

ASTEROID (21) LUTETIA: GLOBAL AND SPATIALLY RESOLVED PHOTOMETRIC PROPERTIES. P. Lamy¹, L. Jorda¹, P. Vernazza², and G. Faury¹. ¹Laboratoire d'Astrophysique de Marseille, 38 rue Frédéric Joliot - Curie, 13388 Marseille, France (philippe.lamy@oamp.fr), and ²European Southern Observatory, Garching, Germany.

Asteroids (21) Lutetia has recently been visited by the Rosetta spacecraft of the European Space Agency and imaged by its Rosetta narrow (NAC) and wide (WAC) angle cameras.

The accurate photometric analysis of the images requires utmost care due to several instrumental problems, the most severe and complex to handle being the presence of optical ghosts which result from multiple reflections on the two filters inserted in the optical beam and on the thick window which protects the CCD detector from cosmic ray impacts.

These ghosts prominently appears as either slightly defocused images offset from the primary images or large round or elliptical halos.

The appearance, the location and the radiance of each individual ghost depends upon the optical configuration (selected filters) and on the image itself so that no general model can be proposed.

Consequently, a case-by-case approach must be adopted which requires a long and tedious work where each ghost is individually parametrized according to its specific geometry (defocused offset image or halo) and iteratively fitted to the original image.

The procedure has been successfully applied to all NAC and WAC images and works extremely well with residuals and sometime artifacts at insignificant levels.

Both NAC and WAC have further been recalibrated using the most recent observations of stellar calibrators VEGA and the solar analog 16 Cyg B allowing to correct the quantum efficiency response of the two CCD and the throughput for all channels (i.e., filters).

We will present results on the global photometric properties of (21) Lutetia, albedo, phase function and spectral reflectivity as well as spatially resolved properties based on a novel method developed in the space of the facets representing the three-dimensional shape of the body. This method successfully implemented in the cases of the nucleus of comet 9P/Tempel 2 and of asteroid (2867) Steins [1] has the advantage of automatically tracking the same local surface element on a series of images.

The analysis proceeds with the determination of the global Hapke and other standard photometric parameters as well as their two-dimensional variations across the surface.

This allows defining, in the body-fixed reference frame, "high residual regions" (HRRs) which correspond to significant relative differences between the observed and modeled photometric parameters such as the single-scattering albedo (SSA), the mean roughness slope angle, and the reflectivity gradient.

We found that the SSA replicates the topography with no hint of compositional trend. It is highly correlated with local slopes: the correlation coefficient amounts to 0.41 pour $1.375 \cdot 10^6$ measures, and it increases to 0.56 when limited to HRRs ($4.08 \cdot 10^5$ measures). This correlation with slopes is positive meaning that the SSA is larger for larger slopes. This is consistent with large slopes inducing regolith movements exposing fresh material. Laboratory measurements indicate that weathering by solar wind particles on enstatite chondrite material leads to a comparable darkening trend of 12%

Regions with large residuals prominently correspond to partial rims of large craters whereas the bulk of the surface of Lutetia is well described by the global Hapke parameters

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References:

[1] Spjuth, S., Jorda, L., Lamy, P.L., Keller, H.U., Li, J.-Y., Disk-resolved photometry of asteroid (2867) Steins. *Icarus* submitted.