Laboratory simulation using AMICA-PM - Imaging polarimetry of simulated surface of asteroid Itokawa

Akiko Nakamura[1]; Fumi Yoshida[2]; Jun Saito[3]; Sunao Hasegawa[4]; Masateru Ishiguro[5]; Ryosuke Nakamura[6]; Naru Hirata[7]

[1] Grad. Sch. of   Sci. and   Tech., Kobe Univ.; [2] NAOJ; [3] Technical Research Inst., NISHIMATSU Construction Co., Ltd.; [4] ISAS/JAXA; [5] UH; [6] JAXA; [7] Kobe University

An imaging polarimetric study of the asteroid Itokawa is planned using the Asteroid Multi-band Imaging CAmera (AMICA) onboard HAYABUSA, the Japanese asteroid mission. Four polarization filters are mounted on the CCD of AMICA, with the polarization angles set at 45-degree intervals.

In previous studies using AMICA-PM, a change in the degree of polarization with phase angle was detected for the scattered light from a pellet of hematite powders. In the present laboratory study, we aimed to verify the analysis procedure and to clarify remaining tasks and problems in using AMICA to carry out imaging polarimetry of the asteroid Itokawa.

The target and the illumination optics were mounted on a stage, and the image of the target was obtained through each of the polarization filters by moving the stage in the vertical direction. The illuminating optical source, a halogen lamp, was mounted on a rotating stage to allow us to change the incident angle of the light to the surface. The horizontal position of the target relative to AMICA is fixed, and so we fixed the emission angle and varied the phase angle by changing the incident angle to the surface. As targets, we used a simulated model of the Itokawa surface, a Spectralon plate and a piece of sandpaper. We used phase angles of 45 and 60 degrees. The Itokawa surface analogue was also imaged at a phase angle of 90 degrees.

The first stage of the analysis was to carry out a sensitivity calibration of the system using images of an integration sphere. Then the images from the polarization filters were matched using characteristic features on the surface. The degree of linear polarization was then calculated. The matching can be accomplished by parallel translation for the flat, Spectralon surface, but a more complicated matching procedure is necessary for the macroscopically rough Itokawa surface.

We will present the results for each of the targets under each illumination condition and will discuss remaining problems.