

Dr. Joshua P. Schwarz

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SPECIALIZED SCIENTIFIC COMPETENCE

- In situ measurements of black carbon and total aerosol from the ground to the lower stratosphere using airborne instrumentation.
- Modeling of the optical properties of bare and coated black carbon particles in the context of experimental analysis.
- Engineering and testing of complex measurement systems in the laboratory and field.
- Written and oral communication of science results to the scientific community.

EDUCATION

Ph.D. Physics, 1998, University of Colorado, Boulder.
M.S. Physics, 1996, University of Colorado, Boulder.
B.S. Physics, 1993, University of Massachusetts, Amherst. Cum laude.

EMPLOYMENT HISTORY

- 2003 – Present **Research Scientist III.** CIRES, University of Colorado/NOAA Earth System Research Laboratory, Chemical Sciences Division, Boulder, CO.
- Lead scientist applying the NOAA Single Particle Soot Photometer (SP2) to atmospheric measurements.
- 2012 – Present **Associate Editor,** Geophysical Research Letters
- 2001 – 2003 **Research Scientist.** Swiss Federal Office of Metrology and Accreditation (METAS), Bern, Switzerland.
- Spearheaded investigations into sources of systematic uncertainty in the METAS Electronic Kilogram Experiment.
- 1999 – 2001 **National Research Council Postdoctoral Fellow.** National Institute of Standards and Technology (NIST), Electricity Division, Fundamental Electrical Measurements Group, Gaithersburg, MD.
- Research into systematic error sources in the NIST Electronic Kilogram Experiment.

FIELD CAMPAIGNS

- 2012 Deep Convective Clouds and Composition (DC3, NSF/NASA)
- 2011 Qinghai Lake Measurements, Qinghai, China (IEECAS)
- 2009/2010/2011 HIAPER Pole-to-pole Observations (NSF/NCAR)
- MacPex 2011, Houston, TX (NASA)
- CalNex 2010, Ontario, CA (NOAA)

– FIELD CAMPAIGNS continued –

- 2008 C3-STAR Pearl River Delta Campaign, Kaiping, China (PKU)
- 2008 Aerosol, Radiation, and Cloud Processes affecting Arctic Climate, Fairbanks, AK (NOAA)
- 2007 Tropical Composition, Cloud, and Climate Coupling, San Jose, Costa Rica (NASA)
- 2006 Texas Air Quality Study / Gulf of Mexico Atmospheric Composition and Climate Study, Houston, TX (NOAA)
- 2006 Costa Rican Aura Validation Experiment, San Jose, Costa Rica (NASA)
- 2004 Aura Validation Experiment, Houston, TX (NASA)

COLLABORATIVE ACTIVITIES

- Represented single-particle BC measurements at the 2011 Workshop on BC Reference Materials, Vienna, Austria
- Promoted discussion and a common approach to calibration within the SP2 community leading to intercomparisons between 8 SP2s during CalNex 2010.
- Provided instruction and support for the Single Particle Soot Photometer (SP2)
 - Junji Cao Group, Institute of Earth Environment, Chinese Academy of Sciences, 2011
 - Andreas Petzold Group, German Aerospace Center, 2008, 2010
 - Antony Clarke Group, University of Hawaii at Manoa, 2008
 - Hugh Coe Group, University of Manchester, 2006
 - Yutaka Kondo Group, University of Tokyo, 2006-2011
- Led NOAA involvement in the DMT SP2 Users Group Meeting 2008, 2009, 2011.
 - Lectured about error sources, system alignment, SP2 detection limits and quality assurance, and SP2 calibration issues.
 - Advocated calibration and interpretation techniques to ensure quality measurements throughout the SP2 community.
 - Informed the SP2 community about the uncertainties associated with interpretation of BC content in liquids.
- Initiated, organized, and conducted SP2 inter-comparisons between NOAA, University of Hawaii, and University of Tokyo during ARCPAC, 2008.
- Supported the modeling community with BC data and interpretation. Vertical profiles of BC mass mixing ratios and degree of internal mixing were provided with careful explanation of detection uncertainties and limitations.
 - Johannes Hendricks group, DLR, Germany
 - Ken Carslaw group, University of Leeds, United Kingdom
 - Dorothy Koch group, NASA GISS/Columbia University, New York
- Reviewer for journals and funding agencies: Atmospheric Chemistry and Physics, Geophysical Research Letters, Journal of Geophysical Research, Atmospheric Measurement Techniques, Department of Energy, National Science Foundation

– COLLABORATIVE ACTIVITIES continued –

- Consulted on black carbon test materials, provided samples, standards, characterizations, and support
 - Yutaka Kondo Group, University of Tokyo, 2011
 - Sarah Doherty Group, University of Washington, USA, 2011
 - Aerosol Physics Group, Paul Scherer Institute, Switzerland, 2010
 - 2010 AIDA SP2 Intercomparison Study, Institute of Meteorology and Climate

Daube, E. J., Dlugokencky, M. L., Fischer, A. H., Goldstein, A., Guha, T., Karl, T., Kofler, J., Kosciuch, P., K. Misztal, A. E., Perring, I. B., Pollack, J. P. Schwarz, J. R. Spackman, S. C. Wofsy, and D. D. Parrish, Airborne observations of methane emissions from rice cultivation in the Sacramento Valley of California, *J. Geophys. Res.*, *117*, D00V25, doi:10.1029/2012JD017994, 2012.

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Langridge, J.M., D Lack, C.A Brock, R Bahreini, A.M Middlebrook, J.A Neuman, J.B Nowak, A.E Perring, **J.P Schwarz**, J.R Spackman, J.S Holloway, I.B Pollack, T.B Ryerson, J.M Roberts, C Warneke, J.A de Gouw, M.K Trainer and D.M Murphy (2012), Evolution of aerosol properties impacting visibility and direct climate forcing in an ammonia-rich urban environment. *J. Geophys. Res.-Atmos.*, *117*, doi:10.1029/2011JD017116, 2012.

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Bahreini, R., A.M Middlebrook, J.A de Gouw, C Warneke, M Trainer, C.A Brock, H Stark, S.S Brown, W.P Dube, J.B Gilman, K Hall, J.S Holloway, W.C Kuster, A.E Perring, A.S.H Prevot, **J.P. Schwarz**, J.R Spackman, S Szidat, N.L Wagner, R.J Weber, P Zotter and D.D Parrish (2012), Gasoline emissions dominate over diesel in formation of secondary organic aerosol mass. *Geophys. Res. Lett.*, *39*, doi:10.1029/2011GL050718, 2012.

Weigum, N. M., P. Stier, **J. P. Schwarz**, D. W. Fahey, J. R. Spackman, Scales of variability of black carbon plumes over the Pacific Ocean, *GRL*, *39*, L15804, doi:10.1029/2012GL052127, 2012.

S. Fan, **J.P. Schwarz**, J. Liu, D.W. Fahey, P. Ginoux, L.W. Horowitz, H. Levy II, Y. Ming, J.R. Spackman, Inferring Ice Formation Processes from Global-Scale Black Carbon Profiles Observed in the Remote Atmosphere and Model Simulations, *JGR*, *117*, D23205, doi:10.1029/2012JD018126, 2012.

Baumgardner, D., Popovicheva, O., Allan, J., Bernardoni, V., Cao, J., Cavalli, F., Cozic, J., Diapouli, E., Eleftheriadis, K., Genberg, P. J., Gonzalez, C., Gysel, M., John, A., Kirchstetter, T. W., Kuhlbusch, T. A. J., Laborde, M., Lack, D., Müller, T., Niessner, R., Petzold, A., Piazzalunga, A., Putaud, **J. P., Schwarz, J.**, Sheridan, P., Subramanian, R., Swietlicki, E., Valli, G., Vecchi, R., and Viana, M.: Soot Reference Materials for instrument calibration and intercomparisons: a workshop summary with recommendations, *Atmos. Meas. Tech.*, *5*, 1869-1887, doi:10.5194/amt-5-1869-2012, 2012

Middlebrook, A.M., D.M Murphy, R Ahmadov, E.L Atlas, R Bahreini, D.R Blake, J Brioude, J.A de Gouw, F.C Fehsenfeld, G.J Frost, J.S Holloway, D.A Lack, J.M Langridge, R.A Lueb, S.A McKeen, J.F Meagher, S Meinardi, J.A Neuman, J.B Nowak, D.D Parrish, J Peischl, A.E Perring, I.B Pollack, J.M Roberts, T.B Ryerson, **J.P Schwarz**, J.R Spackman, C Warneke and A.R Ravishankara (2012), Air quality implications of the Deepwater Horizon oil spill. *Proc. Natl. Acad. Sci. U. S. A.*, *109* (50), doi:10.1073/pnas.1110052108

Moore, R.H., Raatikainen, T., Langridge, J.M., Bahreini, R., Brock, C.A., Holloway, J.S., Lack, D.A., Middlebrook, A.M., Perring, A.E., **Schwarz, J.P.**, Spackman J.R., and Nenes, A. CCN Spectra, Hygroscopicity, and Droplet Activation Kinetics of Secondary Organic Aerosol Resulting from the 2010 Deepwater Horizon Oil Spill, *Env.Sci.Tech.*, doi: 10.1021/es203362w, 2012.

Mann, G. W., Carslaw, K. S., Ridley, D. A., Spracklen, D. V., Pringle, K. J., Merikanto, J., Korhonen, H., **Schwarz, J. P.**, Lee, L. A., Manktelow, P. T., Woodhouse, M. T., Schmidt, A., Breider, T. J., Emmerson, K. M., Reddington, C. L., Chipperfield, M. P., and Pickering, S. J.: Intercomparison of modal and sectional aerosol microphysics representations within the same 3-D global chemical transport model, *Atmos. Chem. Phys.*, 12, 4449-4476, doi:10.5194/acp-12-4449-2012, 2012.

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Ryerson, T. B., K. C. Aikin, W. M. Angevine, E. L. Atlas, D. R. Blake, C. A. Brock, F. C. Fehsenfeld, R.-S. Gao, J. A. d. Gouw, D. W. Fahey, J. S. Holloway, D. A. Lack, R. A. Lueb, S. Meinardi, A. M. Middlebrook, D. M. Murphy, J. A. Neuman, J. B. Nowak, D. D. Parrish, J. Peischl, A. E. Perring, I. B. Pollack, A. R. Ravishankara, J. M. Roberts, **J. P. Schwarz**, J. R. Spackman, H. Stark, C. Warneke, and L. A. Watts. Atmospheric emissions from the Deepwater Horizon spill constrain air-water partitioning, hydrocarbon fate, and leak rate, *Geophysical Research Letters*, 38(L07803), doi:10.1029/2011GL046726, 2011.

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C. Novelli, J. B. Nowak, J. A. Ogren, J. Peischl, R. B. Pierce, P. Pilewskie, P. K. Quinn, T. B. Ryerson, K. S. Schmidt, **J. P. Schwarz**, H. Sodemann, J. R. Spackman, H. Stark, D. S. Thomson, T. Thornberry, P. Veres, L. A. Watts, C. Warneke, and A. G. Wollny, Characteristics, Sources, and Transport of Aerosols Measured in Spring 2008 During the Aerosol, Radiation, and Cloud Processes Affecting Arctic Climate (ARCPAC) Project, *ACPD*, 2010.

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J. R. Spackman, R. S. Gao, W. D. Neff, **J. P. Schwarz**, L. A. Watts, D. W. Fahey, J. S. Holloway, T. B. Ryerson, J. Peischl, C. A. Brock, Aircraft observations of enhancement and depletion of black carbon mass in the springtime Arctic, *ACP*, 2010.

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J. P. Schwarz, J. R. Spackman, R. S. Gao, A. E. Perring, E. Cross, T. B. Onasch, A. Ahern, W. Wrobel, P. Davidovits, J. Olfert, M. K. Dubey, C. Mazzoleni, and D. W. Fahey, The detection efficiency of the single particle soot photometer, *Aeros. Sci. Technol.*, 44:612-628, doi: 10.1080/02786826.2010.481298, 2010.

D. Koch, M. Schulz, S. Kinne, C. McNaughton, J. R. Spackman, Y. Balkanski, S. Bauer, T. Berntsen, T. C. Bond, O. Boucher, M. Chin, A. Clarke, N. De Luca, F. Dentener, T. Diehl, O. Dubovik, R. Easter, D. W. Fahey, J. Feichter, D. Fillmore, S. Freitag, S. Ghan, P. Ginoux, S. Gong, L. Horowitz, T. Iversen, A. Kirkevåg, Z. Klimont, Y. Kondo, M. Krol, X. Liu, R. Miller, V. Montanaro, N. Moteki, G. Myhre, J. E. Penner, J. Perlwitz, G. Pitari, S. Reddy, L. Sahu, H. Sakamoto, G. Schuster, **J. P. Schwarz**, Ø. Seland, P. Stier, N. Takegawa, T. Takemura, C. Textor, J. A. van Aardenne, and Y. Zhao, Evaluation of black carbon estimations in global aerosol models, *Atmos. Chem. Phys.*, 9, 9001–9026, 2009.

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J. G. Slowik, 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, A. Petzold, An intercomparison of instruments measuring black carbon content of soot particles, *Aero. Sci. Technol.*, 41:3, 295, 2007.

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J. P. Schwarz, R. Liu, E. B. Newell, R. L. Steiner, E. R. Williams, D. Smith, Hysteresis and related error mechanisms in the NIST watt balance experiment, *J. Res. Natl. Inst. Stand. Technol.*, 106, 627–640, 2001.

J. P. Schwarz, D. S. Robertson, T. M. Niebauer, and J. E. Faller, A new determination of the Newtonian constant of gravity using the free fall method, *Meas. Sci. Technol.*, 10, 478–486, 1999.

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PRESENTATIONS

Workshop on Black Carbon Reference Materials: **Keynote Lecture:** Challenges in calibrating/validating/comparing SP2 measurements, Vienna, Austria, June 2011.

International Conference on Carbonaceous Particles in the Atmosphere, **Oral Presentation:** Quantifying the hygroscopicity of black-carbon aerosol in the ambient with measurements and theory, Vienna, Austria, June 2011.

SP2 User Group Meeting 2011, **Invited seminar:** SP2 response to black carbon mass, Boulder, CO, April 2011.

HIAPER Pole-to-pole Observations Science Meeting, **Oral Presentation:** Global-Scale Black Carbon Profiles Observed in the Remote Atmosphere and Compared to Models, Boulder, CO, March 2011.

German AeroSpace Center, **Invited seminar:** Black carbon aerosol quantified from the ground to 20 km, between 80N and 70S: observations and implications, Weßling, Germany, May 2010.

2009 AGU Fall meeting, **Oral Presentation:** In situ vertical profiles of black carbon aerosol over the Pacific, Arctic, and Antarctic Regions (80°N to 67°S Latitudes), San Francisco, CA, December 2009

SP2 User Group Meeting 2009, **Invited seminar:** Detection efficiency of the SP2, Boulder, CO, September 2009.

2009 Gordon Research Conference - Atmospheric Sciences, **Poster presentation:** Black carbon aerosol measured in situ from 80N to 67S, Waterville Valley, NH, September 2009.

University of Tokyo, **Invited seminar:** Overview of black carbon measurements at NOAA, Tokyo, Japan, October 2008.

3C-STAR field campaign, **Invited seminar:** Use and Utility of the Single Particle Soot Photometer, Kaiping, China, October 2008.

Droplet Measurement Technologies SP2 User Group Meeting, **Invited seminar:** Theoretical and experimental basis for measurement of black carbon aerosol optical size, Boulder, CO, September 2008.

2007 AGU Fall meeting, **Oral presentation:** Heating of the urban boundary layer by black carbon absorption of solar radiation, San Francisco, CA, December 2007.

2007 Gordon Research Conference - Atmospheric Sciences, **Poster presentation:** In situ measurements of the mixing state, light-scattering, and physical properties of black carbon, Big Sky, MT, August 2007.

NOAA Chemical Sciences Division Seminar Series, **Invited seminar:** Unraveling the black carbon puzzle, Boulder, CO, January 2007.

2006 AGU Fall Meeting, **Poster presentation:** In situ measurements of the mixing state and light-scattering properties of black carbon in the troposphere and lower stratosphere, San Francisco, CA, December 2006.

Aerodyne Research, Inc., **Invited seminar:** Hot science: quantifying black carbon with a single particle soot photometer, Billerica, MA, October 2006.

Costa-Rican Aura Validation Experiment science meeting, **Oral presentation:** Black carbon mixing states measured during CR-AVE with the NOAA single particle soot photometer, Greenbelt, MD, November 2006

2005 AGU Fall meeting, **Poster presentation:** Single-particle black carbon aerosol vertical profiles from the boundary layer to the lower stratosphere. San Francisco, CA, December 2005.

2004 AGU Fall meeting, **Oral presentation:** Characterization of a single particle soot photometer, San Francisco, CA, December 2004

First International Watt Balance Workshop, **Oral presentation:** Alignment issues in the METAS watt-balance experiment, Ottawa, ON, June 2002.

Physics and Astronomy Departmental Colloquium at the University of Kentucky, **Invited seminar:** The delicate balance of power: improving the SI with the NIST Watt Balance experiment, Lexington, KY, September 2000.

IOP Conference on the gravitational constant, theory and experiment 200 years after Cavendish, **Invited oral presentation:** The free-fall measurement of G, London, November 1998.

1997 AGU Chapman Conference on Microgal Gravimetry, **Invited oral presentation:** A new G determination, St. Augustine, FL, March 1997.