# Investigation of Nanoparticle Size to Optimize SERS Substrates for Aerosol Particle Studies

Tubbs, Darrell

Particles suspended in the atmosphere are classified as aerosol particles. While greenhouse gases such as carbon dioxide have a large effect on climate, these are well understood and have a small uncertainty. Aerosol particles have the largest uncertainties associated with their impact on climate of any atmospheric constituent making it important to understand their behavior in the atmosphere. Aerosol particles have a wide range of sources both natural and anthropogenic, which leads to a variety of physical and chemical properties. Aerosol particle properties, such as size and chemical composition, influence how these particles scatter and absorb solar radiation, as well as nucleate cloud droplets and ice crystals, thus impacting climate. There are many challenges associated with accurately measuring these properties, especially chemical composition, since atmospheric particles are very small, with most being 100-200 nm in size. Surface enhanced Raman spectroscopy (SERS) is a technique with potential to overcome these challenges. SERS allows for detection of low concentration analytes at small spatial scales through the amplification of Raman signal. The SERS effect is dependent on the excitation of localized surface plasmon resonances in noble metal substrates, usually nanoparticles. This project focuses on investigating different SERS substrates, with the goal of developing an optimized SERS substrate that can be used for the study of aerosol particles. This project is one of the first applications of SERS to aerosol particle research and preliminary work has shown substantial enhancement of Raman signal for individual aerosol particles.