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Temporal variability of 67P/Churyumov-Gerasimenko nucleus spectral properties from VIRTIS-M onboard Rosetta

M. Ciarniello (1), A. Raponi (1), M. C. De Sanctis (1), F. Capaccioni (1), G. Filacchione (1), F. Tosi (1), S. Erard (2), C. Leyrat (2), D. Bockelée-Morvan (2), A. Barucci (2), A. Longobardo (1), S. Mottola (3), E. Palomba (1), G. Piccioni (1), E. Quirico (4), P. Beck (4), M. T. Capria (1), P. Drossart (2), B. Schmitt (4) and the VIRTIS Science Team.
(1) IAPS-INAF, Via del Fosso del Cavaliere 100, I-00133 Rome, Italy (mauro.ciarniello@iaps.inaf.it), (2) LESIA, Observatoire de Paris/CNRS/UPMC/Université Paris-Diderot, Meudon, France, (3) Institute of Planetary Research, DLR, Berlin, Germany, (4) Laboratoire de Planétologie de Grenoble (LPG) - University Joseph Fourier Grenoble, Grenboble, France

Abstract

We investigate the variability, on both diurnal and seasonal scale, of the spectral properties of the nucleus of comet 67P/Churyumov-Geresimenko as observed by the VIRTIS-M imaging spectrometer onboard the Rosetta spacecraft. The spectrum is described by means of spectral indicators: visible and infrared slopes, band areas and band positions.

1. Introduction

Launched on 2 March 2004, the Rosetta spacecraft arrived to comet 67P/Churyumov-Gerasimenko (CG) on 6 August 2014 at a heliocentric distance of 3.5 AU and started escorting the comet until the perihelion passage (13 August 2015 at 1.24 AU) and beyond. Seasonal and heliocentric distance variations modify the illumination conditions on the surface affecting the cometary activity on long-term scale. Furthermore, diurnal variations are induced by nucleus rotation with a period of 12.4 h [1]. All these effects can modify the surface composition along its physical properties and thereby the spectral shape of the nucleus.

VIRTIS-M [2] is an imaging spectrometer onboard Rosetta spacecraft. It extensively observed CG nucleus in the overall 0.25-5.1 μm range, producing millions of spectra. This allowed us to observe the same regions on the surface multiple times and to monitor temporal variations both on diurnal and seasonal scale.

2. Method

The monitoring of the surface properties is performed by means of spectral indicators aimed at characterizing the most significative regions of the spectrum. In particular, spectral slopes in the visible range (0.55-0.80 μm) and in the infrared range (1-2.5 μm) are computed [3]. Along with these quantities, the band area of the organics feature at 3.2 μm [4] is calculated as well as the position of its minimum. These spectral indicators can give us clues on the temporal variability of water ice on the comet surface since both visible and infrared slopes are affected by water ice content, as well as the region around 3 μm where water ice absorption feature occurs [5].

Together with changes in composition also the observation geometry can affect the spectral shape through phase reddening. In order to disentangle the two effects the analysis is performed on photometrically reduced data, following the approach of [6].

Main findings for selected regions of the nucleus will be discussed.

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