Department of Chemistry Seminar Series Fall 2022

Friday, September 9, 2022, 10:00 AM MSB 359 (Math)
Host: Denisia Popolan-Vaida

Exploring the Physicochemical Properties of Aerosol Using a Linear Quadrupole Electrodynamic Balance

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The physicochemical and optical properties of aerosol particles determine their interactions in the atmosphere and their effect on atmospheric processes, such as cloud formation. Using single particle levitation methods, properties such as hygroscopicity, viscosity, diffusivity, refractive index, and reactivity can be measured in particles with a well-defined size and chemical composition exposed to controlled environmental conditions.

In this talk, I will introduce the linear quadrupole electrodynamic balance as a tool to levitate arrays of particles and describe its applications to characterizing aerosol particle properties. I will show how Mie resonance spectroscopy enables characterization of particle size and optical properties and discuss our recent work on particles containing light absorbing brown carbon chromophores.[1,2] I will show how we can quantifying important morphological and rheological properties of levitated particles, with implications for their atmospheric effects as well as their role in disease transmission.[3] Finally, I will describe how single particles may be probed using high resolution mass spectrometry for exact mass analysis of the chemical composition.[4,5] Together, these methods will allow for a complete characterization of the physical, chemical, and optical properties of aerosol particles to better understand their role in the atmosphere and indoor environments.

(1) Price, C. L.; Bain, A.; Wallace, B. J.; Preston, T. C.; Davies, J. F. Simultaneous Retrieval of the Size and Refractive Index of Suspended Droplets in a Linear Quadrupole Electrodynamic Balance. *J. Phys. Chem. A* **2020**, *124* (9), 1811–1820.
(2) Price, C. L.; Preston, T. C.; Davies, J. F. Hygroscopic Growth, Phase Morphology, and Optical Properties of Model Aqueous Brown Carbon Aerosol. *Environ. Sci. Technol.* **2022**, *56* (7), 3941–3951.
(3) Huynh, E.; Olinger, A.; Woolley, D.; Kohli, R. K.; Choczynski, J. M.; Davies, J. F.; Lin, K.; Marr, L. C.; Davis, R. D. Evidence for a Semisolid Phase State of Aerosols and Droplets Relevant to the Airborne and Surface Survival of Pathogens. *PNAS* **2022**, *119* (4).
(4) Kaur Kohli, R.; Davies, J. F. Measuring the Chemical Evolution of Levitated Particles: A Study on the Evaporation of Multicomponent Organic Aerosol. *Anal. Chem.* **2021**, *93* (36), 12472–12479.
(5) Kaur Kohli, R.; Van Berkel, G. J.; Davies, J. F. An Open Port Sampling Interface for the Chemical Characterization of Levitated Microparticles. *Anal. Chem.* **2022**, *94* (8), 3441–3445.

Bio: James received his undergraduate degree from University of Cambridge in 2010 and his PhD from University of Bristol in 2014, under the supervision of Prof Jonathan Reid. He moved to the USA to complete a postdoc position at the Lawrence Berkeley National Lab where he worked with Dr Kevin Wilson. He began his independent career in 2018 at University of California Riverside.