Spectro-gonio radiometer at LPG

This spectro-gonio radiometer has been specially designed to measure with a high photometric accuracy the bidirectional reflectance of bright planetary materials over most of the solar spectrum and under wide illumination/observation configurations.

- Location / owner: Laboratoire de Planétologie de Grenoble
  CNRS - Université J. Fourier
  Saint Martin d’Hères, France

- Persons in charge:
  - Scientific: Bernard Schmitt, Research director
  - Technical: Olivier Brissaud, Engineer

- Type: Laboratory

- Spectral range: 0.3 - 4.5 µm (-> 5.0 µm: lower S/N) (4.2-4.3µm: atm. CO₂ limited)
- Spectral resolution: variable
  - mini: < 0.1 nm (but S/N limited)
  - maxi: 6 nm (<750nm), 12 nm (<1500nm), 24 nm (<3000nm), 48nm (>3000nm)

- Bidirectional Reflectance
  - Incidence angle: 0° to 85°
    resolution: 0.1°
    maximum sampling: 0.1°
  - Emergence angle: 0° to 80° (to 83° for dark / fine grained samples)
    resolution: ± 2° (may be reduced to < ± 0.5°, but S/N limited)
    max. sampling: 0.1°
  - Azimuth angle: 0° to 180°
    resolution: ± 2° (may be reduced to < ± 0.5°, but S/N limited)
    max. sampling: 0.1°
  - Phase angle: mini to 165°
    mini: ~ 8° for bright / large grained samples
    ~ 4° for dark / fine grained samples

- Illumination diameter (nadir): 200 mm
- Observation diameter (nadir): 20 mm

- Samples
  - Type: rocks, minerals, snow / ice, sulfur, ... (from very bright to dark)
  - Texture: compact or granular
  - Grain size: micrometer to a few millimeters
  - Size: maxi: 300mm diameter, 250 mm deep (bright & coarse grained samples)
    120 mm in diameter, 2-10 mm deep (dark or fine grained samples)
  mini: 25 mm x 120 mm (for principal plane observation down to 80°)
    25 mm x 45 mm (for principal plane observation down to 60°)
  - Temperature: room temperature or heated
    down to -20°C (in cold room)
    down to -40°C (in SERAC environmental cell)
- **Photometry**: absolute: 0.3-1.0 µm: better than 1% over all configurations
  relative to a calibrated Spectralon 0.99 reference panel
  1.0-2.5 µm: better than 1% over all configurations
  2.5-5 µm: better than 2% over all configurations
  relative: better than 0.5% (0.3-2.5 µm)

- **Polarimetry options**
  - **Illumination**: linear polarization: variable 0 to 90°
  - **Spectral range**: 0.3 - 2.8 µm
  - **Observation**: 1 component over the 0.3 - 5µm range + unpolarized or || and ⊥ components over restricted spectral range

- **Experiment control**: PC/Windows, fully software controlled (LabView©).
  automatic acquisition of all spectral/geometric configurations

- **Acquisition time**: typical 15 mn for 200 spectral channels in visible (S/N dependent)
  total: 15 hours for 100 spectral channels and 100 geometries

- **Current state** of system:
  - 0.3 - 5 µm range: fully calibrated
  - polarization: tested -> 2003
  - low temperature: tested in cold room down to -15°C

- **Availability to community**:
  - Technical improvements/calibration (20%)
  - LPG + associated laboratories measurements (60%)
  - open to specific collaborations w. funding (20%)

- **References**:


General view of the Spectro-gonio photometer at LPG

General view of the instrumentation