

## **Veronica M. Bierbaum – Curriculum Vitae**

Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO 80309-0215

### **Education**

B. A.	Chemistry, Summa Cum Laude, Catholic University of America, Washington, DC	1970
Ph.D.	Physical Chemistry, University of Pittsburgh Advisor: Professor Frederick Kaufman Honors: NSF Pre-doctoral Fellowship NSF Center of Excellence Fellowship Woodrow Wilson Fellowship	1974

### **Academic Positions**

Research Associate (with Professor Charles DePuy), Lecturer, and Visiting Assistant Professor, Department of Chemistry, University of Colorado	1974-1978
Senior Research Associate, University of Colorado	1979-1995
Special Member of the Graduate Faculty, University of Colorado	1981-1995
Research Professor, University of Colorado	1995-2002
Professor, University of Colorado	2002-present

### **Professional Membership**

American Association for the Advancement of Science  
American Chemical Society  
American Society for Mass Spectrometry  
Center for Astrophysics and Space Astronomy (CASA)  
Joint Institute for Laboratory Astrophysics (JILA)  
Phi Beta Kappa

### **Research, Education, Professional Activities**

#### **(1) Research activity:**

Extramural research funding over the years from several agencies, primarily NSF, NIH, ARO, AFOSR, NASA  
228 published peer-reviewed research papers; h-index = 53; i-10 index=174 (ISI Web of Science)  
25 editorials, including special issues of *JASMS*, *IJMS* and *Chemical Reviews*  
Many presentations at national and international conferences and university seminars  
Total graduate students advised or co-advised: 37  
Total postdoctoral scholars sponsored or co-sponsored: 42  
College Scholar Award, 2009-2010  
Fellow of the American Association for the Advancement of Science, 2011  
University of Colorado Distinguished Research Lecturer, 2012  
Freiser Memorial Lecturer, 2013  
*IJMS* Special Issue (Honoring Veronica Bierbaum on the Occasion of her 65<sup>th</sup> Birthday), 2015  
CU Green Labs Program Award for Laboratory Achievement, 2016

#### **(2) Chemistry Education (formal course work and the science of teaching and learning):**

I have taught many courses over the years, in particular, large (1000 student) General Chemistry courses for which I have developed interactive and innovative teaching and learning methods. I have implemented interactive methods and lecture demonstrations for Physical Chemistry for Engineers and for Majors General Chemistry, and I have contributed to the revision and improvement of the Physical Chemistry Laboratory. I am currently focusing on

improving the large “service” General Chemistry Laboratory courses, through improved experiments, methods, laboratory descriptions, and training of Teaching Assistants. My Faculty Course Questionnaire ratings have been very strong.

Coordinator and Instructor for the ASMS Short Course “Fundamentals of Gas Phase Ion Chemistry (1992, 1993, 1994) with Scott McLuckey and Robert Squires

Participant in High School-University Chemistry Teachers Conference (1999-present)

Participant in NSF Multi-Dissemination Workshop for Innovative Chemistry Education (2003)

Participant in NSF Project Kaleidoscope Conference “Making Creative Use of Emerging Technologies to Enhance Student Learning” (2003)

Co-investigator with Dr. Margaret Asirvatham of \$1.5M National Science Foundation Grant “Partners in Science Education” which placed graduate fellows from four science departments into our K-12 public school classrooms (2003-2007)

Lead investigator of a five-year science education grant for the Department of Chemistry & Biochemistry from the University of Colorado (2006-2010)

Member, Leadership Team, Carnegie Initiative on the Doctorate (2003-2004)

Member, Advisory Board, Science Education Initiative (2006)

Participant in several education proposals with the Science Education Initiative SEI (2003-2006)

Administered CLASS and Concept Surveys for the Science Education Initiative (2004-present)

Merck-Frosst Lecturer (invited by students), University of British Columbia (2005)

University of Colorado Residence Life Academic Teaching Awards (2005, 2006)

Participant in LEAP (Leadership Education for Advancement and Promotion) Workshops (2006-present)

Advisory Board, Undergraduate Science Course Innovations and their Impact on Student Learning, NSF Grant of Maria Araceli Ruiz-Primo (2007-2008)

Research on using audience feedback devices in general chemistry classes with Angela Hoekstra, graduate student in Sociology, and Margaret Asirvatham, Senior Instructor in Chemistry [*Learning, Media and Technology*, **33**, 329-341 (2008)]

Participant in weekly group meetings on gas phase ion chemistry and on astrochemistry and astronomy (1990-present)

#### Faculty Teaching Excellence Program (FTEP):

Participated in numerous FTEP Workshops including “Performance in a Nutshell” (two sessions 2002) and “Preparing and Delivering Classroom Presentations and Discussions” (three sessions, 2003)

Participant in the two week FTEP Summer Institute on New Media, Pedagogy, Scholarship and Learning Technologies (2003)

Member, FTEP Committee for the Implementation and Assessment of Audience Feedback Devices (2003-2004)

Faculty Facilitator, FTEP Early Career Faculty Program – Peer Perspectives in the Natural Sciences (2004-2008)

Member, Faculty Advisory Board for the FTEP Summer Institute for Assessing Classroom Teaching (2005-2007)

Presenter, FTEP workshops on “Teaching the First Day of Class” (Spring and Fall 2007)

Participated in University of Colorado eText Pilot Program for CHEM 1251, Fall 2012

Mentor for Professor Rainer Volkamer in Chemistry Education (2012-present)

Undergraduate curriculum reform (2014-present)

Implementation of ALEKS assessment and adaptive learning program for 1500 students, 2015

#### **(3) Service to the University and Department:**

Member of many Faculty Search Committees (1990-present)

Organizer, DePuy Science Symposium (1992)

Departmental Captain, Colorado Campaign (1995-1997)  
Reviewer, Beverly Sears Dean's Small Grants Program (1998-2000)  
Member, Instrumentation Committee for Mass Spectrometry (1999-2014)  
Member, General Chemistry Coordination Committee (1999-present)  
Member, Departmental Graduate Scholastic Committee (2000-2002)  
Member, Executive Committee, Department of Chemistry & Biochemistry (2001, 2006-2009, 2010-2012)  
Member, Undergraduate Curriculum Committee (2002-present)  
Member, Vice Chancellor's Advisory Committee (2002-2006)  
Member, Departmental Faculty Merit Evaluation Committee (2003)  
Member, Provost's Teaching, Learning, and Assessment Committee (2004-2005)  
Member, Review Panel for Innovative Grants Program (2006-2009, 2011-2012)  
Coordinator, Physical Chemistry Program (2006-2012)  
Member, Organizing Committee for "Forty Years of Ion Chemistry" Conference, Boulder, Colorado (2008-2009)  
Member, Research Review Board, University of Colorado (2012-2014)  
Member, Arts & Sciences Personnel Committee, University of Colorado (2013-2015)  
Member, Distinguished Research Lecturer Selection Committee (2013-2015)  
Member, Dean's Level Review Committee, School of Education (2016-2017)  
Chair, Self-Study Committee, Department of Chemistry (2016-2017)

**(4) Service to the Scientific Community through National & International Organizations:**

American Society for Mass Spectrometry (professional organization of 8000 scientists) elected positions: Secretary (1989-1991), Vice-President (1994-1996), President (1996-1998), and Past-President (1998-2000)  
ASMS Program Review Committee Member (1994-1997) and Chair (1995-1996)  
ASMS Corporate Members Advisory Committee (1998-2000)  
ASMS Publications Committee (1999-2001)  
ASMS Nominating Committee Member (2000-2002, 2004-2006) and Chair (2001, 2002, 2006)  
ASMS Committee on Conference Growth (2001-2002)  
ASMS 50<sup>th</sup> Anniversary Committee (2001-2002)  
ASMS Awards Evaluation Committee (2004-2005)  
ASMS Committee for *JASMS* Outstanding Publication Award (2008)  
Board of Directors, Asilomar Conference Committee (1990-1992, 1999-2001; 2006-2009)  
Chair, Asilomar Conference Committee (2007-2008)  
Council of Scientific Society Presidents, Member (1994-2000)  
Council of Scientific Society Presidents, Executive Board (1998)  
Council of Scientific Society Presidents, Chair of International Science Committee (1998)  
Advisory Panel, Pacific Northwest National Laboratories (1997-2000)  
Member of ACS National Awards Committee, multiple years  
Member of ASMS Awards Committee, multiple years  
Member of proposal review panels (NSF, 1992, 1994, 1998, 2009, 2013, 2014; DOE 1999; NASA 2006)  
Member, Elsevier/*JASMS* Planning Committee (2009)  
Member, Scientific Organizing Committee, Conference on "PAHs and the Universe," Toulouse, France (2009-2010)  
Gordon Conference Session Chair (2001, 2013, 2015)  
ASMS Conference Session Chair (2002, 2005, 2013)  
Member of the KIDA expert team, *Kinetic Database for Astrochemistry* (2010-2014)  
ACS Conference Session Chair (2015)

Many “confidential” committees for awards, nominations of colleagues, and task forces (ASMS, ACS, AAAS, University of Colorado)  
*IJMS* Best Student Paper Committee, 2016

**(5) Outreach Activities:**

Judged science fairs at the local, regional, state, and national levels (1980-present)  
Provided science demonstrations for local elementary and middle schools (1990-present)  
Mentor for several science projects (1990-present)  
Member of the Scientific Review Committee of the Boulder Valley School District; annual review of 200 science projects (1999-present)  
Member of the Steering Committee of the International Baccalaureate Program, Fairview High School, Boulder (2000-2007)  
Member and presenter of the CU Wizards Program; developed a new presentation “The Magic of Chemistry” as outreach to elementary, middle, and high school students (2005-present)  
Coach, Chemistry Olympiad Team, Fairview High School (2006-2007); a student qualified for the Summer Camp at the Air Force Academy (among top 20 students nationally)  
Laboratory tours high school students, 2012.  
Mentor, Undergraduate Luncheon, ASMS Conference, 2015.

**Broadening the Participation of Women and Underrepresented Groups:**

Member, Organizing Committee of the “Expanding Your Horizons” Conference, Colorado State University; conference is designed to expose young women in high school to the excitement of science and math (1982-1984)  
Principal Investigator of a grant from the President’s Fund to Support the Recruitment and Retention of Minority and Women Faculty (1999)  
Mentor for the CU Summer Multicultural Access to Research Training (SMART) Program (2003)  
Mentor for AGEP minority fellow (2005)  
Supported the activities of my graduate student, Oscar Martinez, in the Faculty Diversity Institute on Teaching and Mentoring and the Leadership Alliance National Symposium (2005-2009)  
Mentor for “Colorado Diversity Initiative” Post-doctoral Research Fellow (2012-2014)  
Mentor for female NSF Graduate Fellowship recipient (2012-2015)  
Supported the activities of my graduate student, Callie Cole, in the CU Upward Bound Program for Native American students, 2012 and 2013.  
My research group has always included women and underrepresented groups, including African American and Hispanic students. I actively recruit and mentor these students. I prepare letters of recommendation for about 30 students and colleagues each year.

**(6) Editorial and Review Activities:**

Associate Editor for the *Journal of the American Society for Mass Spectrometry* (1999-present); preparation of sixteen special issues (and one in preparation), and annual review of 50 manuscripts.  
Guest Editor for *Chemical Reviews* (Thematic Issue on Mass Spectrometry, 1999-2001).  
Member of the Editorial Board of the *Encyclopedia of Mass Spectrometry* (2001-2003).  
Member of the Editorial Board of the *International Journal of Mass Spectrometry* (2004-present); Guest Editor for four special issues.  
Member of Proposal Review Panels for NSF, NASA, and DOE (1992-present).  
Review of Journals: Analyst, Analytical Chemistry, Astrophysical Journal, Canadian Journal of Chemistry, Chemical Physics Letters, Chemical Reviews, Encyclopedia of Mass Spectrometry, European Journal of Mass Spectrometry, Icarus, International Journal of Chemical Kinetics, International Journal of Mass Spectrometry, Journal of the American

Chemical Society, Journal of the American Society for Mass Spectrometry, Journal of Chemical Physics, Journal of Mass Spectrometry, Journal of Organic Chemistry, Journal of Physical Chemistry, Journal of Physical Chemistry Letter, Mass Spectrometry Reviews, Physical Chemistry Chemical Physics, Proceedings of the National Academy of Sciences, Rapid Communications in Mass Spectrometry, Reviews of Scientific Instruments, Zeitschrift für Physikalische Chemie.

Review of Proposals: Air Force Office of Scientific Research, Department of Energy, Marsden Fund, MIT Sea Grant Program, National Aeronautics and Space Administration, National Science Foundation, Natural Sciences and Engineering Research Council of Canada, Netherlands Organization of Scientific Research, Petroleum Research Fund of the American Chemical Society, Research Corporation, United States-Israel Binational Science Foundation, University of North Texas, Wellcome Trust.

### Publications

1. C. J. Howard, V. M. Bierbaum, H. W. Rundle and F. Kaufman, "Kinetics and Mechanism of the Formation of Water Cluster Ions from  $O_2^+$  and  $H_2O$ ," *J. Chem. Phys.* **57**, 3491-3497 (1972).
2. V. M. Bierbaum and F. Kaufman, "Kinetics of the Reactions of  $N_2H^+$ ,  $N_3^+$  and  $N_4^+$  with  $H_2O$  in the Gas Phase," *J. Chem. Phys.* **61**, 3804-3809 (1974).
3. V. M. Bierbaum, M. F. Golde and F. Kaufman, "Flowing Afterglow Studies of Hydronium Ion Clustering Including Diffusion Effects," *J. Chem. Phys.* **65**, 2715-2724 (1976).
4. V. M. Bierbaum, C. H. DePuy, R. H. Shapiro and J. H. Stewart, "Flowing Afterglow Studies of the Reactions of Hydroxide, Amide and Methoxide Ions with Ethylene Oxide and Propylene Oxide," *J. Am. Chem. Soc.* **98**, 4229-4235 (1976).
5. V. M. Bierbaum, C. H. DePuy and R. H. Shapiro, "Gas Phase Reactions of Anions with Nitrous Oxide and Carbon Dioxide," *J. Am. Chem. Soc.* **99**, 5800-5802 (1977).
6. V. M. Bierbaum, G. B. Ellison, J. H. Futrell and S. R. Leone, "Vibrational Chemiluminescence from ion-molecule reactions:  $O^- + CO \rightarrow CO_2 + e^-$ ," *J. Chem. Phys.* **67**, 2375-2376 (1977).
7. J. H. Stewart, R. H. Shapiro, C. H. DePuy and V. M. Bierbaum, "Hydrogen-Deuterium Exchange Reactions of Carbanions with  $D_2O$  in the Gas Phase," *J. Am. Chem. Soc.* **99**, 7650-7653 (1977).
8. C. H. DePuy, V. M. Bierbaum, R. J. Schmitt and R. H. Shapiro, "Gas Phase Oxidation and Reduction Reactions with  $C_6H_7^-$ ,  $HNO^-$  and  $HO_2^-$ ," *J. Am. Chem. Soc.* **100**, 2920 (1978).
9. C. H. DePuy, V. M. Bierbaum, G. K. King and R. H. Shapiro, "Hydrogen-Deuterium Exchange Reactions of Carbanions with Deuterated Alcohols in the Gas Phase," *J. Am. Chem. Soc.* **100**, 2921-2922 (1978).
10. C. H. DePuy, V. M. Bierbaum, L. A. Flippin, J. J. Grabowski, G. K. King and R. J. Schmitt, "Generation of Specific Isomeric Carbanions in the Gas Phase," *J. Am. Chem. Soc.* **101**, 6443 (1979).
11. R. J. Schmitt, V. M. Bierbaum and C. H. DePuy, "Gas-Phase Reactions of Carbanions with Triplet and Singlet Molecular Oxygen," *J. Am. Chem. Soc.* **101**, 6443-6445 (1979).

12. T. S. Zwier, M. M. Maricq, C. J. S. M. Simpson, V. M. Bierbaum, G. B. Ellison and S. R. Leone, "Direct Detection of the Product Vibrational State Distribution in the Associative Detachment Reaction  $\text{Cl}^- + \text{H} \rightarrow \text{HCl}(\nu) + \text{e}^-$ ," *Phys. Rev. Lett.* **44**, 1050-1053 (1980).
13. T. S. Zwier, V. M. Bierbaum, G. B. Ellison and S. R. Leone, "Vibrational Product State Distributions of Ion-Molecule Reactions by Infrared Chemiluminescence:  $\text{Cl}^- + \text{HBr}, \text{HI} \rightarrow \text{HCl}(\nu) + \text{Br}^-, \text{I}^-$ ," *J. Chem. Phys.* **72**, 5426-5436 (1980).
14. C. H. DePuy, V. M. Bierbaum, L. A. Flippin, J. J. Grabowski, G. K. King, R. J. Schmitt and S. A. Sullivan, "Gas-Phase Reactions of Anions with Substituted Silanes," *J. Am. Chem. Soc.* **102**, 5012-5015 (1980).
15. V. M. Bierbaum, R. J. Schmitt and C. H. DePuy, "Reactions of Carbanions with Triplet and Singlet Molecular Oxygen," *Env. Health Persp.* **36**, 119-124 (1980).
16. C. H. DePuy and V. M. Bierbaum, "Gas Phase Reactions of Organic Anions as Studied by the Flowing Afterglow Technique," *Accts. Chem. Res.* **14**, 146-153 (1981).
17. R. R. Squires, C. H. DePuy and V. M. Bierbaum, "Gas Phase Hydrogen-Deuterium Exchange Reactions in Carbanions: Exchange of Vinyl and Aryl Protons by  $\text{D}_2\text{O}$ ," *J. Am. Chem. Soc.* **103**, 4256-4258 (1981).
18. C. H. DePuy and V. M. Bierbaum, "Gas Phase Elimination Reactions of Ethers Induced by Amide and Hydroxide Ions," *J. Am. Chem. Soc.* **103**, 5034-5038 (1981).
19. V. M. Bierbaum, R. J. Schmitt, C. H. DePuy, R. D. Mead, P. A. Schulz and W. C. Lineberger, "Experimental Measurement of the Electron Affinity of the Hydroperoxy Radical," *J. Am. Chem. Soc.* **103**, 6262-6263 (1981).
20. G. K. King, M. M. Maricq, V. M. Bierbaum and C. H. DePuy, "Gas Phase Reactions of Negative Ions with Alkyl Nitrites," *J. Am. Chem. Soc.* **103**, 7133-7140 (1981).
21. C. H. DePuy and V. M. Bierbaum, "Gas-Phase Sulfur Anions: Synthesis and Reactions of  $\text{H}_2\text{NS}^-$  and Related Ions," *Tetrahedron Lett.* **22**, 5129-5130 (1981).
22. R. Damrauer, C. H. DePuy and V. M. Bierbaum, "The Reactions of Trimethylchlorosilane with Various Nucleophiles in the Gas Phase Using the Flowing Afterglow Technique," *Organometallics* **1**, 1553-1554 (1982).
23. C. H. DePuy, J. J. Grabowski and V. M. Bierbaum, "Chemical Reactions of Anions in the Gas Phase," *Science* **218**, 955-960 (1982).
24. C. H. DePuy, E. C. Beedle and V. M. Bierbaum, "The Reactions of Cyclic Ethers with Amide and Hydroxide Ions in the Gas Phase," *J. Am. Chem. Soc.* **104**, 6483-6488 (1982).
25. C. E. Hamilton, M. A. Duncan, T. S. Zwier, J. C. Weisshaar, G. B. Ellison, V. M. Bierbaum and S. R. Leone, "Product Vibrational Analysis of Ion-Molecule Reactions by Laser-Induced Fluorescence in a Flowing Afterglow:  $\text{O}^- + \text{HF} \rightarrow \text{OH}(\nu=0,1) + \text{F}^-$ ," *Chem. Phys. Lett.* **94**, 4-9 (1983).
26. M. A. Smith, V. M. Bierbaum and S. R. Leone, "Infrared Chemiluminescence from Vibrationally Excited  $\text{NO}^+$ : Product Branching in the  $\text{N}^+ + \text{O}_2$  Ion-Molecule Reaction," *Chem. Phys. Lett.* **94**, 398-403 (1983).

27. C. H. DePuy, E. W. Della, J. Filley, J. J. Grabowski and V. M. Bierbaum, "Absence of an  $\alpha$ -Effect in the Gas-Phase Nucleophilic Reactions of  $\text{HOO}^-$ ," *J. Am. Chem. Soc.* **105**, 2481-2482 (1983).
28. J. J. Grabowski, C. H. DePuy and V. M. Bierbaum, "Gas Phase Hydrogen-Deuterium Exchange Reactions of  $\text{HO}^-$  and  $\text{DO}^-$  with Weakly Acidic Neutrals," *J. Am. Chem. Soc.* **105**, 2565-2571 (1983).
29. D. R. Anderson, V. M. Bierbaum and C. H. DePuy, "Gas Phase Chemistry of  $\text{H}_2\text{P}^-$ ," *J. Am. Chem. Soc.* **105**, 4244-4248 (1983).
30. R. R. Squires, V. M. Bierbaum, J. J. Grabowski and C. H. DePuy, "Multiple Proton Transfers Within Long-Lived Ion-Molecule Complexes," *J. Am. Chem. Soc.* **105**, 5185-5192 (1983).
31. D. R. Anderson, V. M. Bierbaum, C. H. DePuy and J. J. Grabowski, "Flowing Afterglow Studies of Organic Positive Ions Generated by Penning Ionization Using Metastable Argon Atoms," *Int. J. Mass Spectrom. Ion Phys.* **52**, 65-94 (1983).
32. M. A. Duncan, V. M. Bierbaum, G. B. Ellison and S. R. Leone, "Laser-induced Fluorescence Studies of Ion Collisional Excitation in a Drift Field: Rotational Excitation of  $\text{N}_2^+$  in Helium," *J. Chem. Phys.* **79**, 5448-5456 (1983).
33. J. M. Oakes, M. E. Jones, V. M. Bierbaum and G. B. Ellison, "Photoelectron Spectroscopy of  $\text{CCO}^-$  and  $\text{HCCO}^-$ ," *J. Phys. Chem.* **87**, 4810-4815 (1983).
34. J. J. Grabowski, J. M. Van Doren, C. H. DePuy and V. M. Bierbaum, "Flowing Afterglow Studies of the Electron Affinity of  $\text{SO}_2$ ," *J. Chem. Phys.* **80**, 575-577 (1984).
35. D. M. Walba, C. H. DePuy, J. J. Grabowski, V. M. Bierbaum, "Oxidation of Alkenes by  $\text{d}^0$  Transition Metal Oxo Species: A Mechanism for the Oxidation of Ethylene by a Dioxo chromium (VI) Complex in the Gas Phase," *Organometallics* **3**, 498-499 (1984).
36. C. E. Hamilton, V. M. Bierbaum, and S. R. Leone, "Vibrational Energy Disposal in Polyatomic Ion-Molecule Reactions:  $\text{SF}_6^- + \text{H,D} \rightarrow \text{SF}_5^- + \text{HF}(v)$ ,  $\text{DF}(v)$ ," *J. Chem. Phys.* **80**, 1831-1838 (1984).
37. V. M. Bierbaum, J. J. Grabowski and C. H. DePuy, "Gas Phase Synthesis and Reactions of Nitrogen- and Sulfur-Containing Anions," *J. Phys. Chem.* **88**, 1389-1393 (1984).
38. V. M. Bierbaum, G. B. Ellison and S. R. Leone, "Flowing Afterglow Studies of Ion Reaction Dynamics Using Infrared Chemiluminescence and Laser Induced Fluorescence," In *Gas Phase Ion Chemistry*, (M. T. Bowers, ed.), Vol. 3, pp 1-39, Academic Press, New York, 1984.
39. C. H. DePuy, V. M. Bierbaum, and R. Damrauer, "Relative Gas Phase Acidities of the Alkanes," *J. Am. Chem. Soc.* **106**, 4051-4053 (1984).
40. D. R. Anderson, C. H. DePuy, J. Filley and V. M. Bierbaum, "Gas Phase Chemistry of Trimethyl Phosphite," *J. Am. Chem. Soc.* **106**, 6513-6517 (1984).
41. C. H. DePuy, J. J. Grabowski, V. M. Bierbaum, S. Ingemann, and N. M. M. Nibbering, "Gas Phase Reactions of Anions with Methyl Formate and N,N-Dimethylformamide," *J. Am. Chem. Soc.* **107**, 1093-1098 (1985).

42. V. M. Bierbaum, J. Filley, C. H. DePuy, M. F. Jarrold and M. T. Bowers, "Kinetic Isotope Effect in Gas Phase Base-Induced Elimination Reactions," *J. Am. Chem. Soc.* **107**, 2818-2820 (1985).
43. C. H. DePuy, V. M. Bierbaum, R. Damrauer, and J. A. Soderquist, "Gas Phase Reactions of the Acetyl Anion," *J. Am. Chem. Soc.* **107**, 3385-3386 (1985).
44. C. E. Hamilton, V. M. Bierbaum and S. R. Leone, "Product Vibrational State Distributions of Thermal Energy Charge Transfer Reactions:  $N^+ + CO \rightarrow CO^+(v=0-2) + N$ ," *J. Chem. Phys.* **83**, 601-610 (1985).
45. C. E. Hamilton, V. M. Bierbaum and S. R. Leone, "Product Vibrational State Distributions of Thermal Energy Charge Transfer Reactions:  $Ar^+ + CO \rightarrow CO^+(v=0-6) + Ar$ ," *J. Chem. Phys.* **83**, 2284-2292 (1985).
46. A. O. Langford, V. M. Bierbaum and S. R. Leone, "Flowing Afterglow Infrared Chemiluminescence Studies of Vibrational Energy Disposal in the Ion-Molecule Reactions  $F^- + HBr, DBr \rightarrow HF, DF + Br^-$ ," *J. Chem. Phys.* **83**, 3913-3918 (1985).
47. A. O. Langford, V. M. Bierbaum and S. R. Leone, "Auroral Implications of Recent Measurements on  $O(^1S)$  and  $O(^1D)$  Formation in the Reaction of  $N^+$  with  $O_2$ ," *Planet. Space Sci.* **33**, 1225 (1985).
48. J. J. Grabowski, C. H. DePuy, J. M. Van Doren and V. M. Bierbaum, "Gas Phase Hydrogen-Deuterium Exchange Reactions of Anions: Kinetics and Detailed Mechanism," *J. Am. Chem. Soc.* **107**, 7384-7389 (1985).
49. A. O. Langford, V. M. Bierbaum and S. R. Leone, "Branching Ratios for Electronically Excited Oxygen Atoms Formed in the Reaction of  $N^+$  with  $O_2$  at 300 K," *J. Chem. Phys.* **84**, 2158-2166 (1986).
50. J. M. Van Doren, S. E. Barlow, C. H. DePuy, V. M. Bierbaum, I. Dotan and E. E. Ferguson, "Chemistry and Structure of the  $CH_3O_2^+$  Product of the  $O_2^+ + CH_4$  Reaction," *J. Phys. Chem.* **90**, 2772-2777 (1986).
51. J. H. Bowie, C. H. DePuy, S. A. Sullivan and V. M. Bierbaum, "Gas Phase Reactions of the Hydroperoxide and Peroxyformate Anions," *Can. J. Chem.* **64**, 1046-1050 (1986).
52. S. E. Barlow, J. M. Van Doren, C. H. DePuy, V. M. Bierbaum, I. Dotan, E. E. Ferguson, D. Smith, N. G. Adams, B. R. Rowe, J. B. Marquette, G. Dupeyrat and M. Durup-Ferguson, "Studies of the Reaction of  $O_2^+$  with Deuterated Methanes," *J. Chem. Phys.* **85**, 3851-3859 (1986).
53. V. M. Bierbaum and S. R. Leone, "Optical Studies of Product State Distributions in Thermal Energy Ion-Molecule Reactions" in "Structure/Reactivity and Thermochemistry of Ions," P. Ausloos and S. G. Lias (eds.); D. Reidel: Dordrecht, Holland; 23-55 (1987).
54. C. H. DePuy and V. M. Bierbaum, "Formation of Anions in the Gas Phase" in "Structure/Reactivity and Thermochemistry of Ions," P. Ausloos and S. G. Lias (eds.); D. Reidel: Dordrecht, Holland; 279-291 (1987).
55. C. H. DePuy and V. M. Bierbaum, "Proton Transfer Reactions of Anions," in "Structure/Reactivity and Thermochemistry of Ions," P. Ausloos and S. G. Lias (eds.); D. Reidel, Dordrecht, Holland; 293-303 (1987).



56. J. M. Van Doren, S. E. Barlow, C. H. DePuy and V. M. Bierbaum, "Tandem Flowing Afterglow-Selected Ion Flow Tube and Its Application to the Thermal Energy Reactions of  $^{18}\text{O}^-$ ," *J. Am. Chem. Soc.* **109**, 4412-4414 (1987).
57. C. H. DePuy, S. E. Barlow, J. M. Van Doren, C. R. Roberts and V. M. Bierbaum, "Gas Phase Chemistry of  $\text{CH}_2^-$ ," *J. Am. Chem. Soc.* **109**, 4414-4415 (1987).
58. J. Filley, C. H. DePuy and V. M. Bierbaum, "Gas Phase Negative Ion Chemistry of Methyl Isocyanide," *J. Am. Chem. Soc.* **109**, 5992-5995 (1987).
59. R. A. Dressler, H. Meyer, A. O. Langford, V. M. Bierbaum and S. R. Leone, "Direct Observation of  $\text{Ba}^+$  Velocity Distributions in a Drift Tube using Single-Frequency Laser-Induced Fluorescence," *J. Chem. Phys.* **87**, 5578-5579 (1987).
60. J. M. Van Doren, S. E. Barlow, C. H. DePuy and V. M. Bierbaum, "The Tandem Flowing Afterglow SIFT-Drift," *Int. J. Mass Spectrom. Ion Proc.* **81**, 85-100 (1987).
61. C. H. DePuy and V. M. Bierbaum, "Ion-Molecule Reactions in a Flowing Afterglow and SIFT," *Spectros. Int. J.* **5**, 95-100 (1987).
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