EPSC Abstracts
Vol. 12, EPSC2018-249, 2018
European Planetary Science Congress 2018

Colours, albedos and spectral properties of the Khepry-Imhotep region of comet 67P as observed by Rosetta/OSIRIS during the April 2016 flyby

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Abstract

The ROSETTA mission was the ESA cornerstone mission for the study of the small bodies of the solar system in the Horizon 2000 perspective. Between July 2014 and September 2016, the Rosetta spacecraft rendez-vous'ed with the comet 67P/Churyumov-Gerasimenko (hereafter 67P/CG) and followed it closely along its orbit, before, during and after its passage at perihelion. During this period, the observations performed by the instruments on-board the Rosetta spacecraft, and the Philae lander, have allowed to observe, measure and constrain many of the physical and chemical properties of the nucleus and inner coma of 67P/CG. Additionally, during those 26 months, the Rosetta spacecraft also performed 3 flyby manoeuvres at small phase angles, which have allowed the on-board scientific imaging system to obtain highly detailled images of the nucleus' surface, and in two cases, to observe the opposition effect as well. We present here the results of the spectrophotometric and photometric analyses of the area of the comet 67P/CG's nucleus, over which the Rosetta spacecraft flew-by in April 2016. During this manoeuvre, the OSIRIS instruments [6] collected 256 high-resolution images of the surface using different filters in the 250-1000 nm domain.

Between the 9th and 10th of April 2016, the Rosetta spacecraft flew by the nucleus at an altitude of ~29 km, thus allowing the OSIRIS instrument to map the boundary between the Khepry and Imhotep morphological regions [1] with, at best, a resolution of 0.53 cm/px and several other surface of the comet with a resolution of at least 5 m/pxl. From those observations, we have assembled the phase curve of the flyby area for phase angles ranging from 0.1° to 62°.

The boundary between the Khepry and Imhotep regions presents a large diversity of morphological features (such as fine material deposits, boulder fields, megaclasts, scarps, outcropping consolidated material, or diamictons). Similarly, this area also presents some diversity in terms of colours and albedos: while the average reflectance of the area is similar to that the whole nucleus (~ 6.8% at 649 nm), some particular features present systematically a reflectance around 15% lower than the average, while the brightest features observed display a reflectance up to 3 times higher than this average. While the former tend to present a spectral slope steeper than that of the average featureless surface, the latter present lower spectral slopes. Such bright features with a neutral or low spectral slope display properties similar to surface features proven to be water-ice enriched material [3], and as such stands as candidates for water-ice exposure on the nucleus at the time of the flyby.
Such features were not observed in the area flown-by the Rosetta spacecraft in February 2015 [2]. Photometric modeling of the data shows the absence of a strong increase of the reflectance at phase angle lower than 2°. Furthermore, for all of the wavelengths investigated (480, 649, 743 nm), the computed FHWMs using the linear exponential model [5,7] range between 5.0° and 6.3° and indicate that the opposition effect is dominated by the shadow-hiding mechanism. This result concurs with initial modeling results [4].

We will present the results of our global and local spectrophotometric analysis of the flyby area, and those of the phase curve modeling using different photometric models, and we will compare them to those previously obtained for the comet nucleus at different heliocentric distances as well as for other primitive Solar System bodies.

Acknowledgements

OSIRIS was built by a consortium of the Max-Planck-Institut fuer Sonnensystemforschung, Goettingen, Germany; CISAS–University of Padova, Italy, the Laboratoire d' Astrophysique de Marseille, France; the Instituto de Astrof' ısica de Andalucia, CSIC, Granada, Spain; the Research and Scientific Support Department of the European Space Agency, Noordwijk, The Netherlands; the Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain; the Universidad Politechnica de Madrid, Spain; the Department of Physics and Astronomy of Uppsala University, Sweden; and the Institut fuer Datentechnik und Kommunikationsnetze der Technischen Universitaet Braunschweig, Germany. The support of the national funding agencies of Germany (DLR), France (CNES), Italy (ASI), Spain (MEC), Sweden (SNSB), and the ESA Technical Directorate is gratefully acknowledged.

References

[1] El-Maarry M. R. et al., 2015, A&A, 583, A26
[2] Feller C. et al., 2016, MNRAS, 462, S287
[3] Filacchione G. et al., 2016, Nature, 529, 368
[4] Hasselmann, P. et al., 2016, MNRAS, 469,S55
[5] Kaasalainen S. et al., 2003, Icarus, 161, 34
[6] Keller, H.U. et al., SSR, 128,433-506, 2007
[7] Rosenbush V. K et al., 2005, Icarus, 178, 222