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Compositional maps of 67P/CG nucleus after perihelion passage by VIRTIS-M aboard Rosetta

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Abstract

Comet 67P/Churyumov-Gerasimenko undergoes periherm transit at 1.2 AU in August 2015. During this passage the illumination conditions above the south hemisphere of the nucleus rapidly improve becoming optimal for the retrieval of the surface properties by VIRTIS-M [1] onboard Rosetta. A similar mapping of the surface at about 12.5 m/pixel and at solar phases below 40 deg has been already performed during the Philae prelanding phase (August-September 2014, heliocentric distance 3.6 AU) allowing us to build compositional maps of the entire north hemisphere and equatorial regions down to latitudes -50 deg on a limited part of the Hapi, or the comet's neck, region [2]. One year after this first mapping campaign the illumination geometry becomes favorable to complete the coverage above the South polar region. Since comet's activity is rapidly increasing and the Rosetta spacecraft cannot orbit on low trajectories like during the prelanding phase, the south hemisphere maps shall be reasonably observed by VIRTIS-M with a spatial resolution of about 25 m/pixel. Global scale data have shown that the nucleus' double-lobe surface is characterized by morphologically different units [3] uniformly covered by a very dark, low-albedo, dehydrated organic-rich material [4]. Compositional properties across the different regions of the nucleus are mapped by measuring visible and infrared spectral slopes, calculated on the best linear fit to the reflectance spectra between 0.5-0.8 μm and 1-2.5 μm, respectively. As pre-landing data have clearly shown, spectral slopes are highly diagnostic to identify active areas, like in the Hapi area [5], and exposed water ice deposits where the spectra appear less red. As heliocentric distance decreases and diurnal temperatures increase, the 3-5 μm spectral range becomes affected by thermal emission from the surface [6]. This emission is overlapping with the 3 μm feature previously observed by VIRTIS during the pre-landing period making more difficult to retrieve the distribution of the organic material. A summary of the spectral characteristics observed on the south hemisphere region during the perihelion passage is given. Activity-driven spectral changes observed before and after perihelion passage on some specific areas of the surface are discussed.

References

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