

HANS MOOSMÜLLER

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EDUCATION

Ph.D.	Physics	1988	Colorado State University, Fort Collins, CO
DIPLOM (M.S.)	Physics	1982	Ludwigs-Maximilians Universität, München

RESEARCH EXPERIENCE

Dr. Moosmüller's interests include experimental and theoretical research in optical spectroscopy as well as its applications to atmospheric and aerosol physics. Currently, his research focuses on development and application of real time, *in situ* measurement methods for aerosol light absorption, scattering, and extinction, and new optical remote sensing techniques. These measurement methods are being used both for ambient air monitoring and for vehicle, fugitive dust, and biomass burning emission studies. Dr. Moosmüller has also participated in the planning, field work, and data analysis of major air quality studies including SNAQS (Southern Nevada Air Quality Study, 1999-2005), CCOS (Central California Ozone Study, 2000), BRAVO (Big Bend Regional Aerosol & Visibility Observational Study, 1999), SCOS97 (Southern California Ozone Study, 1997), NFRAQS (Northern Front Range Air Quality Study, Colorado, 1996-1997), CRPAQS (California Regional Particulate Air Quality Study, 1993-2003), and COAST (Coastal Oxidant Assessment for Southeast Texas, 1993). During his first three years at DRI, he was responsible for the airborne ozone lidar research program under the cooperative agreement with the USEPA.

Before joining DRI, Dr. Moosmüller was at Colorado State University where he investigated Brillouin light scattering of spin waves and millimeter-wave effective linewidths in thin metal films. He also did research on high-spectral-resolution lidar and coherent light scattering techniques. This work included the development of supersonic flow measurement techniques and the investigations of spectral line shapes. His earlier work at the Ludwigs-Maximilians Universität in Munich and the Max Planck Institute for Quantum Optics in Garching focused on laser remote sensing.

PROFESSIONAL EXPERIENCE

2000 - Present	<i>Research Professor</i> Desert Research Institute, University of Nevada System, Reno, NV
1995 - Present	<i>Graduate Faculty</i> Physics Department, University of Nevada, Reno, NV Atmospheric Sciences Program, University of Nevada, Reno, NV
1995 - 2000	<i>Associate Research Professor</i> Desert Research Institute, University of Nevada System, Reno, NV

- 1991 - 1995 *Assistant Research Professor*
Desert Research Institute, University of Nevada System, Reno & Las Vegas, NV
- 1988 - 1990 *Postdoctoral Research Associate*
Magnetics Laboratory, Colorado State University, Fort Collins, CO
- 1982 - 1988 *Graduate Research and Teaching Assistant*
Geoscience Center, Nonlinear Optics Laboratory, and Physics Department, Colorado State University, Fort Collins, CO
- 1980 - 1982 *Graduate Research Assistant*
Physics Department, Ludwigs-Maximilians Universität, München, Germany and Max Planck Institute for Quantum Optics, Garching, Germany
- Summer 1979 *Intern*
IBM München, Germany
- Summer 1977 *Intern*
Bayer Dormagen, Germany

PROFESSIONAL ACTIVITIES

Graduate Student Adviser

- Mr. Ali Abu-Rahmah (2005 – present)
Mr. Rajan K. Chakraborty (2004 - present)
Dr. Claudio Mazzoleni (Ph.D. 2003)
Dr. Ravi Varma (Ph.D. 2003)
Dr. Joseph D. Vance (M.S. 1998)

Conferences

- Chair, Session 2, Optical Monitoring Methods, *Regional and Global Perspectives on Haze: Causes, Consequences, and Controversies (Visibility Specialty Conference)*, Asheville, NC, October 25-29, 2004.
- Topic Leader, Topic #8: What New and Innovative Sampling, Analytical, and Interpretive Techniques are Needed to Determine the Properties and Sources of Carbonaceous Aerosol in the Atmosphere? *International Workshop for the Development of Research Strategies for the Sampling and Analysis of Organic and Elemental Carbon Fractions in Atmospheric Aerosol (OC/EC Workshop)*, Durango, CO, March 4-5, 2003.
- Chair, Session 106: Remote Sensing of Chemical Species in the Atmosphere, *87th Annual Meeting of the Air & Waste Management Association*, Cincinnati, OH, June 19-24, 1994.
- Co-Chair, Session 21: Atmospheric Spectroscopy and Source Emissions Characterization, *II, International Symposium on Optical Sensing for Environmental Monitoring*, Atlanta, GA, October 12-14, 1993.

Awards

- Gillies, J. A., N. Lancaster, H. D. Kuhns, H. Moosmüller, E. McDonald, D. Gillette, and W. Nickling (2004). SERDP project (CP-1191) “Characterizing and Quantifying Local and Regional Particulate Matter Emissions from Department of Defense Installations”, SERDP Compliance Project of the Year.

Select Committees

Member, External Review Committee, Los Alamos National Laboratory (LANL) Laboratory Directed Research and Development (LDRD), Resolving the Aerosol-Climate-Water Puzzle (2005-present)

Member, Adjunct Science Team, Department of Energy's Atmospheric Science Program (2005-present)

Chair, Bylaws Committee, Atmospheric Sciences Program, University of Nevada, Reno (2005-present)

Member, Desert Research Institute's Research Affairs Committee (2003-present)

Chair, Desert Research Institute, Division of Atmospheric Sciences' Promotion Committee (2003-present)

Member, Desert Research Institute's Library Committee (2002-present)

Member, Desert Research Institute's Senior Research Council (2000-present)

Member, Air & Waste Management Association's Technical Committee AB-2, Chemistry (1993-2002)

Member, Desert Research Institute's Faculty Senate (1998-2001)

Member, American Meteorological Society's Committee on Laser Atmospheric Studies (1995-1998)

Manuscript Review

Aerosol Science and Technology,
American Institute of Aeronautics and Astronautics (AIAA) Journal,
Applied Optics,
Atmospheric Chemistry and Physics
Atmospheric Environment,
Computers and Electronics in Agriculture
Environmental Engineering Science,
Environmental Science and Technology,
Journal of Aerosol Science,
Journal of Applied Meteorology,
Journal of Geophysical Research,
Journal of the Air & Waste Management Association,
Optics Express,
Optics Letters
Science of the Total Environment
Society of Automotive Engineers (SAE) Transactions

Proposal Review

Army Research Office,
Department of Energy,
Department of Defense EPSCoR Program,
NASA Earth Science Enterprise,
National Oceanic and Atmospheric Administration,
National Science Foundation,
Research Corporation
U.S. Civilian Research and Development Foundation

Membership

Air & Waste Management Association
American Association for Aerosol Research
American Geophysical Union
Optical Society of America

RESEARCH GRANTS AND CONTRACTS (TOTAL FUNDING OF \$15,921,134)

Title: Characterizing Particulate Matter Emissions by Wildland Fires Relevant to Visibility Impairment and PM Non-Attainment

Investigators: H. Moosmüller and W. P. Arnott

Duration: November 1, 2005 – October 31, 2008

Sponsor: Joint Fire Science Program (JFSP) through US National Park Service (NPS)

Funding: \$ 329,793

Title: Laboratory Measurements of Aerosol Scattering and Extinction Properties

Investigators: H. Moosmüller

Duration: October 1, 2005 – September 30, 2008

Sponsor: National Institute for Global Environmental Change (NIGEC) of the Department of Energy (DOE) through Colorado State University

Funding: \$ 138,501

Title: Acquisition of an X-Ray Diffractometer (EAR-0521619)

Investigators: J. Engelbrecht, E. V. McDonald, H. Moosmüller, J. A. Gillies, and J. R. McConnell

Duration: September 15, 2005 – August 31, 2007

Sponsor: National Science Foundation, Division of Atmospheric Sciences, Major Research Instrumentation Program

Funding: \$ 269,163

Title: Developing Advanced Optical Methods for the Sensitive Detection of Mercury Concentrations in the Atmosphere and Mercury Fluxes into the Atmosphere

Investigators: H. Moosmüller

Duration: August 1, 2005 – July 31, 2008

Sponsor: NSHE – NSF EPSCoR

Funding: \$ 262,791

Title: Aerosol Light Absorption and Climate: Quantification by the Photoacoustic Method (DE-FG02-05ER64008)

Investigators: W. P. Arnott, H. Moosmüller, and J. Xu

Duration: February 1, 2005 – January 31, 2008

Sponsor: Department of Energy, Atmospheric Sciences Program (DOE ASP)

Funding: \$ 409,274

Title: Climate Change – Characterization of Black Carbon and Organic Carbon Air Pollution Emissions and Evaluation of Measurement Methods

Investigators: J. C. Chow, P. W. Barber, J. G. Watson, H. Moosmüller, W. P. Arnott, D. H. Lowenthal, M.-C. O. Chang, L.W. A. Chen, and K. K. Fung

Duration: January 1, 2005 – December 31, 2007
Sponsor: California Air Resources Board, Research Division
Funding: \$ 449,997

Title: Particulate Matter Emissions Factors for Dust from Unique Military Activities (CP-1399)
Investigators: J. A. Gillies, H. Moosmüller, V. Etyemezian, H. D. Kuhns, W. P. Arnott, and J. G. Watson

Duration: September 1, 2004 – December 31, 2008
Sponsor: Department of Defense, Strategic Environmental Research & Development Program (SERDP)
Funding: \$ 1,698,400

Title: Measurement, Modeling and Analysis Methods for Airborne Carbonaceous Fine Particulate Matter (PM_{2.5})
Investigators: J. C. Chow, J. G. Watson, H. Moosmüller, W. P. Arnott, P. W. Barber, and L.-W. Chen

Duration: October 1, 2003 – September 30, 2006
Sponsor: Environmental Protection Agency, Science to Achieve Results (STAR) Research Grants Program
Funding: \$ 449,547

Title: Measurements and Modeling of Diesel Exhaust Emissions from Engines Used by the U.S. Military (CP-1336)
Investigators: J. G. Watson, H. Moosmüller, H. D. Kuhns, and P. W. Barber

Duration: April 1, 2003 – January 31, 2007
Sponsor: Department of Defense, Strategic Environmental Research & Development Program (SERDP)
Funding: \$ 2,495,274

Title: Optical Properties of Particulate Matter Emitted by Fires (Pilot Study)
Investigators: H. Moosmüller and W. P. Arnott

Duration: March 31, 2003 – December 31, 2004
Sponsor: Department of Agriculture – Forest Service
Funding: \$ 58,708

Title: 2003 Aerosol IOP at DOE's ARM Site
Investigators: W. P. Arnott and H. Moosmüller

Duration: March 17, 2003 – December 31, 2003
Sponsor: Department of Energy, Pacific Northwest National Laboratory
Funding: \$ 126,489

Title: Development of an Instrument for Multi-Spectral Measurement of Atmospheric Light Absorption (ATM-0340423)
Investigators: W. P. Arnott and H. Moosmüller

Duration: August 15, 2002 – August 14, 2005
Sponsor: National Science Foundation, Division of Atmospheric Sciences, Major Research Instrumentation Program
Funding: \$ 835,490

Title: Use of Novel Infrared Light Emitting Diodes (LEDs) for the Remote Sensing of Automotive Emissions
Investigator: H. Moosmüller
Duration: July 1, 2002 - June 30, 2004
Sponsor: Desert Research Institute, Institute Project Assignment
Funding: \$ 11,500

Title: In Situ Aerosol Absorption Measurement Characterization Experiment
Investigators: W. P. Arnott and H. Moosmüller
Duration: May 2, 2002 – May 2, 2003
Sponsor: Department of Energy, Pacific Northwest National Laboratory
Funding: \$ 67,738

Title: Southern Nevada Air Quality Study: Phase III
Investigators: J. G. Watson, P. W. Barber, and H. Moosmüller
Duration: September 1, 2001 – September 30, 2005
Sponsor: Department of Transportation, Federal Transit Authority
Funding: \$ 777,000

Title: Southern Nevada Air Quality Study: Phase II
Investigators: J. G. Watson, P. W. Barber, H. Moosmüller, and R. E. Keislar,
Duration: May 1, 2001 - December 31, 2002
Sponsor: Department of Transportation, Federal Transit Authority
Funding: \$ 435,500

Title: Gasoline/Diesel PM Split Study: Chemical Analysis, Ambient Sampling, and Apportionment Phase
Investigators: E. M. Fujita, W. P. Arnott, H. Moosmüller, J. Sagebiel, J. Chow, and B. Zielinska
Duration: March 15, 2001 – September 30, 2002
Sponsor: Department of Energy, National Renewable Energy Laboratory
Funding: \$ 754,299

Title: Characterizing and Quantifying Local and Regional Particulate Matter Emissions from Department of Defense Installations (CP-1191)
Investigators: J. A. Gillies, N. Lancaster, H. D. Kuhns, H. Moosmüller, E. McDonald, D. Gillette, and W. Nickling
Duration: February 1, 2001 – January 31, 2004
Sponsor: Department of Defense, Strategic Environmental Research & Development Program (SERDP)
Funding: \$ 938,253

Title: Photoacoustic Instrument
Investigators: W. P. Arnott and H. Moosmüller
Duration: October 16, 2000 – December 31, 2000
Sponsor: Max Planck Institute for Chemistry, Germany
Funding: \$ 67,995

Title: CRC Project No. E-56: Instrumentation Field Demonstration
Investigators: R. E. Keislar, H. Moosmüller, and J. G. Watson
Duration: September 1, 2000 - March 31, 2001
Sponsor: Coordinating Research Council
Funding: \$ 32,604

Title: BRAVO: Special Aerosol Light Absorption and Extinction Measurements
Investigators: H. Moosmüller and W. P. Arnott
Duration: October 1, 1999 - September 30, 2000
Sponsor: CIASTA, National Park Service
Funding: \$ 77,800

Title: Aerosol Light Absorption Measurements
Investigators: W. P. Arnott and H. Moosmüller
Duration: July 15, 1999 - July 14, 2000
Sponsor: Department of Energy, Pacific Northwest National Laboratory
Funding: \$ 23,454

Title: Photoacoustics of Aerosols
Investigators: W. P. Arnott and H. Moosmüller
Duration: July 1, 1999 - June 30, 2000
Sponsor: Office of Naval Research through University of Mississippi, National Center for Physical Acoustics
Funding: \$ 27,343

Title: Southern Nevada Air Quality Study: Phase I
Investigators: J. G. Watson H. Moosmüller, R. E. Keislar, M. C. Green, and W. R. Stockwell
Duration: May 14, 1999 - December 31, 2002
Sponsor: Department of Transportation, Federal Transit Authority
Funding: \$ 999,742

Title: Characterization of Particulate Emissions: Size Fractionation and Chemical Characterization (CP-1106)
Investigators: E. Fujita, W. P. Arnott, H. Moosmüller, J. C. Sagebiel, B. Zielinska
Duration: May 1, 1998 – May 31, 2002
Sponsor: Department of Defense, Strategic Environmental Research & Development Program (SERDP) through University of Utah
Funding: \$ 565,118

Title: Simple Particulate Emission Measuring System
Investigators: H. Moosmüller and W. R. Pierson
Duration: September 30, 1998 - February 29, 2000
Sponsor: Department of Energy, Office of Transportation Technologies
Funding: \$ 269,002

Title: Development of Instrumentation to Measure Atmospheric Light Extinction and its Scattering and Absorption Components (ATM-9871192)

Investigators: H. Moosmüller and W. P. Arnott

Duration: August 28, 1998 - July 31, 2002

Sponsor: National Science Foundation, Division of Atmospheric Sciences,
Major Research Instrumentation Program

Funding: \$ 804,645

Title: Atmospheric Aerosol Correction for Airborne Hyperspectral Measurements

Investigators: H. Moosmüller, D. Koracin, and M. Wetzel

Duration: May 26, 1998 - March 31, 2000

Sponsor: Department of Energy through Bechtel, Center for Excellence in Remote Sensing

Funding: \$ 178,862

Title: SCOS97 Quality Assurance Management

Investigators: E. Fujita, H. Moosmüller, M. Green, and J. Bowen

Duration: June 1, 1997 - December 31, 1997

Sponsor: Ventura County Air Pollution Control District

Funding: \$ 56,132

Title: CEDAR: An Operational CW Solid-State Laser System for Temperature and Wind Measurements in the Mesopause

Investigator: H. Moosmüller

Duration: January 1, 1997 - May 31, 1999

Sponsor: National Science Foundation, Division of Atmospheric Sciences,
Upper Atmosphere Research Section

Funding: \$ 77,341

Title: An Interferometric Turbulence Sensor

Investigator: H. Moosmüller

Duration: January 1, 1996 - June 30, 1998

Sponsor: Desert Research Institute, Institute Project Assignment

Funding: \$ 11,783

Title: CEDAR: Approaching an Ultimate Lidar for Temperature and Wind Measurements in the Mesopause Region

Investigator: H. Moosmüller

Duration: July 1, 1994 - December 31, 1996

Sponsor: National Science Foundation, Division of Atmospheric Sciences,
Upper Atmosphere Research Section

Funding: \$ 206,447

Title: Analysis of UV-DIAL Data Taken During the COAST Study

Investigator: H. Moosmüller

Duration: April 1, 1994 - December 31, 1994

Sponsor: Texas Natural Resource Conservation Commission

Funding: \$ 85,731

Title: A New Lidar Method Utilizing Elastic and Raman Scattering for the Measurement of Backscattering and Extinction Profiles

Investigator: H. Moosmüller

Duration: January 1, 1994 - June 30, 1994

Sponsor: Desert Research Institute, Institute Project Assignment

Funding: \$ 9,760

Title: Advanced Methods to Measure Light Absorption by Aerosol Particles

Investigators: W. P. Arnott, H. Moosmüller, and C. F. Rogers

Duration: November 1, 1993 - October 30, 1997

Sponsor: Environmental Protection Agency, Office of Exploratory Research

Funding: \$ 338,978

Title: Basic Research Cooperative in Remote Sensing (CR-816826)

Investigators: C. D. Elvidge, H. Moosmüller, and M. C. Green

Duration: August 1, 1990 - December 31, 1993

Sponsor: Environmental Protection Agency, Office of Research and Development

Funding: \$ 1,580,681

PUBLICATIONS

Peer Reviewed Publications

- 53) Chakrabarty, R. K., H. Moosmüller, W. P. Arnott, M. A. Garro, and J. W. Walker (2006). Structural and Fractal Properties of Particles Emitted by Spark Ignition Engines. *Environ. Sci. Technol.*, submitted.
- 52) Slowik, J. G., E. S. Cross, J.-H. Han, P. Davidovits, T. B. Onasch, J. T. Jayne, L. R. Williams, M. R. Canagaratna, D. R. Worsnop, R. K. Chakrabarty, H. Moosmüller, W. P. Arnott, J. P. Schwarz, R.-S. Gao, D. W. Fahey, G. L. Kok, and A. Petzold (2006). An Inter-Comparison of Instruments Measuring Black Carbon Content of Soot Particles. *Aerosol Sci. Tech.*, submitted.
- 51) Abu-Rahmah, A., W. P. Arnott, and H. Moosmüller (2006). Integrating Nephelometer with Low Truncation Angle, Fast Time Response and a Novel Calibration Scheme. *Meas. Sci. Tech.*, submitted.
- 50) Mazzoleni, C., H. D. Kuhns, J. Witt, N. J. Nussbaum, H. Moosmüller, O. M. C. Chang, G. Parthasarathy, S. K. K. Nathagoundenpalayam, D. Nikolic, and J. G. Watson (2006). A Real-World Case Study of Tailpipe Emissions for School Buses Using a 20% Biodiesel Blend. *Environ. Sci. Technol.*, submitted.
- 49) Chakrabarty, R. K., H. Moosmüller, M. A. Garro, W. P. Arnott, J. W. Walker, R. A. Susott, R. E. Babbitt, C. E. Wold, E. N. Lincoln, and W. M. Hao (2006). Particle Emissions from Laboratory Combustion of Wildland Fuels: Particle Morphology and Size. *J. Geophys. Res.*, **111**, doi:10.1029/2005jd006659 (in press).
- 48) Chen, L.-W. A., H. Moosmüller, W. P. Arnott, J. C. Chow, J. G. Watson, R. A. Susott, R. E. Babbitt, C. E. Wold, E. N. Lincoln, and W. M. Hao (2006). Particle Emissions from Laboratory Combustion of Wildland Fuels: *In-Situ* Optical and Mass Measurements. *Geophys. Res. Lett.*, **33**, doi:10.1029/2005GL024838 (4 pages).

- 47) Arnott, W. P., J. W. Walker, H. Moosmüller, R. A. Elleman, H. H. Jonsson, G. Buzorius, W. C. Conant, R. C. Flagan, and J. H. Seinfeld (2006). Photoacoustic Insight for Aerosol Light Absorption Aloft from Meteorological Aircraft and Comparison with Particle Soot Absorption Photometer Measurements: DOE Southern Great Plains Climate Research Facility and the Coastal Stratocumulus Imposed Perturbation Experiments. *J. Geophys. Res.*, **111**, doi:10.1029/2005JD005964 (16 pages).
- 46) Moosmüller, H., R. Varma, W. P. Arnott, H. D. Kuhns, V. Etyemezian, and J. A. Gillies (2005). Scattering Cross Section Emission Factors for Visibility and Radiative Transfer Applications: Military Vehicles Traveling on Unpaved Roads. *J. Air & Waste Manage. Assoc.*, **55**, 1743-1750.
- 45) Arnott, W. P., B. Zielinska, C. F. Rogers, J. Sagebiel, K. Park, J. C. Chow, H. Moosmüller, J. G. Watson, K. Kelly, D. Wagner, A. Sarofim, J. Lighty, and G. Palmer (2005). Evaluation of 1047-nm Photoacoustic Instruments and Photoelectric Aerosol Sensors in Source-Sampling of Black Carbon Aerosol and Particle-Bound PAHs from Gasoline and Diesel Powered Vehicles. *Environ. Sci. Technol.*, **39**, 5398-5406.
- 44) Moosmüller, H., R. Varma, and W. P. Arnott (2005). Cavity Ring-Down and Cavity-Enhanced Detection Techniques for the Measurement of Aerosol Extinction. *Aerosol Sci. Tech.*, **39**, 30-39.
- 43) Arnott, W. P., K. Hamasha, H. Moosmüller, P. J. Sheridan, and J. A. Ogren (2005). Towards Aerosol Light-Absorption Measurements with a 7-Wavelength Aethalometer: Evaluation with a Photoacoustic Instrument and 3-Wavelength Nephelometer, *Aerosol Sci. Tech.*, **39**, 17-29.
- 42) Sheridan P. J., W. P. Arnott, J. A. Ogren, E. Andrews, D. B. Atkinson, D. S. Covert, H. Moosmüller, A. Petzold, B. Schmidt, A. W. Strawa, R. Varma, and A. Virkkula (2005). The Reno Aerosol Optics Study: An Evaluation of Aerosol Absorption Measurement Methods. *Aerosol Sci. Tech.*, **39**, 1-16.
- 41) Mazzoleni, C., H. Moosmüller, H. D. Kuhns, R. E. Keislar, P. W. Barber, D. Nikolic, N. J. Nussbaum, and J. G. Watson (2004). Correlation between Automotive CO, HC, NO, and PM Emission Factors from On-Road Remote Sensing: Implications for Inspection and Maintenance Programs. *J. Transportation Res. D*, **9**, 477-496.
- 40) Barber, P. W., H. Moosmüller, R. E. Keislar, H. D. Kuhns, C. Mazzoleni, and J. G. Watson (2004). On-Road Measurement of Automotive Particle Emissions by Ultraviolet Lidar and Transmissometer: Theory. *Meas. Sci. Tech.*, **15**, 2295-2302.
- 39) Chow, J. C., J. G. Watson, L.-W. A. Chen, W. P. Arnott, H. Moosmüller, and K. Fung (2004). Equivalence of Elemental Carbon by Thermal/Optical Reflectance and Transmittance with Different Temperature Protocols. *Environ. Sci. Technol.*, **38**, 4414-4422.
- 38) Chen, L.-W. A., J. C. Chow, W. P. Arnott, H. Moosmüller, and J. G. Watson (2004). Modeling Reflectance and Transmittance of Quartz-Fiber Filter Samples Containing Elemental Carbon Particles: Implications for Thermal/Optical Analysis. *J. Aerosol Sci.*, **35**, 765-780.

- 37) Mazzoleni, C., H. D. Kuhns, H. Moosmüller, R. E. Keislar, P. W. Barber, N. F. Robinson, J. G. Watson, and D. Nikolic (2004). On-Road Vehicle Particulate Matter and Gaseous Emission Distributions in Las Vegas, Nevada, Compared with Other Areas. *J. Air & Waste Manage. Assoc.*, **54**, 711-726.
- Mazzoleni, C., H. D. Kuhns, H. Moosmüller, R. E. Keislar, P. W. Barber, N. F. Robinson, J. G. Watson, and D. Nikolic (2004). Re: On-Road Vehicle Particulate Matter and Gaseous Emission Distributions in Las Vegas, Nevada, Compared with Other Areas. *J. Air & Waste Manage. Assoc.*, **54**, 1339.
- 36) Kuhns, H. D., C. Mazzoleni, H. Moosmüller, D. Nikolic, R. E. Keislar, P. W. Barber, Z. Li, V. Etyemezian, and J. G. Watson (2004). Remote Sensing of PM, NO, CO, and HC Emission Factors for On-Road Gasoline and Diesel Engine Vehicles in Las Vegas, NV. *Sci. Total Environ.*, **322**, 123-137.
- 35) Moosmüller, H., C. Mazzoleni, P. W. Barber, H. D. Kuhns, R. E. Keislar, and J. G. Watson (2003). On-Road Measurement of Automotive Particle Emissions by Ultraviolet Lidar and Transmissometer: Instrument. *Environ. Sci. Technol.*, **37**, 4971-4978.
- 34) Moosmüller, H. and W. P. Arnott (2003). Angular Truncation Errors in Integrating Nephelometry. *Rev. Sci. Instrum.*, **74**, 3492-3501.
- 33) Varma R., H. Moosmüller, and W. P. Arnott (2003). Toward an Ideal Integrating Nephelometer. *Opt. Lett.*, **28**, 1007-1009.
- 32) Raspet, R, W. V. Slaton, W. P. Arnott, and H. Moosmüller (2003). Evaporation – Condensation Effects on Resonant Photoacoustics of Volatile Aerosols. *J. Atmos. Oceanic Technol.*, **20**, 685-695.
- 31) Arnott, W. P., H. Moosmüller, P. J. Sheridan, J. A. Ogren, R. Raspet, W. V. Slaton, J. L. Hand, S. M. Kreidenweis, and J. L. Collett, Jr. (2003). Photoacoustic and Filter-Based Ambient Aerosol Light Absorption Measurements: Instrument Comparison and the Role of Relative Humidity. *J. Geophys. Res.*, **108**, 4034-4044, doi: 10.1029/2002JD002165.
- 30) She, C. Y., J. D. Vance, B. Williams, T. Hu, D. A. Krueger, H. Moosmüller, D. Gibson-Wilde, and D. Fritts (2002). Lidar Studies of Atmospheric Dynamics Near Polar Mesopause. *EOS, Transactions, American Geophysical Union*, **83**, 289-293.
- 29) Moosmüller, H., W. P. Arnott, C. F. Rogers, J. L. Bowen, J. A. Gillies, W. R. Pierson, J. F. Collins, T. D. Durbin, and J. M. Norbeck (2001). Time Resolved Characterization of Diesel Particulate Emissions. 2. Instruments for Elemental and Organic Carbon Measurements. *Environ. Sci. Technol.*, **35**, 1935-1942.
- 28) Moosmüller, H., W. P. Arnott, C. F. Rogers, J. L. Bowen, J. A. Gillies, W. R. Pierson, J. F. Collins, T. D. Durbin, and J. M. Norbeck (2001). Time Resolved Characterization of Diesel Particulate Emissions. 1. Instruments for Particle Mass Measurements. *Environ. Sci. Technol.*, **35**, 781-787.
- 27) Arnott, W. P., H. Moosmüller, and J. W. Walker (2000). Nitrogen Dioxide and Kerosene-Flame Soot Calibration of Photoacoustic Instruments for Measurement of Light Absorption by Aerosols. *Rev. Sci. Instrum.* **71**, 4545-4552.
- 26) Arnott, W. P., H. Moosmüller, C. F. Rogers, T. Jin, and R. Bruch (1999). Photoacoustic Spectrometer for Measuring Light Absorption by Aerosol: Instrument Description. *Atmos. Environ.* **33**, 2845-2852.

- 25) Moosmüller, H., W. P. Arnott, C. F. Rogers, J. C. Chow, C. A. Frazier, L. E. Sherman, and D. L. Dietrich (1998). Photoacoustic and Filter Measurements Related to Aerosol Light Absorption during the Northern Front Range Air Quality Study (Colorado 1996/1997). *J. Geophys. Res.* **103**, 28149-28157.
- 24) Moosmüller, H. (1998). Brewster's Angle Porro Prism: A Different Use for a Pellin-Broca Prism. *Engineering & Laboratory Notes*, a supplement to *Opt. Photon. News* **9**, 5, 3pp. and *Appl. Opt.* **37**, 8140-8141.
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