Plenary Talk PV VI Wed 9:45 E415

Cavity-enhanced light-induced processes in aerosol droplets

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When light interacts with an aerosol particle, the light intensity can be greatly amplified inside the particle as the latter acts as a light-amplifying cavity. This optical phenomenon can be viewed as a dielectric analogue of plasmon resonances in metallic nanoparticles. The role these optical confinement effects play in aerosols are diverse. We report their influence in three different areas: (1) Photochemical processes have been identified as the main causes of degradation and oxidation of matter in atmospheric aerosol particles. Photochemistry in aerosol particles is accelerated by optical confinement effects compared with reactions in bulk condensed matter. We have studied and quantified the acceleration of in-particle photochemistry using photoacoustic spectroscopy and X-ray spectro-microscopic imaging of single aerosol particles. (2) Low-energy electron scattering in liquid water plays a crucial role in a variety of physical, chemical, and biological processes. However, the quantitative description of electron scattering has been hampered by the lack of scattering cross-sections for liquid water. By exploiting optical confinement effects in photoemission images of water droplets, we have contributed to solving this problem. (3) Optical confinement also affects ultrafast, laser-driven plasma formation from aerosol particles by structuring the internal light intensity. We report recent coherent diffraction imaging experiments during nanoplasma expansion of core-shell aerosol particles.