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Investigations of 67/P-CG surfaces thermal properties at Southern latitudes and variations with heliocentric distances with VIRTIS/Rosetta

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Abstract

The Visible InfraRed and Thermal Imaging Spectrometer VIRTIS [1] instrument onboard Rosetta (ESA) has been intensively used to map the nucleus spectral and thermal properties of the nucleus comet 67/P-CG [2][3]. Here we report the thermal analysis of surfaces using thermal modeling dedicated to the comet. We focus on variations of thermo-physical properties with time, as long as the comet reaches its perihelion, and on thermal properties of the southern regions that were not illuminated during the last years due to the high obliquity of CG [4].

1. Introduction

Thermal emission of airless planetary surfaces depends on composition, surface roughness, porosity, thermal conductivity but also on the shape of the body. Thermal conduction is usually the most efficient mechanism to transport energy from the surface down the sub-surface. When ice is present at surface or beneath the surface, sublimation affects significantly the thermal contrast between noon and midnight. Because of its eccentricity and its strong obliquity, the comet 67/P-CG experiences strong seasonal variations especially near its south pole which is only illuminated near perihelion. Up to mid 2015, VIRTIS data allowed us to derive the temperatures and the thermal properties of the northern hemisphere [5]. This presentation focuses on the derivation of thermal properties of the southern hemisphere and on their variations in the equatorial regions between 3 AU and perihelion.

2. Thermal properties

We use a quasi-3D approach to model heat transfert by conduction that includes sublimation effects, self-heating and mutual shadowing. We analyze separately the geomorphological regions described by [6]. For each of them, a representative set of temperature measurements is selected randomly and compared directly to the simulated one in order to determine the thermal parameters that best fit the measurements within a given region. For each of the considered geomorphological regions, we aim to derive thermal conductivity that provides information on the physical properties of the surface. We particularly focus on the Southern hemisphere and on the equatorial regions. The southern hemisphere is only heated by the Sun when the comet is close to the perihelion so we expect strong seasonal variations. In particular, water ice that is supposed to be present in this cold should sublimate rapidly as long as the surface is illuminated. Thus, one may detect variations of thermal conduction as long as ice sublimates. We also analyze and model temperatures at equatorial latitudes as those area can be observed at very similar absolute sub-solar latitudes in summer and winter but at very different heliocentric distances. Direct comparisons with models can emphasize variations of thermal properties due to chemical variations of the surface to radiations processes and structural surface modification.

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References

[1] Coradini, A., Capaccioni, F., Drossart, P., et al.: An Imaging Spectrometer for the Rosetta Mission, Space Science Reviews, 128, 529, 2007.

[2] Capaccioni, F. et al.: The organic-rich surface of comet 67P/Churyumov-Gerasimenko as seen by VIRTIS/Rosetta, Science 347, 2015.

[3] Filacchione, G., et al. (2015). *LPSC XLVI*.

[4] Sierks, H. et al.: On the nucleus structure and activity of comet 67P/Churyumov-Gerasimenko, Science, 347, doi: 10.1126/science.aaa1044, 2015.

[5] Tosi, F., et al. (2015). EGU General Assembly 2015.

[6] Thomas N. et al.: The morphological diversity of comet 67P/Churyumov-Gerasimenko, Science, 347, doi: 10.1126/science.aaa0440, 2015.