ELS-XV-2015 Abstracts
ELS-XV-2015-89
Electromagnetic & Light Scattering XV 2015, Leipzig

Light scattering by cometary dust particles analogs

E. Hadamcik (1), J.-B. Renard (2), N. Carrasco (1), N. Johnson (3), M. Kuga (4), J. Nuth (3), and L. Tissancier (4)

(1) LATMOS-IPSL, Guyancourt, France (edith.hadamcik@latmos.ipsl.fr), (2) LPC2E-CNRS, Univ. Orléans, Orléans, France (jbrenard@cnrs-orleans.Fr), (3) NASA Goddard Space Flight Center, Greenberg, France (joseph.a.nuth@nasa.gov), (4) CRPG/CNRS, Vandeuvre les Nancy, France (tix@crpg.cnrs-nancy.fr)

Polarimetric observations of cometary comae may be used to infer dust properties through experimental simulations. Mixtures of fluffy silicates and carbon were successfully studied and confirmed the results from remote observations. Different space missions (e.g. Stardust, Deep Impact, EPOXI), have revealed complementary information on the dust particles, while the Rosetta mission to comet 67P/Churyumov-Gerasimenko is still yielding incomparable data on the structure and composition of dust particles (Schulz et al., 2015; Rotundi et al., 2015). Rosetta also confirmed, the preperihelion dust properties found by remote observations. In its first phase, Rosetta finds various structures for individual dust particles: e.g. (i) very fluffy and large aggregates captured on the plates of COSIMA (more than 50 micron pure carbonaceous compounds); (ii) 100-1000 micron-sized particles, which dominate the dust light scattering observations (GIADA and OSIRIS).
Laboratory simulations of light scattering by cometary analog particles help to disentangle different physical properties by comparison with observational data. The linear polarization depends on the geometry of the observations (phase angle), the particle properties (size distributions, structures, refractive indices) and on the wavelength of observation. Our PROGRA2 light scattering experiment is perfectly adapted to study these large particles, levitating in micro-gravity or lifted by an air-draught.
The aim of this study is to simulate differences between the period of observations (perihelion distance, seasonal effect), regions in the coma or the classes of comets. We had to obtain realistic compositions, materials such as silicates, amorphous carbon and different carbonaceous compounds. Organics are produced in our laboratories by different methods: from liquids (poly-HCN), or from molecular dissociation in N2:CO:CH4:H2:H_2O gas mixtures in different ratios by an electric discharge where electrons from the plasma initiate gas-phase chemistry. Finally clear to dark brown solid particles are formed in the gas phase with the PAMPRE/LATMOS instrument and dark solids are deposited on the walls in the nebulotron/CRPG-CNRS. The organics differ in size distribution and composition depending on their formation conditions. Their elemental composition e.g. N related to C depends on their formation conditions and their colour is related to chemical functional groups. The different organics are analyzed with SEM, TEM, IR and Raman spectroscopy. Some are heated ex-situ. To build cometary analogs, organics are mixed with silicates (e.g. NASA and CRPG) or coat them (NASA). Their optical properties are compared using the PROGRA2 experiment and the results are tentatively related to their composition.