Mem. S.A.It. Vol. 87, 151

Memorie della

Comet 67P/CG: major results from Rosetta/VIRTIS-M

F. Capaccioni[1], G. Filacchione[1], M.C. De Sanctis[1], F. Tosi[1], M. Ciarniello[1], A. Raponi[1], M.T. Capria[1], G. Piccioni[1], P. Cerroni[1], A. Migliorini[1], E. Palomba[1], S. Erard[2], D. Bockelee-Morvan[2], C. Leyrat[2], and Rosetta VIRTIS team

[1] INAF-IAPS, Istituto di Astrofisica e Planetologia Spaziali, Area di Ricerca di Tor Vergata, via del Fosso del Cavaliere 100, 00133 Rome, Italy
[2] LESIA, Observatoire de Paris, LESIA/CNRS, UPMC, Université Paris-Diderot, F-92195 Meudon, France

Abstract.

Comets are probably the least-altered objects that survive from the origin of the Solar System, and they therefore carry the record of the physical processes that have led to their formation. The solid components we observe on the nuclei may have existed before the Solar System formed, as interstellar grains, or they could be materials that condensed in the early protosolar nebula. With the arrival, in early august 2014, of the Rosetta spacecraft at 67P/ Churyumov-Gerasimenko (hereafter 67P), VIRTIS, the Visible, Infrared and Thermal Imaging Spectrometer began a mapping campaign to provide direct measurements of the surface composition of the nucleus. VIRTIS is a dual channel spectrometer; VIRTIS-M (M for Mapper) is a hyper spectral imager covering a wide spectral range with two detectors: a CCD detector (VIS) ranging from 0.25 through 1.0 μm and an HgCdTe detector (IR) covering the 1.0-5 μm region. VIRTIS-M uses a slit and a scan mirror to generate images with spatial resolution of 250 μrad over a FOV of 3.7°. The second channel is VIRTIS-H (H for High-resolution), a point spectrometer with high spectral resolution in the range 2-5 μm . As outcome of the mapping phase, lasted between August and November 2014, the VIRTIS instrument on board the Rosetta spacecraft has provided evidence of carbon-bearing compounds on the nucleus of the comet 67P. Capaccioni et al. (2015). The very low reflectance of the nucleus (normal albedo of 0.060 0.003 at 0.55 μm), the spectral slopes in VIS and IR ranges, and the broad absorption feature in the 2.9-3.6 μm range present across the entire illuminated surface, are compatible with opaque minerals associated with nonvolatile organic macromolecular materials: a complex mixture of various types of C-H and/or O-H chemical groups, with little contribution of N-H. In active areas, the changes in spectral slope and absorption feature width may suggest small amounts of water ice. However, no ice-rich patches are observed so far, indicating a generally dehydrated nature for the surface currently illuminated by the Sun. Also the surface temperature has been measured in the thermal emission region, at 3.5-5.0 μm; once

the temperature is calculated from the radiance data we obtain surface temperatures in the range 180-230 K during daytime. It is interesting to note that the above temperatures are compatible with a low inertia uppermost layer (estimated up to few hundred microns) probably formed by a dark porous dehydrated refractory materials, confirming the compositional results.

References

Capaccioni, F., Coradini, A., Filacchione, G., et al. 2015, Science, 347, aaa0628