

Concentrated atmospheric nanoparticle beams in vacuum for X-ray and optical spectroscopy.

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The IPCC AR4 points out the important role of aerosol in the radiation budget of the earth. In the model prediction, direct and indirect contribution of the atmospheric aerosol causes a net cooling of the earth. Understanding the fundamental physical and chemical processes of heterogeneous nucleation of water on nanoparticles could help improving the models.

On our poster we present the first stage of the TRAPS apparatus (Trapped Reactive Atmospheric Particle Spectrometer). The apparatus comprises as nanoparticle sources atomizers, electrospray and plasma reactors in order to produce nanoparticle sizes from 20-50nm, 10-20nm and 5-10nm respectively. The nanoparticles are dispersed in helium as carrier gas at high pressure. After passing a critical orifice into rough vacuum a tuneable aerodynamic lens is used to focus the particles into a differential pumping stage. We put high effort in optimizing the aerodynamic lens for particle beams close to the

diffusion limit by CFD calculations. Downstream the differential pumping the particle beam is used to continuously refill a linear ion trap. For the trapping of particles in the size range of several kDa to MDa, a radio frequency from 10-150 kHz is. In contrast to the work of other groups, which are using digital ion traps, we developed an amplifier capable to provide an appropriate sinusoidal voltage with amplitude up to 3kV.

This assembly is capable to inject nanoparticles into vacuum chambers in a highly efficient way. The dilution of the particle number concentration arising from the gas expansion from room pressure into vacuum is compensated by concentrating the particles in a small cylindrical volume by electrodynamic trapping. The enlargement of the target density compared to a free molecular beam provides a tool for various techniques of spectroscopy used on smaller ions by routine.