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# 67P/Churymov Gerasimenko comet: investigation of spectrophotometric properties of the structural layers as from OSIRIS data

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The Optical, Spectroscopic, and Infrared Remote Imaging System (OSIRIS, Keller et al. 2007) of ESA's Rosetta spacecraft provided numerous images of the bilobate comet 67P/Churyumov-Gerasimenko (67P). Thanks to such imagery, the identification of morphological properties has been complemented by detailed studies of the spectrophotometric behaviour of the global surface. The surface of each lobe is a sequence of pitted planes and cliffs partially covered by dust deposits. This staircase morphology has been interpreted as the surface expression of extended discontinuities that separate superimposed layers of consolidated material (Massironi et al. 2015, Giacomini et al. 2016, Lee et al. 2016). By measuring the orientation of the terraces, Penasa et al. (2017) produced a simplified three dimensional ellipsoid-based model (Ellipsoidal Model, EM) that can be used to evaluate the structural level of any point on the cometary surface as a distance from the structural centre of the pertaining lobe. They resolved the overall geometry of the layers, highlighting that different portions of the comet expose different structural depths, thus implying that 67P underwent a non-homogenous process of volume removal. According to the EM, the outermost and innermost layers are revealed in different regions of each lobe.
Concerning the bigger lobe, inner layers correspond to the Imhotep region, whereas the outermost ones are located between Atum and the elongated Ash region, including Apis and part of Khonsu, and appear darker than the adjacent - underlying - materials (Fornasier et al. 2015). Global and local spectrophotometric investigations of 67P nucleus (e.g., Fornasier et al. 2015, 2016, Oklay et al. 2016a, 2016b, 2017, Hasselmann et al. 2017) enhanced the relative surface content of volatiles depending on the spectral slope of the terrains (i.e. relatively bluer spectra are associated to terrains enriched in water ice), but no correlation with a layered disposition was observed. We therefore conducted on post-perihelion multispectral images a supervised classification of those outcrops on the basis of their elevation in the EM, concluding that materials located at different structural levels are characterized by different brightness. In particular, inner layers are brighter than the outermost ones. This variegation can be attributed to a different texture of the outcrop surface and/or to a different content of refractory materials, implying different scenarios for the accretion or the evolution of comet 67P. Indeed, such a variation could have occurred during the nucleus accretion and/or before the volume loss of the outer layers pointed out by Penasa et al. 2017, implying that the inner layers reveal their intrinsic brighter nature coinciding with those volume removals, or during a process selectively involving parts of a homogeneous cometary nucleus.