

Hope A. Michelsen

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Education

Stanford University Ph.D. major in Chemistry and minor in Physics 1/7/93
Dartmouth College A.B. with High Honors in Chemistry 6/10/84

Awards, appointments, and science team membership

Fellow of the American Physical Society (APS) 9/19
Fellow of The Optical Society (OSA) 9/17
Full member of Sigma Xi 12/19
Member of Nominating Committee of the APS Group on the Physics of Climate 10/20 - present
University of Colorado Boulder Research Impact Fellow 1/20 - present
Co-organizer of the Advanced Light Source (ALS) Annual User Meeting 8/20
Elected Member of the Advanced Light Source Users' Executive Committee 11/19 - present
Advanced Light Source (ALS) Proposal Study Panel (LBNL, Dept. of Energy) 6/19 - present
Recipient, Adams Award, Combustion Research Facility, Sandia National Labs 11/18
Gold Medal Selection Committee, Combustion Institute 10/19 - present
Tsuji Award Committee, Combustion Institute 9/18 - present
Program Advisory Committee, 38th International Symposium on Combustion 9/18 - present
Associate Editor, Proceedings of the Combustion Institute 1/18 - present
Linac Coherent Light Source (LCLS) Peer Review Panel (SLAC, Dept. of Energy) 5/17 - present
Science Advisory Board, International Sooting Flame Workshop 2/17 - present
Chair (Co-chair), Colloquium on Soot, 37th (36th) Int'l Symposium on Combustion 8/18 (8/16)
Chair (Vice chair) Gordon Research Conference on Laser Diagnostics in Combustion 8/17 (8/15)
Host, 7th International Workshop on Laser-Induced Incandescence of Soot 6/16
Awardee, Outstanding Women at Sandia National Laboratories 2/14
Inductee, Alameda County Women's Hall of Fame 1/13
Sandia National Laboratories Employee Recognition Award 6/11
Advisory Committee, International Workshop on Laser-Induced Incandescence 9/05 - present
Topical editor, Applied Optics (The Optical Society) 5/02 - 11/05
Award for Excellence in Reviewing (American Geophysical Union) 12/03
SPARC international water vapor assessment panel 3/99 - 3/00
SAGE II (III) (satellite/space station instruments) science team (NASA) 1/96 - 4/99 (3/98 - 3/01)
TOMS (Total Ozone Mapping Spectrometer instrument) science team (NASA) 1/98 - 10/01
NASA Group Achievement Awards: POLARIS (ASHOE/MAESA) (ER-2 missions) 9/97 (11/94)
ATMOS (space shuttle FTIR solar occultation instrument) science team (NASA) 3/94 - end
Postdoctoral Research Fellowship in Chemistry (National Science Foundation) 2/93 - 3/95
Global Change Distinguished Postdoctoral Fellowship (Dept. of Energy) - declined 6/92
Student Award and Nellie Yeoh Whetten Award (American Vacuum Society) 11/92
Chandler T. White 1916 Research Prize (Dartmouth College) 5/84

Papers or book chapters published, in press, or under review for publication

Atmospheric sci. 55; Combustion sci. 45; Surface sci. 20; Total: 120
h-index: Google scholar 50, Scopus 42

Work experience

University of Colorado Boulder Program faculty, Environmental Engineering 7/20 – present
University of Colorado Boulder Associate professor, Mechanical Engineering 8/19 – present
Sandia National Laboratories Technical staff, Combustion Research Facility 7/99 – 8/19
Atmospheric and Environmental Research, Inc. Staff scientist 12/97 - 6/99
Harvard University Postdoctoral research fellow/research associate 2/93 - 10/97
Stanford University and IBM Almaden Research Center Graduate research assistant 6/85 – 1/93

Ph.D. students advised

James Rundel	August 2019 – present
Chaitanya Ghole	August 2019 – present
Jonathan Silberstein	August 2020 - present
Charlotte Thomas	August 2020 - present

Classes taught

Thermodynamics 1 (63 students)	Spring 2020
Thermodynamics 1 (98 students)	Fall 2020

Patents

R. P. Bambha and H. A. Michelsen, "Method and system for multi-pass laser-induced incandescence", *U. S. Patent Office*, Application no. 15239634 (August 17, 2016), Issued 2018.

Recent invited conference talks

- H. A. Michelsen, "A Discussion of Terminology to Describe Soot", *5th International Sooting Flames Workshop*, Adelaide, Australia (remote) (January 2021).
- H. A. Michelsen, "Soot Particles: So Ubiquitous, So Destructive, So Important, Yet So Elusive", *Molecular Understanding Of Atmospheric Aerosols*, Lake Arrowhead, CA (May 2021).
- H. A. Michelsen, "Soot Particles: So Ubiquitous, So Destructive, So Important, Yet So Elusive", *American Association of Aerosol Research Annual Meeting*, Plenary talk, Portland, OR (October 2019).
- H. A. Michelsen, "Using X-Ray Tools to Solve the Mystery of Soot Formation", *Advanced Light Source Annual Users' Meeting*, Berkeley, CA (October 2019).
- H. A. Michelsen, "Solving the Mystery of Soot Particle Inception and Growth", *American Chemical Society Annual Meeting*, San Diego, CA (August 2019).
- H. A. Michelsen, "Using VUV and X-Ray Tools to Solve the Mystery of Soot Formation", *The 40th International Conference on Vacuum Ultraviolet and X-Ray Physics*, Plenary talk, San Francisco, CA (July 2019).
- H. A. Michelsen, "Soot Formation, Growth, and Global Impact: The Life Story of a Mass Murderer", *11th U. S. National Combustion Meeting*, Plenary talk, Pasadena, CA (March 2019).
- H. A. Michelsen, "Mysteries of High-Temperature Particle Formation: Soot, Interstellar Dust, and Novel Materials", *LCLS-II-HE Workshop*, Menlo Park, CA (October 2018).
- H. A. Michelsen, "Probing Soot Formation and Chemical Evolution During Combustion", *Fundamentals in Optics/Laser Science (OSA/APS)*, Washington, DC (September 2018).
- H. A. Michelsen, "Soot Inception: What do we know, and where do we go from here?", *4th International Sooting Flames Workshop*, Keynote talk, Dublin, Ireland (July 2018).
- K. O. Johansson and H. A. Michelsen, "Probing Soot Formation and Chemical Evolution During Combustion", *CLEO*, San Jose, CA (May 2018).
- H. A. Michelsen, "Probing Combustion Chemistry Using Hard X-Rays: Needs, Challenges, and Opportunities", *LCLS-II-HE Workshop*, Menlo Park, CA (September 2016).
- H. A. Michelsen, "Topical Overview: Probing Soot Formation, Chemical and Physical Evolution, and Oxidation: A Review of Diagnostic Techniques and Needs", *36th International Symposium on Combustion*, Seoul, South Korea (August 2016).

Publications (*corresponding authors)

120. H. A. Michelsen*, M. B. Colket, P.-E. Bengtsson, A. D'Anna, P. Desgroux, B. S. Haynes, J. H. Miller, G. J. Nathan, H. Pitsch, and H. Wang "A review of terminology used to describe soot formation and evolution under combustion and pyrolytic conditions", *ACS Nano*, **14**, 12470-12490 (2020) DOI: 10.1021/acsnano.0c06226.

119. H. A. Michelsen*, "Effects of maturity and temperature on soot density and specific heat", *Proc. Combust. Inst.*, **38**, online (2020) DOI: 10.1016/j.proci.2020.06.383.
118. Q. Wang, P. Elvati, D. Kim, K. O. Johansson, P. E. Schrader, H. A. Michelsen*, and A. Violi*, "Spatial dependence of polycyclic aromatic compound growth in counterflow flames", *Carbon*, **149**, 328-335 (2019) DOI: 10.1016/j.carbon.2019.03.017.
117. K. O. Johansson*, M. P. Head-Gordon, P. E. Schrader, K. R. Wilson, and H. A. Michelsen*, "Resonance-stabilized hydrocarbon-radical chain reactions may explain soot inception and growth", *Science* **361**, 997-1000 (2018) DOI: 10.1126/science.aat3417.
116. H. Graven*, M. L. Fischer, T. Lueker, S. Jeong, T. P. Guilderson, R. F. Keeling, R. P. Bambha, K. Brophy, W. Callahan, X. Cui, C. Frankenberg, K. R. Gurney, B. W. LaFranchi, S. J. Lehman, H. A. Michelsen, J. B. Miller, S. Newman, W. Paplawsky, N. C. Parazoo, C. Sloop, and S. J. Walker, "Assessing fossil fuel CO₂ emissions in California using atmospheric observations and models", *Environ. Res. Lett.* **13**, 065007 (2018) DOI: 10.1088/1748-9326/aabd43.
115. M. F. Campbell, P. E. Schrader, A. L. Catalano, K. O. Johansson, G. A. Bohlin, N. K. Richards-Henderson, C. J. Kliewer, and H. A. Michelsen*, "A small porous-plug burner for studies of combustion chemistry and soot formation", *Rev. Sci. Instrum.* **88**, 125106 (2017) DOI: 10.1063/1.5016212.
114. K. O. Johansson, F. El Gabaly, P. E. Schrader, M. F. Campbell, and H. A. Michelsen*, "Evolution of maturity levels of particle surface and bulk during soot growth and oxidation in a flame", *Aerosol Sci. Technol.* **51(12)**, 1333-1344 (2017) DOI: 10.1080/02786826.2017.1355047.
113. K. O. Johansson*, M. F. Campbell, P. Elvati, P. E. Schrader, J. Zádor, N. K. Richards-Henderson, K. R. Wilson, A. Violi, and H. A. Michelsen*, "Photoionization efficiencies of five polycyclic aromatic hydrocarbons", *J. Phys. Chem. A* **121(23)**, 4447-4454 (2017) DOI: 10.1021/acs.jpca.7b02991.
112. K. O. Johansson*, J. Zádor, P. Elvati, M. F. Campbell, P. E. Schrader, N. K. Richards-Henderson, K. R. Wilson, A. Violi, and H. A. Michelsen*, "Critical assessment of photoionization efficiency measurements for characterization of soot-precursor species", *J. Phys. Chem. A* **121(23)**, 4475-4485 (2017) DOI: 10.1021/acs.jpca.7b02992.
111. Y. Y. Cui*, J. Brioude, W. M. Angevine, S. A. McKeen, S.-W. Kim, J. Peischl, J. A. Neuman, D. Henze, N. Bousserez, M. L. Fischer, S. Jeong, Z. Liu, R. P. Bambha, H. A. Michelsen, G. W. Santoni, B. C. Daube, E. A. Kort, G. J. Frost, T. B. Ryerson, S. C. Wofsy, and M. Trainer, "Top-down estimate of methane emissions in California using a mesoscale inverse modeling technique: The San Joaquin Valley", *J. Geophys. Res.* **122(6)**, 3686-3699 (2017) DOI: 10.1002/2016JD026398.
110. S. Jeong*, X. Cui, D. R. Blake, B. Miller, S. Montzka, A. E. Andrews, A. Guha, P. Martien, R. P. Bambha, B. F. LaFranchi, H. A. Michelsen, C. Clements, P. Glaize, and M. L. Fischer, "Estimating methane emissions from biological and fossil-fuel sources in the San Francisco Bay Area", *Geophys. Res. Lett.* **44**, 486-495 (2017) DOI: 10.1002/2016GL071794.
109. H. A. Michelsen*, "Probing soot formation, chemical and physical evolution, and oxidation: A review of *in situ* diagnostic techniques and needs", *Proc. Combust. Inst.* **36**, 717-735 (2017) DOI: 10.1016/j.proci.2016.08.027.
108. K. O. Johansson, T. Dillstrom, P. Elvati, M. F. Campbell, P. E. Schrader, D. M. Popolan-Vaida, N. K. Richards-Henderson, K. R. Wilson, A. Violi, and H. A. Michelsen*, "Radical-radical reactions, pyrene nucleation, and incipient soot formation in combustion", *Proc. Combust. Inst.* **36**, 799-806 (2017) DOI: 10.1016/j.proci.2016.07.130.
107. S. Jeong*, S. Newman, J. Zhang, A. E. Andrews, L. Bianco, J. Bagley, X. Cui, H. Graven, J. Kim, P. Salameh, B. F. LaFranchi, C. Priest, M. Campos-Pineda, E. Novakovskaia, C. D. Sloop, H. A. Michelsen, R. P. Bambha, R. F. Weiss, R. Keeling, and M. L. Fischer, "Estimating methane emissions in California's urban and rural regions using multi-tower observations", *J. Geophys. Res. Atmos.* **121**, 13,031-13,049 (2016) DOI: 10.1002/2016JD025404.

106. M. F. Campbell, A. Bohlin, P. E. Schrader, R. P. Bambha, C. J. Kliewer, K. O. Johansson, and H. A. Michelsen*, "Design and characterization of a linear Hencken-type burner", *Rev. Sci. Instrum.* **87**, 115114 (2016) DOI: 10.1063/1.4967491.
105. K. O. Johansson, T. Dillstrom, M. F. Campbell, M. Monti, F. El Gabaly, P. E. Schrader, D. M. Popolan-Vaida, N. K. Richards-Henderson, K. R. Wilson, A. Violi*, and H. A. Michelsen*, "Formation and emission of large furans and oxygenated hydrocarbons from flames", *Proc. Natl. Acad. Sci. USA* **113**, 8374-8379 (2016) DOI: 10.1073/pnas.1604772113.
104. R. P. Bambha and H. A. Michelsen*, "Effects of aggregate morphology and size on laser-induced incandescence and scattering from black carbon (mature soot)", *J. Aerosol Sci.* **88**, 159-181 (2015) DOI: 10.1016/j.jaerosci.2015.06.006.
103. H. A. Michelsen, C. Schulz, G. J. Smallwood, and S. Will*, "Laser-induced incandescence: Particulate diagnostics for combustion, atmospheric, and industrial applications", *Progress Energy Combust. Sci.* **51**, 2-48 (2015) DOI: 10.1016/j.pecs.2015.07.001.
102. K. O. Johansson, J. Y. W. Lai, S. A. Skeen, D. M. Popolan-Vaida, K. R. Wilson, N. Hansen, A. Violi, and H. A. Michelsen*, "Soot precursor formation and limitations of the stabilomer grid", *Proc. Combust. Inst.* **35**, 1819-1826 (2015) DOI: 10.1016/j.proci.2014.05.033.
101. A. Nanthamornphong, J. C. Carver, K. Morris, H. A. Michelsen, and D. W. I. Rouson*, "Building CLiME via test-driven development: A case study", *Comput. Sci. Eng.* **16(3)**, 36-46 (2014).
100. X. López-Yglesias, P. E. Schrader, and H. A. Michelsen*, "Soot maturity and absorption cross sections", *J. Aerosol Sci.* **75**, 43-64 (2014) DOI: 10.1016/j.jaerosci.2014.04.011.
99. N. Hansen*, S. A. Skeen*, H. A. Michelsen*, K. R. Wilson*, and K. Kohse-Höinghaus*, "Flame experiments at the Advanced Light Source: New insights into soot formation processes", *Journal of Visualized Experiments (JoVE)* **87**, e51369 (2014) DOI: 10.3791/51369.
98. Z. Liu, R. P. Bambha*, J. Pinto, T. Zeng, J. Boylan, M. Huang, H. Lei, C. Zhao, S. Liu, J. Mao, C. Schwalm, X. Shi, Y. Wei, and H. A. Michelsen, "Toward verifying fossil fuel CO₂ emissions from the CMAQ model: Motivation, model description, and initial simulation", *J. Air Waste Manage. Assoc.* **64(4)**, 419-435 (2014) DOI: 10.1080/10962247.2013.816642.
97. R. P. Bambha, M. A. Dansson, P. E. Schrader, and H. A. Michelsen*, "Effects of volatile coatings on the laser-induced incandescence of soot", *Appl. Phys. B* **112(3)**, 343-358 (2013).
96. R. P. Bambha, M. A. Dansson, P. E. Schrader, and H. A. Michelsen*, "Effects of volatile coatings and coating removal mechanisms on the morphology of graphitic soot", *Carbon* **61**, 80-96 (2013).
95. F. Goulay, P. E. Schrader, X. López-Yglesias, and H. A. Michelsen*, "A dataset for validation of models of laser-induced incandescence from soot: Temporal profiles of LII signal and particle temperature", *Appl. Phys. B* **112(3)**, 287-306 (2013).
94. J. M. Headrick, P. E. Schrader, and H. A. Michelsen*, "Radial-profile and divergence measurements of combustion-generated soot focused by an aerodynamic-lens system", *J. Aerosol Sci.* **58**, 158-170 (2013).
93. S. A. Skeen, H. A. Michelsen, K. R. Wilson, D. M. Popolan, A. Violi, and N. Hansen*, "Near-threshold photoionization mass spectra of combustion-generated high-molecular-weight soot precursors", *J. Aerosol Sci.* **58**, 86-102 (2013). DOI: 10.1016/j.jaerosci.2012.12.008.
92. S. A. Skeen, B. Yang, H. A. Michelsen, J. A. Miller, A. Violi, and N. Hansen*, "Studies of laminar opposed-flow diffusion flames of acetylene at low pressures with photoionization mass spectrometry", *Proc. Combust. Inst.* **34**, 1067-1075 (2013).
91. H. A. Michelsen*, P. E. Schrader, and F. Goulay, Erratum to "Wavelength and temperature dependences of the absorption and scattering cross sections of soot" [*Carbon* 48 (2010) 2175-2191], *Carbon* **50**, 740 (2012).
90. J. M. Headrick, F. Goulay, P. E. Schrader, and H. A. Michelsen*, "High-vacuum time-resolved laser-induced incandescence of flame-generated soot", *Appl. Phys. B* **104**, 439-450 (2011).

89. H. A. Michelsen*, P. E. Schrader, and F. Goulay "Wavelength and temperature dependences of the absorption and scattering cross sections of soot", *Carbon* **48**, 2175-2191 (2010).
88. F. Goulay, P. E. Schrader, and H. A. Michelsen*, "Effect of the wavelength dependence of the emissivity on inferred soot temperatures measured by spectrally resolved laser-induced incandescence", *Appl. Phys. B* **100**, 655-663 (2010).
87. B. Zak*, B. Bader, R. Bambha, H. Michelsen, M. Boslough, M. Moorman, and A. Jacobson, "Reduction of uncertainties in remote measurement of greenhouse gas fluxes", *2010 IEEE Aerospace Conference*, Accession # 11258446 (2010).
86. F. Goulay, L. Nemes, P. E. Schrader, and H. A. Michelsen*, "Spontaneous emission from $C_2(d^3\Pi_g)$ and $C_3(A^1\Pi_u)$ during laser irradiation of soot particles", *Mol. Phys.* **108**, 1013-1025 (2010).
85. F. Goulay, P. E. Schrader, and H. A. Michelsen*, "The effects of pulsed laser injection seeding and triggering on the temporal behavior and magnitude of laser-induced incandescence from soot", *Appl. Phys. B* **96(4)**, 613-621 (2009).
84. H. A. Michelsen*, "Derivation of a temperature-dependent accommodation coefficient for use in modeling laser-induced incandescence of soot", *Appl. Phys. B* **94**, 103-117 (2009).
83. F. Goulay, P. E. Schrader, L. Nemes, M. A. Dansson, and H. A. Michelsen*, "Photochemical interferences for laser-induced incandescence of flame-generated soot", *Proc. Comb. Inst.* **32**, 963-970 (2009).
82. H. A. Michelsen*, M. A. Linne, B. F. Kock, M. Hofmann, B. Tribalet, and C. Schulz, "Modeling laser-induced incandescence of soot: Enthalpy changes during sublimation, conduction, and oxidation", *Appl. Phys. B* **93**, 645-656 (2008).
81. M. A. Dansson, M. Boisselle, M. A. Linne, and H. A. Michelsen*, "Complications to optical measurements using a laser with an unstable resonator: A case study on laser-induced incandescence of soot", *Appl. Opt.* **46**, 8095-8103 (2007).
80. H. A. Michelsen* et al., "Modeling laser-induced incandescence of soot: A summary and comparison of LII models", *Appl. Phys. B* **87**, 503-521 (2007).
79. L. Nemes*, A. M. Keszler, C. G. Parigger, J. O. Hornkohl, H. A. Michelsen, and V. Stakhursky, "On spontaneous emission from the C_3 radical in carbon plasma", *Appl. Opt.* **46**, 4032-4040 (2007).
78. H. A. Michelsen*, A. V. Tivanski, M. K. Gilles, L. H. van Poppel, M. A. Dansson, and P. R. Buseck, "Particle formation from pulsed laser irradiation of soot aggregates studied with a scanning mobility particle sizer, a transmission electron microscope, and a scanning transmission x-ray microscope", *Appl. Opt.* **46**, 959-977 (2007).
77. C. Schulz*, B. F. Kock, M. Hofmann, H. A. Michelsen, S. Will, B. Bougie, R. Suntz, and G. Smallwood, "Laser-induced incandescence: Recent trends and current questions", *Appl. Phys. B* **83**, 333-354 (2006).
76. H. A. Michelsen*, "Laser-induced incandescence of flame-generated soot on a picosecond timescale", *Appl. Phys. B* **83**, 443-448 (2006).
75. L. Nemes*, A. M. Keszler, C. G. Parigger, J. O. Hornkohl, H. A. Michelsen, and V. Stakhursky, "The C_3 puzzle: Formation of and spontaneous emission from the C_3 radical in carbon plasmas", *Int. Elect. J. Mol. Design* **5**, 150-167 (2006).
74. P. O. Witze*, M. Y. Gershenson, and H. A. Michelsen, "Dual-laser LIDELS: An optical diagnostic for time-resolved volatile fraction measurements of diesel particulate emissions", *Proc. SAE*, SAE paper #2005-01-3791 (2005).
73. B. K. Pun*, C. Seigneur, and H. A. Michelsen, "Atmospheric Transformations", in *Air Pollution Modeling: Theories, Computational Methods, and Available Software*, 2nd edition, Vol. 2, P. Zannetti, Ed., Van Nostrand Reinhold, New York, Chapter 12 (2005).

72. E.-W. Chiou*, L. W. Thomason, S. P. Burton, and H. A. Michelsen, "Assessment of the SAGE II version 6.2 water vapor data set through intercomparison with ATMOS/ATLAS-3 measurements", *Geophys. Res. Lett.* **31**, L14101 (2004). DOI: 10.1029/2004GL020071
71. H. A. Michelsen*, P. O. Witze, D. Kayes, and S. Hochgreb, "Time-resolved laser-induced incandescence of soot: The influence of experimental factors and microphysical mechanisms", *Appl. Opt.* **42**, 5577-5590 (2003).
70. H. A. Michelsen*, "Understanding and predicting the temporal response of laser-induced incandescence from carbonaceous particles", *J. Chem. Phys.* **118**, 7012-7045 (2003).
69. F. W. Irion* et al., "Atmospheric Trace Molecule Spectroscopy (ATMOS) Experiment Version 3 data retrievals", *Appl. Opt.* **41**, 6968-6979 (2002).
68. H. A. Michelsen* et al., "ATMOS Version 3 water vapor measurements: Comparisons with observations from two ER-2 Lyman- α hygrometers, MkIV, HALOE, SAGE II, MAS, and MLS", *J. Geophys. Res.* **107**, 10.1029 ACH 2, 1-19 (2002).
67. P. O. Witze*, S. Hochgreb, D. Kayes, H. A. Michelsen, and C. R. Shaddix, "Time-resolved laser-induced incandescence and laser elastic scattering measurements in a propane diffusion flame", *Appl. Opt.* **40**, 2443-2452 (2001).
66. H. A. Michelsen*, "The reaction of Cl with CH₄: A connection between kinetics and dynamics", *Acc. Chem. Res.* **34**, 331-337 (2001).
65. H. A. Michelsen*, "Carbon and hydrogen kinetic isotope effects for the reaction of Cl with CH₄: Consolidating chemical kinetics and molecular dynamics measurements", *J. Geophys. Res.* **106**, 12,267-12,274 (2001).
64. G. L. Manney*, H. A. Michelsen et al., "Comparison of satellite ozone observations in coincident air masses in early November 1994", *J. Geophys. Res.* **106**, 9923-9943 (2001).
63. H. A. Michelsen* and W. R. Simpson, "Relating state-dependent cross sections to non-Arrhenius behavior for the Cl+CH₄ reaction", *J. Phys. Chem. A* **105**, 1476-1488 (2001).
62. K. H. Rosenlof et al., "Stratospheric water vapor increases over the past half century", *Geophys. Res. Lett.* **28**, 1195-1198 (2001).
61. H. A. Michelsen*, G. L. Manney, J. M. Russell III, P. N. Purcell, E. E. Remsberg, F. W. Irion, G. C. Toon, and M. R. Gunson, edited by D. Kley, *Stratospheric Processes and their Role in Climate: Water Vapor Assessment*, World Climate Research Programme of WMO/ICSU/IOC, WCRP-113, WMO/TD-1043, Chapters 1.3.4, 2.3.4, and 2.4.1 (2000).
60. H. A. Michelsen*, F. W. Irion, G. L. Manney, G. C. Toon, and M. R. Gunson, "Features and trends in Atmospheric Trace Molecule Spectroscopy (ATMOS) Version 3 water vapor and methane measurements", *J. Geophys. Res.* **105**, 22,713-22,724 (2000).
59. A. McIlroy*, T. D. Hain, H. A. Michelsen, and T. A. Cool, "A laser and molecular beam mass spectrometer study of low-pressure dimethyl ether flames", *Proc. Combust. Inst.* **28**, 1647-1653 (2000).
58. G. L. Manney*, H. A. Michelsen, F. W. Irion, G. C. Toon, M. R. Gunson, and A. E. Roche, "Lamination and polar vortex development in fall from ATMOS long-lived trace gases observed during November 1994", *J. Geophys. Res.* **105**, 29,023-29,038 (2000).
57. C. R. Webster*, H. A. Michelsen et al., "Response of lower stratospheric HCl/Cl_y to volcanic aerosol: Observations from aircraft, balloon, space shuttle, and satellite instruments", *J. Geophys. Res.* **105**, 11,711-11,719 (2000).
56. H. A. Michelsen* et al., "Maintenance of high HCl/Cl_y and NO_x/NO_y in the Antarctic vortex: A chemical signature of confinement during spring", *J. Geophys. Res.* **104**, 26,419-26,436 (1999).
55. G. L. Manney*, H. A. Michelsen, M. L. Santee, M. R. Gunson, A. E. Roche, and N. J. Livesey, "Polar vortex dynamics during spring and fall diagnosed using trace gas observations from the Atmospheric Trace Molecule Spectroscopy instrument", *J. Geophys. Res.* **104**, 18,841-18,866 (1999).

54. H. A. Michelsen*, C. M. Spivakovsky, and S. C. Wofsy, "Aerosol-mediated partitioning of stratospheric Cl_y and NO_y at temperatures above 200 K", *Geophys. Res. Lett.* **26**, 299-302 (1999).
53. H. A. Michelsen* et al., "Intercomparison of ATMOS, SAGE II, and ER-2 observations in Arctic vortex and extra-vortex air masses during spring 1993", *Geophys. Res. Lett.* **26**, 291-294 (1999).
52. H. Jost*, M. Loewenstein, L. Pfister, J. J. Margitan, A. Y. Chang, R. J. Salawitch, and H. A. Michelsen, "Laminae in the tropical middle stratosphere: Origin and age estimation", *Geophys. Res. Lett.* **25**, 4337-4340 (1998); correction *Geophys. Res. Lett.* **26**, 479 (1999).
51. H. A. Michelsen*, "A parameterization for the activity of H^+ in aqueous sulfuric acid solutions", *Geophys. Res. Lett.* **25**, 3571-3573 (1998).
50. R. J. Barnes*, A. Sinha, and H. A. Michelsen, "Assessing the contribution of the lowest triplet state to the near UV absorption spectrum of HOCl ", *J. Phys. Chem. A* **102**, 8855-8859 (1998).
49. H. A. Michelsen*, G. L. Manney, M. R. Gunson, and R. Zander, "Correlations of stratospheric abundances of NO_y , O_3 , N_2O , and CH_4 derived from ATMOS measurements", *J. Geophys. Res.* **103**, 28,347-28,359 (1998).
48. H. A. Michelsen*, G. L. Manney, M. R. Gunson, C. P. Rinsland, and R. Zander, "Correlations of stratospheric abundances of CH_4 and N_2O derived from ATMOS measurements", *Geophys. Res. Lett.* **25**, 2777-2780 (1998).
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