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Photometric surface properties of Lutetia as seen by OSIRIS/Rosetta.

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Abstract

The asteroid (21) Lutetia was succesfully observed on July 10, 2010 by the ESA Rosetta spacecraft during its long interplanetary journey toward the comet 67P/Churyumov-Gerasimenko. With a diameter of almost 130 km, Lutetia becomes the largest asteroid observed by a space probe. Because of the trajectory, the northern hemisphere could be observed while the southern remained hidden. The images obtained in visible wavelengths with the OSIRIS cameras (both NAC and WAC) revealed a variety of craters densities and surface properties, suggesting a different geological history of the areas and different regolith properties. Here we present a spectrophotometric analysis of the surface using the OSIRIS images. Spectro-photometric data were used to generate multi-wavelengths maps of the surface.

1. Lutetia Flyby

During the Lutetia flyby in July 2010, remote sensing instruments on-board the Rosetta spacecraft have acquired precious information on the surface of the asteroid. The closest approach occurred at 15H45 UTC at a relative speed of 15km/s and a relative distance of 3160 km. The Narrow Angle Camera (NAC) and the Wide Angle Camera (WAC) of the OSIRIS instrument on board Rosetta acquired images at different phase angles ranging from almost zero to more than 150 degrees. The best spatial resolution (60 m/pixel) allowed revealing a very complex topography. Numerous sets of images have been obtained at different wavelengths from 270nm to 980nm, allowing to perform a spectro-photometric analysis of the surface. For this purpose, we used 189 images obtained with the NAC with 16 different filters combinations, and 160 images corresponding to 10 WAC combination filters.

2. Photometric Parameters

To generate multi-wavelengths maps of Lutetia, we used the 3D shape model from [1, 2] to create simulated images using the OASIS simulator (LAM). An auto-correlation algorithm was used to adjust OSIRIS data with simulated images on which the local conditions of illumination are known for each pixel (i.e., phase, incidence and emission angle).

Photometric properties were then derived using either [3] photometric law or [4] semi-empirical law. On each case, photometric parameters were first obtained for the full set of pixels on each image by looking for the minimum chi square between the measured and the modelled reflectance. Each image was then corrected assuming a specific phase angle. We will present those images, the photometric wavelengths dependant parameters associated, and the areas corresponding to different photometric properties. The baetica area shows high contrasts of reflectance up to 30%. It seems that landslides appears brighter and bluer than accumulation areas at the bottom of concavities. Such behaviour can be due either to space weathering or different kind of regoliths.

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