

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)  
Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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THE PROGRA2 PROJECT: OPTICAL PROPERTIES OF SOLID GRAINS OBTAINED DURING  
MICROGRAVITY PARABOLIC FLIGHTS, FOR THE INTERPRETATION OF REMOTE SENSING  
MEASUREMENTS

**Abstract**

The analysis of light scattered by dust in planetary and cometary atmospheres, by the interplanetary dust and by the regolith on small bodies surface, can provide some information of the physical properties of the grains, mainly their nature, size and porosity. Many remote sensing observations of these bodies have been conducted from telescopes at ground and from space. To interpret these observations, there is a need of a laboratory data base for the optical properties of various kinds of irregular shaped dust grains. This is the aim of the PROGRA2 project. PROGRA2 instruments are imaging polarimeters that allow us to retrieve the complete brightness and polarization scattering functions of a cloud of solid particles. For the smallest particles, having diameter below 20 micrometers, the cloud can be produced in laboratory at ground using an air lifting system. For the largest particles, experimental bias can occur for the size distribution and the particles orientations when using an air drag system. On the opposite, microgravity conditions are the best method to produce such cloud of large grains. Also, large aggregates that cannot be produced at ground can be easily obtained during microgravity conditions. 2 instruments are dedicated to the scattering measurements of the levitating particles at different wavelengths: PROGRA2-VIS at 544 and 633 nm, and PROGRA2-IR at 1500 nm. A third instrument, PROGRA2-SURF, allow us to obtain the scattering functions of deposited particles, to be compared to the scattering functions of the same particles in levitating conditions. The PROGRA2 project has started in 1994 and have participated to 42 parabolic flights campaigns onboard the Caravelle ZeroG, the NASA-KC-135 and the NOVESPACE A300 Zero-G, during campaigns funded by CNES and by ESA. 20 parabolas are necessary to obtain a

complete scattering phase functions, and PROGRA2 has performed more than 3500 parabolas. Hundred of scattering curves were obtained, taking into account also those obtained in ground-based conditions for small-sized grains and for deposited grains. The results can be found at: [www.icare.univ-lille1.fr/progra2/](http://www.icare.univ-lille1.fr/progra2/) We will present the main results obtained with PROGRA2, in particular for carbon particles that can be found in comets and in interplanetary dust and for solid particles in the Earth atmosphere. PROGRA2 also participate to preliminary works for the ICAPS project (ESA) expected to be onboard ISS in few years.