# SPECTRAL SIGNS OF CARBONACEOUS CHONDRITIC MATERIAL ON (21) LUTETIA

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**Introduction:** An increased attention to asteroid (21) Lutetia arouse after it was announced as an object of the Rosetta space mission of ESA. Due to its peculiar characteristics, Lutetia is one of the most attractive objects for examination within the framework of the mission. Then preliminary investigations of the asteroid with ground-based astronomical methods are of great interest.

We have discovered considerable variations in the continuum slope and shape of the visible-range reflectance spectra of the asteroid with rotation in November 2004 (4/5, 5/6 and 7/8) and March 2006 (3/4). Unusual behavior the spectral data obtained in November 2004 led us to a suggestion that Lutetia is a binary object of a complex C-S-M-type [1]. On the other hand, some of the asteroid reflectance spectra obtained in March 2006 may be interpreted as similar to those of carbonaceous chondritic meteorites.

**Results of observations in March 2006:** Spectral (0.40 – 0.91 µm, $R$~1000) observations of Lutetia were performed in the SAI Crimean observatory on 4/5 March 2006 when the asteroid had ~7° phase and close to equatorial (~83°) aspect angles. The observations were carried out at the 1.25-m reflector equipped with a 10" (width) -slit spectrograph and 375 x 242 ST-6 SBIG CCD-camera. The CCD-data were reduced in a standard way (flat-field, background and other necessary corrections were performed). A solar analog star, HD117176 [2], was also observed on the night for calculation of the approximate asteroid reflectance spectra. Resulting normalized (at 0.55 µm) and smoothed reflectance spectra are shown in Fig. 1. The spectra (1-5) were registered consecutively one after another in ~40 minutes and cover a time interval close to half of the known asteroid rotational period, $8.172^h$ [3]. It means that reflectance spectra 1 and 5 in Fig. 1 represent nearly opposite sides of the asteroid.

**Discussion:** Apparently from Fig. 1, the reflectance spectra are gradually changing in shape from concave to convex with Lutetia's rotation. Similar variations in reflectance spectra of the asteroid were observed also at the same time by others [4] (e. g., curves A and B in Fig. 3 of the cited paper). As is known (e. g., [5]), a concave shape of the visible-range reflectance spectrum (at 550-1000 nm) is typical for powdered carbonaceous chondrites (Fig. 2). It may be a manifestation of $Fe^{2+} \rightarrow Fe^{3+}$- charge transfer absorption [6] in serpentines and other layered minerals forming matrix of the meteorites. The result agrees with our previous identification of $Fe^{3+}$- absorption band at 0.44 µm in some reflectance spectra of Lutetia [7].

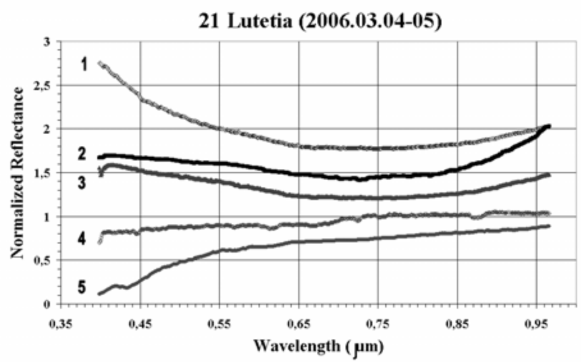


Fig. 1. Normalized (at 0.55 µm) and smoothed reflectance spectra of (21) Lutetia. The spectra are presented separately for clarity.

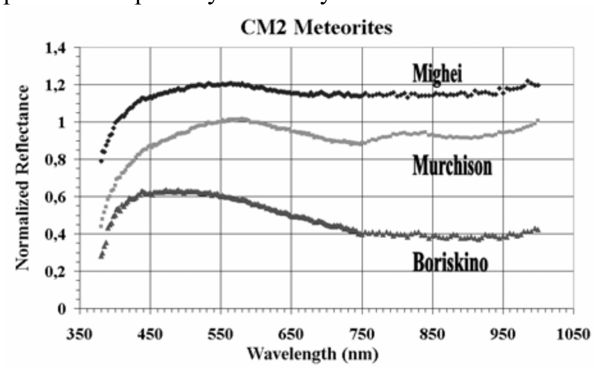


Fig. 2. Normalized (at 550 nm) and scaled reflectance spectra of some powdered (<0.25 mm) carbonaceous chondrites from [5].

**Conclusions:** The observed variations in Lutetia's reflectance spectra are probably caused by changes in content of the surface matter with rotation. In our opinion, the asteroid surface may incorporate very different materials from high-temperature silicates and/or Fe-Ni-metals to phyllosilicates.

**References:** [1] Busarev V.V. et al. (2007) *LPS XXXVIII,* Abstract #1016. [2] Cayrel de Strobel G. (1996) *Astron. Astrophys. Rev., 7 (3)*, 243-288. [3] Michalowski T. (1996) *Icarus, 123*, 456-462. [4] Nedelcu D.A. et al. (2007) *A&A, 470,* 1157-1164. [5] Busarev V.V., Taran M.N. (2002) *Proc. of ACM-2002,* Tech. Univ. of Berlin (ESA-SP-500), 933-936. [6] Burns R.G. (1993) *Mineralogical applications of crystal field theory*. NY: Cambridge Univ. Press. [7] Busarev, V.V., et al. (2004) In: *The New Rosetta Targets*. Colangeli L. et al. (Eds.), Dordrecht: Kluwer Acad. Publishers, 79-83.