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Infrared spectral challenges of individual, respirable, micron-sized dust particles: Strong phonons and their distorted lineshapes[1]
JAMES COE, Ohio State Univ - Columbus — Consideration of cluster properties as they grow through the nanosize regime and into the micron-sized regime, leads to expectations of bulk-like trends which are well understood. However, individual micron-sized particles are of comparable size to the wavelength of probing infrared (IR) light, so vibrational spectra will be dominated by scattering effects and lineshapes will have dispersion and saturation distortions. Airborne dust particles of ~ 4 micron widths are of particular health interest because they get past the nose, throat, and thorax and can be inhaled into people's lungs. This talk will describe the use of plasmonic metal mesh to obtain scatter-free, IR absorption spectra of single, ~ 4 micron respirable particles. A dust library of single particle IR spectra is being compiled to chemically characterize respirable dust and a Mie-Bruggeman model has been created to predict the IR spectra of collections of mixed-composition dust particles. Having dealt with scattering effects, the remaining difficulty involves the effect of strong phonons. Many of the most common mineral components of dust have strong phonons with intensity cross sections comparable to the size of the particle which leads to severe and interesting lineshape distortions.

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