PARTICULARS

The E-Newsletter of the American Association for Aerosol Research

SUMMER 2018

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As always, we'd love any feedback or suggestions you may have for ***Particulars***.

Simply email **info@aaar.org** with the subject line ***'Particulars'***

Kristina Wagstrom, *Editor*

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President's Message

Dear Colleagues,

As the **International Aerosol Conference (IAC)** rapidly approaches I hope everyone that has finished their presentations are pleased with their results and wish smooth sailing for those rushing to completion.

We have been receiving reports recently that companies are approaching members for IAC hotel room bookings and sale of the IAC attendee list. Please know that the AAAR **does not authorize any travel agents** for conference hotel bookings and **does not sell our attendee list.** If you receive a solicitation via phone or email regarding either of these items I suggest you ignore it.

Although not officially a part of the IAC, there will be a **Grand Challenges Workshop** sponsored by AAAR and held in conjunction with it on Sunday, September 2 from 1:30 – 5:00 pm at the America's Center Convention Complex. **Chris Sorenson** and **Rick Flagan** have taken the North American lead in organizing this workshop which is designed to identify the grand challenges in aerosol science and technology and then create a vision and provide directions for the global aerosol community. The workshop is open to all and there is no fee for attendance. As an initial follow-up to the workshop, there will be a Grand Challenges Summary held during the IAC on Thursday, September 6 from 3:20 – 4:20 pm (please check the final program to confirm the time).

There will also be **Meet the Pioneers** sessions held during IAC where you can interact with leaders in the field in an informal setting. Scheduled during lunch breaks on Monday, Tuesday, and Friday and also from 4:30 – 5:30 pm on Thursday following the Grand Challenges Summary these are the type of opportunities which come along infrequently and I encourage all who are able to make the time to attend at least one of these offerings.

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Two other unique IAC events will be the **Aerosol Particle Photography Competition** and the **Most Popular Poster Contest.** The poster contest is a late breaking event dreamed up by the conference committee and will be crowd voted via app (assuming they are able to get it fully organized in time).

In case you missed the recent blast email from AS&T editor **Warren Finlay**, we have started production on a series of AS&T featured article video vignettes. Links to the first two videos are here:

https://vimeo.com/ideafactory/review/262825124/9b150d52ee
https://vimeo.com/ideafactory/review/262825586/57bdc60e20

The videos were funded by the board as a strategic project, I hope you are as pleased with the results as I am. We will be tracking the viewership and plan on producing three more per year if all goes well.

Finally, my thanks to all who have contributed to the success of our association during this last year. We are indeed fortunate to have so many committed members who along with our executive director **Bill Carney** and his crew at Drohan Management have kept our ship afloat. If you have never volunteered your time there are a wide range of ways to do so, please stop by the AAAR booth at the IAC exhibition to learn more.

See you in St. Louis! ●

Tyler Beck, *AAAR President*

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Article Highlight

By Ben Murphy, US EPA

"Size Resolved Chemical Composition of Nanoparticles from Reactions of Sulfuric Acid with Ammonia and Dimethylamine"

By Haihan Chen, Sabrina Chee, Michael J. Lawler, Kelley C. Barsanti, Bryan M. Wong, and James N. Smith

https://doi.org/10.1080/02786826.2018.1490005

Atmospheric new particle formation (NPF) is an extraordinarily complex phenomenon that, through impacts on ambient particle size distributions, has potential implications for cloud properties (and thus large-scale radiation budgets) as well as for human exposure to airborne particles. Not only are newly formed particles exceedingly difficult to measure due to their small size, but the strength and chemical composition of NPF processes are also highly sensitive to the identity of the vapor-phase precursors and environmental conditions like relative humidity, temperature, and background particle size distribution. Studies that can isolate the roles some of these factors play and build a general understanding of how particles nucleate and grow are of high value.

Whereas many studies focus on the earliest stages of particle formation (i.e. particle diameter smaller than 4 nm), Chen and coauthors have undertaken a set of targeted flowtube experiments to better quantify the chemical properties of newly formed particles later in the growth process (particle diameters 8-21 nm). Through their analysis of sulfuric acid – ammonia (H_2SO_4-NH_3) and sulfuric acid – dimethylamine (H_2SO_4-DMA) systems, the authors demonstrate that the composition of ultrafine particles deviates from the predictions of models assuming bulk equilibrium thermodynamics. In particular, the ratio of acid to base in both systems exceeds the predicted ratio of 0.5, indicating enhanced acidity. The magnitude of the deviation is stronger for the H_2SO_4-NH_3 system, and the acid:base ratio is still enhanced for particles up to 12 nm in diameter. The H_2SO_4-DMA particles show less enhancement, relax to bulk equilibrium composition at a diameter equal to 12 nm, and show strong relative humidity (RH) dependence when comparing experiments at dry and 60% RH conditions (Fig. 1).

As the authors describe, their results are qualitatively consistent with other studies showing enhanced acidity in sub-30 nm particles (e.g. Kim et al., 2016; Lawler et al., 2016). One of the strengths of this work, though, is the highly controlled nature of the experimental setup. For example, because they inject H_2SO_4 directly into the flowtube rather than injecting and oxidizing SO_2, the authors can rule out potential interferences with heterogeneous reactions of SO_2 on particle surfaces, a potential complication identified in the Lawler et al. (2016) study. With their constrained data, the authors apply a custom model of nonlinear equations considering mass

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balance, electroneutrality, and acid dissociation (evaluated for performance against the Extended Aerosol Inorganics Model; E-AIM). In order to achieve the acid:base ratios observed in the smaller particles, acid dissociation constants are raised significantly for both H_2SO_4 and the bases, and neutral base mass is volatilized, both indicating a less efficient role for acid-base chemistry in sub-20 nm particles than one would find in bulk aqueous solutions.

Chen et al. provide a robust analysis of a highly uncertain and influential atmospheric chemical process and highlight more than one compelling avenue for future work. Indeed, a working understanding of particle growth processes across the range of relevant sizes is critical for deploying accurate algorithms in fine- and large-scale atmospheric models, better quantifying cloud-aerosol interactions at multiple scales, and better anticipating complex anthropogenic-biogenic interactions to inform responsible environmental management. ●

Kim, J., Ahlm, L., Yli-Juuti, T., Lawler, M., Keskinen, H., Tröstl, J., Schobesberger, S., Duplissy, J., Amorim, A., Bianchi, F., Donahue, N. M., Flagan, R. C., Hakala, J., Heinritzi, M., Jokinen, T., Kürten, A., Laaksonen, A., Lehtipalo, K., Miettinen, P., Petäjä, T., Rissanen, M. P., Rondo, L., Sengupta, K., Simon, M., Tomé, A., Williamson, C., Wimmer, D., Winkler, P. M., Ehrhart, S., Ye, P., Kirkby, J., Curtius, J., Baltensperger, U., Kulmala, M., Lehtinen, K. E. J., Smith, J. N., Riipinen, I., and Virtanen, A.: Hygroscopicity of nanoparticles produced from homogeneous nucleation in the CLOUD experiments, Atmos. Chem. Phys., 16, 293-304.

https://doi.org/10.5194/acp-16-293-2016, 2016

Lawler, M. J., Winkler, P. M., Kim, J., Ahlm, L., Tröstl, J., Praplan, A. P., Schobesberger, S., Kürten, A., Kirkby, J., Bianchi, F., Duplissy, J., Hansel, A., Jokinen, T., Keskinen, H., Lehtipalo, K., Leiminger, M., Petäjä, T., Rissanen, M., Rondo, L., Simon, M., Sipilä, M., Williamson, C., Wimmer, D., Riipinen, I., Virtanen, A., and Smith, J. N.: Unexpectedly acidic nanoparticles formed in dimethylamine–ammonia–sulfuric-acid nucleation experiments at CLOUD, Atmos. Chem. Phys., 16, 13601-13618.

https://doi.org/10.5194/acp-16-13601-2016, 2016

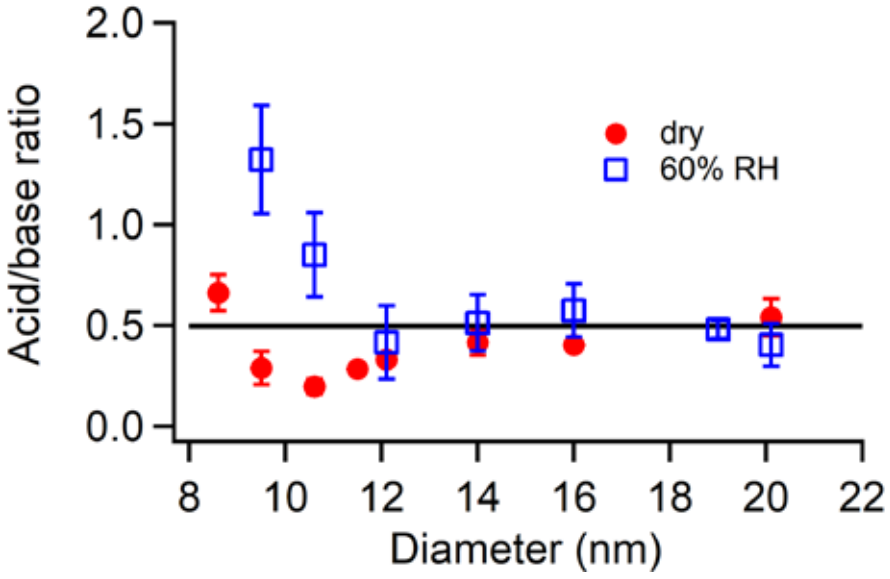

Figure 1. *(Fig. 4 in paper)*

Size resolved acid:base ratio of newly formed particles in the H_2SO_4-DMA system under dry conditions and at 60% RH. The concentrations of H_2SO_4 and DMA introduced into the flow tube reactor were 2.5×10^{10} and 8.9×10^{10} cm^{-3}, respectively, for both the dry conditions and at 60% RH. The error bars represent standard deviations of at least three repeated measurements. The horizontal black line represents the acid: base ratio of fully neutralized H_2SO_4-DMA particles.

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EPA Requesting Nominations for Their Science Advisory Board (SAB) and Four SAB Subcommittees

The US EPA is requesting nominations for their **Science Advisory Board (SAB**) as well as four **SAB subcommittees** (Chemical Assessment Advisory Committee, Drinking Water Committee, Agricultural Sciences Committee, and Radiation Advisory Committee). The SAB is a chartered federal advisory committee that provides independent, expert advice to the EPA Administrator on a range of environmental science, engineering and economic issues.

The Federal Register Notice of the request can be found here:
https://www.gpo.gov/fdsys/pkg/FR-2018-07-09/pdf/2018-14680.pdf

Web links for the nominations can be found under the "Nomination of Experts" category at the bottom of the SAB (www.epa.gov/sab) home page. The nomination deadline is **August 8, 2018**.

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Organizational Members

AAAR would like to thank the companies that support us as Organizational Members:

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In Case You Missed It

By Jason D. Surratt

Using Electrostatics to Collect Fog Droplets to Help Mitigate Water Scarcity.

Researchers at the Massachusetts Institute of Technology in the Department of Mechanical Engineering proposed an alternative approach to typical fog collection methods, such as collectors that are meshes that rely on inertial collision of droplet capture, and thus, are limited by aerodynamics. The newly proposed approach here introduces electrical forces that can overcome aerodynamic drag forces. By using an ion emitter the researchers introduce a space charge into the fog to give a net charge to the incoming droplets and direct them toward a collector using an imposed electric field. The researchers experimentally measure the collection efficiency of fog droplets and propose a physical model to quantify it. This work provides new insights into designing effective fog droplet collection systems. This article was published in the latest issue of *Science Advances*:

Damak and Varanasi (2018), Electrostatically driven fog collection using space charge injection, *Scientific Advances,* 4
DOI: 10.1126/sciadv.aao5323

Nanometer-Sized pH Probes Dispersed in 20-μm Diameter Droplets to Report pH via Surface-Enhanced Raman Spectroscop.

Researchers from Virginia Tech, Duke and the University of South Carolina scanned droplets containing 4-mercaptobenzoic acid-functionalized gold nanoparticle pH nanoprobes by 2D and 3D laser confocal Raman microscopy. By using surface-enhanced Raman scattering, the researchers determined the pH distribution inside ~ 20-mm-diamter phosphate-buffered aerosol droplets and found that the pH of the droplet core was higher than that of the bulk solution by up to 3.6 pH units. This work reveals a spatial gradient in aerosol pH that has implications for acid-base-catalyzed atmospheric chemistry. The authors recognize that more work is needed with more acidic particles (such as those containing ammonium bisulfate) at submicron sizes. This article was recently published in *PNAS*:

Wei, H. et al. (2018), Aerosol Microdroplets Exhibit a Stable pH Gradient, *PNAS*
www.pnas.org/cgi/doi/10.1073/pnas.1720488115

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Aerosol Composition Measurements Made from an Indoor Classroom Reveals Novel Exposure Route For Thirdhand Smoke to Humans.

Researchers at Drexel University recently made real-time aerosol mass spectrometry (AMS) measurements in an indoor classroom. Positive matrix factorization (PMF) analyses, or source apportionment, of the AMS data revealed a reduced nitrogen component, contributing 29% of the indoor submicron aerosol mass. These researchers found that this AMS-resolved source of indoor submicron aerosol results from thirdhand smoke compounds partitioning from interior surfaces to the gas phase and then to the aerosol phase. The partitioning of thirdhand smoke vapors to aerosols was found to require an aqueous phase of aerosols of outdoor origin for reactive uptake of the reduced nitrogen species. The latter lead to seasonal differences in thirdhand smoke concentrations indoors. Protonation of reduced nitrogen species found within thirdhand smoke vapors occurs upon acid-catalyzed reactive uptake on indoor aerosols derived from outdoors. This article was published in the latest issue of *Science Advances*:

DeCarlo, P.F. et al. (2018), Thirdhand Smoke Uptake to Aerosol particles in the Indoor Environment, *Science Advances*, 4
DOI: 10.1126/sciadv.aap8368

10-μg m^{-3} Increase in $PM_{2.5}$ Concentrations is Found to be Associated with a 9% Rise in Infant Mortality in Africa.

Researchers from Standard University, University of California, San Diego, and the National Bureau of Economic Research combined household survey-based information on the location and timing of nearly 1 million births across sub-Saharan Africa with satellite-based estimates of exposure to ambient respirable particulate matter ($PM_{2.5}$) to estimate the impact of air quality on mortality rates among infants in Africa. They found that a 10-μg m^{-3} increase in $PM_{2.5}$ concentrations is associated with 9% (at the 95% confidence interval) rise infant mortality across the region. This effect was found not to decline over the last 15 years and did not diminish with higher household income. These researchers estimated that infant deaths are more than three times higher than existing estimates that attribute it to poor air quality in these countries. Modest reductions in African $PM_{2.5}$ exposures are predicted to have health benefits to infants that are larger than most known health interventions. This article was published in *Nature*:

Heft-Neal, S. et al. (2018), Robust Relationship Between Air Quality and Infant Mortality in Africa, *Nature*, **https://doi.org/10.1038/s41586-018-0263-3** •

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Student Chapter Updates

Colorado State

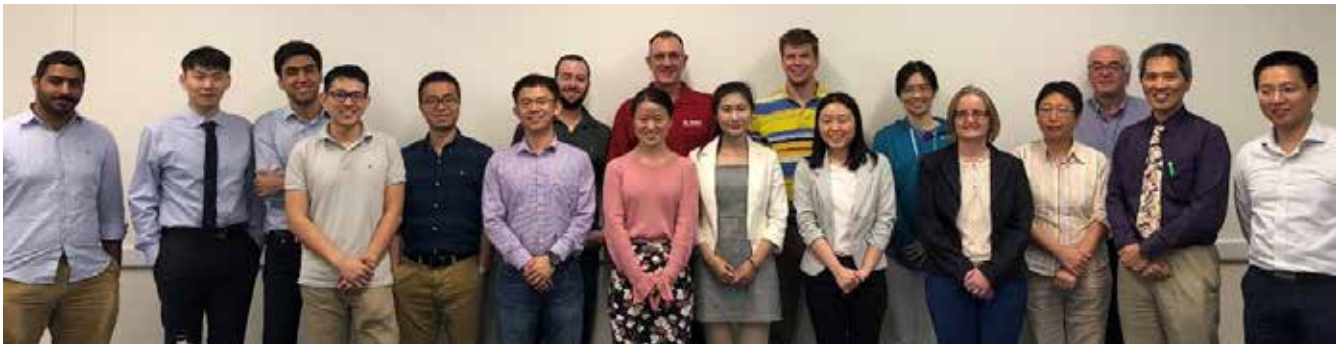
The Colorado State University chapter is working to expand participation from students all across campus and is planning a research field trip to the Storm Peak Lab in Steamboat Springs, CO, along with a "spark talk" series by students this fall, where students take turns presenting a topic with one slide and a time limit of 5 minutes.

Riverside

In the past year, members of the UCR Student Chapter attended the 35th Informal Symposium on Kinetics and Photochemical Processes in the Atmosphere where our Chapter advisor, Dr. Kelley Barsanti, gave an excellent talk. Several of our members volunteered as note takers at the Southern California Ozone Research Symposium held in Riverside, CA. Our student chapter was also privileged to enjoy an invited talk followed by a lunch meeting with Dr. Joost de Gouw. Finally, members of our chapter recently took on a number of high school student volunteers to train and mentor them in the lab and teach them the importance of air quality research. At least 7 of us will be presenting research at the IAC this year, come find us!

University of Florida

Every March, the AAAR Student Chapter at University of Florida helps to host the annual Air Quality Workshop, which invites students, professors and local air quality professional engineers to present their research outcome related to emerging issues in air quality and innovative techniques. We are also providing lab tours to local primary school students, high school students and undergraduate students to help them explore the fundamental knowledge of air pollutions.



University of Florida Student Chapter

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