The Structure of Atmospheric Particles & Impacts on Atmospheric Chemistry and Climate

The interactions of aerosol particles with light and clouds are the leading uncertainties in our understanding of the climate system. These interactions are determined in part by the structure of atmospheric particles. In this talk, I will give an overview of research in my laboratory that focuses on characterizing the structure of particles and how this structure impacts heterogeneous atmospheric chemistry and climate. In particular, the talk will focus on molecular-level studies of surfaces relevant for cirrus (ice) cloud formation and the phase separation behavior of submicron aerosol particles composed of organic and inorganic components. Global climate models are extremely sensitive to the formation and properties of cirrus clouds. While “active sites” are proposed to be important for ice nucleation, the identity of these sites is unknown. Using systems in which the ice nucleation behavior is altered by chemical processing, we can determine the identity of these active sites. In aerosol particles composed of organic and inorganic components, the arrangement of components within the particles affects the formation and growth of particles, their radiative properties, and heterogeneous chemistry. For certain compositions, we observe that the morphology of submicron particles is size dependent, where small particles (less than approximately 200 nm) are homogeneous and large particles are phase separated. I will comment on the possible origins of this size dependent behavior as well as potential impacts on aerosol radiative properties. Through these projects, I will demonstrate the importance of characterizing aerosol structure in determining aerosol physical and chemical properties relevant to atmospheric chemistry and climate.

Biosketch: Miriam Freedman graduated from Swarthmore College in 2000. She received a Master’s degree in Mathematics at the University of Minnesota before pursuing her PhD in Chemistry at the University of Chicago, where she graduated in 2008. In graduate school, Miriam studied the dynamics of complex organic thin films. Following an interest in environmental sciences, Miriam studied atmospheric chemistry as a postdoc at the University of Colorado. She has been an Assistant Professor of Chemistry at Penn State since 2010. Miriam has received several awards throughout her career: an NSF graduate research fellowship, a NOAA Climate and Global Change postdoctoral fellowship, and, most recently, an NSF CAREER award in 2014.

*Light Refreshments will be served.*