PHOTOMETRIC ANALYSIS OF ASTEROID (21) LUTETIA. N. Masoumzadeh[1], C. Tubiana[1], J. -B. Vincent[1], H. Sierks[1], [1] Max-Planck-Institut fuer Sonnensystemforschung, Max-Planck-Str. 2, 37191 Katlenburg-Lindau, Germany (masoumzadeh@mps.mpg.de)

Introduction: The ESA's Rosetta spacecraft flew by asteroid (21) Lutetia on July 10, 2010 with a closest approach distance of 3170 km. Images obtained by the Optical, Spectroscopic, and Infrared Remote Imaging System (OSIRIS) cameras [1] onboard Rosetta are adopted to study the disk-integrated and disk-resolved photometry of the asteroid. We will present results of the photometric analysis of asteroid (21) Lutetia using the Hapke model.

Asteroid Phase Curve: Images in different filters spanning the phase angle range $0.1° < \alpha < 115°$, allow us to construct disk-intergrated phase curve (Fig.1).

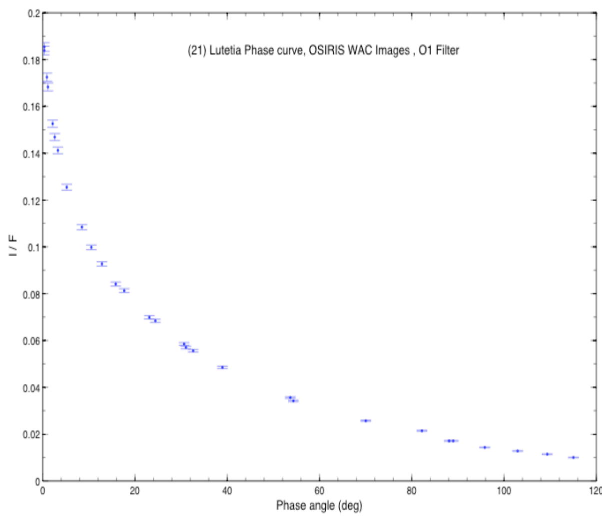

Figure 1. The reflectance data from OSIRIS WAC images at a wavelength of 630 nm versus phase angle.

Belskaya et al. (2010) obtained IAU H-G phase function parameters for Lutetia ground-observation data at $\alpha < 30°$ [2]. Our phase curve is in a good agreement with their finding. Phase function fitting, using a five parameters Hapke function, lead us to derive physical characteristics of the surface such as single-scattering albedo and macroscopic surface roughness [3].

In addition, the OSIRIS data at very small phase angles allow us to investigate the opposition effect by shadow hiding and coherent backscattering effects[4].

Disk-Resolved Photometry: OSIRIS disk-resolved images give us the possibility to apply Hapke disk-resolved modeling through bidirectional reflectance, I/F, to individual surface areas of the asteroid over a wide range of incidence, emission and phase angles.To calculate the photometric geometry at each facet, we used the Lutetia shape model [5]. Since Lutetia has a complex surface, we divided the asteroid surface from a geological point of view [6] to model Hapke's parameters for each terrain [7].

Another approach is to model the global photometric properties of the surface with empirical photometric functions such as Lambert and Lunar-Lambert functions. The Lutetia digital elevation model (DEM) is derived from two stereo images at phase angles of 57.0790° and 59.0389°. To produce the DEM we employed SOCET Set software (© BAE systems; Miller and Walker, 1993, 1995), and followed the methodology of US Geological Survey. The photometric properties of the asteroid surface can be studied comparing synthetic images, generated with Lambert and Lunar-Lambert shaded view of the DEM, with observed ones [8].

Surface disk-resolved photometry of (21) Lutetia has been studied also by Leyrat et al. (2012) with different technique using the OASIS simulator (developed at LAM) [9].

We will compare our results with the ones obtained by different authors with various approaches.

References: [1] Sierks H. et al. (2011) *Science* 334, 487-490. [2] Belskaya I. N. et al. (2010) *A&A., 515,* A29. [3] Li, J.-Y., et al., 2007a, *Icarus* 187, 41-55. [4] Belskaya I. N. and Shevchenko V. G. (2000) *Icarus, 147,* 94–105. [5] Jorda L. et al. (2011) *Vol. 6, EPSC-DPS2011-776*. [6] Massironi M. et al. (2012) *Planetary and Space Science., 66,* 125-136. [7] Li, J.-Y., et al., 2007b, *Icarus* 188, 195-211. [8] Kirk R. L. (2004) *Icarus, 167,* 54-69. [9] Leyrat C. et al. (2012) ACM., Abstract # 6332.