Molecular and Optical Physics (DAMOP) of the American Physical Society (APS), (2002).

8) "*Electron-Cs Cross Sections Measured in a Magneto-Optical Trap*", J. A. MacAskill, W. Kedzierski, J. Borbely, J. W. McConkey, J. Domyslawska, I. Bray, International Conference on Atomic Physics (ICAP), (2002).

9) "*Electron Impact Cross Section Data for Cesium Obtained using a MOT*", J. MacAskill, W. Kedzierski, J. Borbely, W. McConkey, J. Domyslawska, I. Bray, Gaseous Electronics Conference (GEC), (2002).

10) "*Electron Collisions with Ground and Excited State Cesium*", J.A. MacAskill, C. McGrath, W. Kedzierski, J.W. McConkey, I. Bray, Congress of the Canadian Association of Physicists (CAP), (2003).

11) "*Ground and excited state cross sections for electron impact on cesium*", J. A. MacAskill, C. McGrath, W. Kedzierski, J. W. McConkey, W. A. van Wijngaarden and I. Bray, International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC), (2003).

12) "*Electron-Cesium collisions using a Magneto-Optical Trap*", J. MacAskill, C. McGrath, W. Kedzierski, J. Teeuwen, J.W. McConkey, I. Bray, Gaseous Electronics Conference (GEC), (2003).

13) "*Progress report on the measurement of cesium electron-impact cross sections using a magneto-optical trap*", J.A. MacAskill, C. McGrath, D.P. Secombe, M. Lukomski, J. Teeuwen, S. Sutton, W. Kedzierski, T.J. Reddish, J.W. McConkey, W.A. van Wijngaarden and I. Bray, Congress of the Canadian Association of

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Physicists (CAP), (2004).

14) “*Absolute Charge Exchange Cross Sections for  $O^{5+}$ ,  $O^{6+}$ , and  $O^{7+}$  Collisions with CO and  $CO_2$* ”, R. Mawhorter, N. Djuric, J.A. MacAskill, S.J. Smith, A. Chutjian, I.D. Williams, Congress of the Division of Atomic, Molecular and Optical Physics (DAMOP) of the American Physical Society (APS), (2005).

15) “*MOT Measurements of Electron Impact Cross Sections in Cesium*”, Bill McConkey, M. Lukomski, J.A. MacAskill, D.P. Seccombe, C. McGrath, S. Sutton, J. Teeuwijn, W. Kedzierski, T.R. Reddish, W.A. van Wijngaarden, I. Bray, Congress of the Canadian Association of Physicists (CAP), (2005).

16) “*Cesium electron impact cross sections measured in a magneto-optical trap*”, M. Lukomski, J. A. MacAskill, D. P. Seccombe, C. McGrath, S. Sutton, J. Teeuwijn, W. Kedzierski, T.J. Reddish, J. W. McConkey, W. A. van Wijngaarden and I. Bray, International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC), (2005).

17) “*Measurement of reactions using fast atoms:  $O(3P) (10 eV) + CO \rightarrow CO_2$* ”, S. Madzunkov, B. Shortt, J. MacAskill, A. Chutjian and M. Darrach, International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC), (2005).

18) “*Absolute Charge Exchange Cross Sections for  $C^{3,4,5,6+}$ ,  $N^{4,5+}$ ,  $O^{5,6,7+}$ , and  $Ne^{7,8+}$  Collisions with  $H_2O$ ,  $CH_4$ ,  $CO$  and  $CO_2$* ”, Richard Mawhorter, Nada Djuric, Sabbir Hossain, John MacAskill, Steven J. Smith, Ara Chutjian, Congress of the Division of Atomic, Molecular and Optical Physics (DAMOP) of the American Physical Society (APS), (2006).

19) “*Current Capability and Possibilities for In-Situ Stable Isotope Analysis of Minerals Compared to Science Needs and Laboratory Measurements*”, M. L. Coleman, B. Brunner, L. E. Christensen, A. Chutjian, J. A. MacAskill, S. Madzunkov, R. E. Mielke, K. N. Truong, C. R. Webster, Fall Meeting of the American Geophysical Union, (2006).

20) “*Novel Approaches to Stable Isotope Instruments for in situ Measurements of Mineral Samples*”, M. Coleman, C. Webster, A Chutjian, B Brunner, L Christensen, J. MacAskill, S. Madzunkov, R Mielke and K Truong”, European Geophysical Union General Assembly (2007).

21) “*Formation of Molecular Species on Grains Using Superthermal Atoms: The Reaction  $2H (2 eV) + CO(s) \rightarrow H_2CO(s)$* ”, S. Madzunkov, J. A. MacAskill, M. R. Darrach, G. Vidali, B. J. Shortt, and A. Chutjian, XXVth International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC) (2007).

22) “*Overview of the Vehicle Cabin Atmosphere Monitor, a Miniature Gas Chromatograph/Mass Spectrometer for Trace Contamination Monitoring on the ISS and CEV*”, A. Chutjian, D. G. Conroy, A. P. Croonquist, M. R. Darrach, E. Edgu-Fry, D. J. Fry, M. A. Girard, R. D. Kidd, J. A. MacAskill, R. T. Schaefer, N. Toomarian, M. Christensen, D. Demonbrun, R. Vanholden, P. M. Holland, B. J. Shortt, International Conference on Environmental Systems (ICES), (2007).

23) “*Results from the Vehicle Cabin Atmosphere Monitor: A Miniature Gas Chromatograph/Mass Spectrometer for Trace Contamination Monitoring on the ISS and Orion*”, A. Chutjian, M. R. Darrach, B. J. Bornstein, A. P. Croonquist, E. Edgu-Fry, D. J. Fry, V. Garkanian, M. A. Girard, V. R. Haemmerle, W. M. Heinrichs, R. D. Kidd, S. Lee, J. A. MacAskill, S. M. Madzunkov, L. Mandrake, T.M. Rust, R. T. Schaefer, J. L. Thomas, N. Toomarian, and M. J. Walch, , International Conference on Environmental Systems (ICES), (2008).

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24) “Formation of  $H_2CO$  and  $CO_2$  on an Icy Grain Analogue Using Fast H-Atoms”, S. Madzunkov, J. MacAskill, A. Chutjian, P. Ehrenfreund, M. Darrach, G. Vidali, B. Shortt XXVI International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC) (2009).

25) “Formation of  $CO_2$ ,  $CH_3OH$  and  $CH_3CH_2OH$  on an icy grain analogue using fast O-atoms”, S. M. Madzunkov, J. A. MacAskill and A. Chutjian, XXVI International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC) (2009).

26) “Formation of  $H_2CO$  and  $CO_2$  on an icy grain analogue using fast H-atoms”, S. Madzunkov, J. A. MacAskill, A. Chutjian, P. Ehrenfreund, M. Darrach, G. Vidali and B. Shortt, XXVI International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC) (2009)

27) “Dipole field effects on ion ejections from a Paul ion trap”, J. A. MacAskill, S. Madzunkov, A. Chutjian, XXVII International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC) (2011).

28) “Collision Physics in the Atomic and Molecular Universe”, A. Chutjian, J. Simcic, S. M. Madzunkov, J. A. MacAskill, R. J. Mawhorter, and E. Tsikata, XXVII International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC) (2011).

### **PATENTS:**

- 1.) Electronic drive and acquisition system for mass spectrometry, United States Patent 7772550, (2010).
- 2.) Histogrammatic method for determining relative abundance (MCA) of input gas pulse in the presence of obscuring gas background, provisional patent application 61/240,559, (2010).