

Surface scattering property of asteroid Itokawa from HAYABUSA NIRS observation

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We present the results of near-infrared photometry of asteroid 25143 Itokawa obtained by the near-infrared spectrometer (NIRS) on-board the Hayabusa spacecraft. Before the Hayabusa mission, Itokawa was classified as an S-type asteroid based on telescopic observations. The main components detectable in near-infrared spectra of S-type asteroids are the minerals olivine and pyroxene, which exhibit absorption features in reflectance spectra centered near 1 and 2 microns. From previous work, it is known that S-type asteroid spectra exhibit variations in brightness and color due not only to compositional differences but also due to viewing geometry changes. A photometric correction is needed for the purposes of comparing spectra obtained at highly variable viewing geometries.

During the rendezvous phase from September 12, 2005, until November 24, 2005, NIRS observations were conducted from the Home Position (HP) where the altitude of the spacecraft from the asteroid was about 7 km. NIRS obtained the disk-resolved spectra at phase angles ranging from 0.1 to 38.4 degrees. Spectra were obtained with 64 channels covering the wavelength range 0.76 to 2.25 microns. The field-of-view of NIRS is 0.1 x 0.1 degrees and typical spatial resolutions at HP are approximately 12 x 12 m.

We found that each of the phase curves at different wavelengths show a strong opposition effect (a non-linear increase in brightness with decreasing phase angle near 0 degree). By estimating the Hapke parameter at each wavelength, this phenomena could be corrected with wavelength or albedo. According to theory, a strong wavelength dependence in opposition surge is consistent with coherent backscattering phenomena near opposition. This suggests that Itokawa's opposition effect may not be entirely due to shadow-hiding. During fitting, we found that the amplitude of the opposition surge did not exceed 1.0. Since Eros' photometric behavior could not be fit with values less than 1.0, this indicates that the surge is stronger at Eros than it is at Itokawa.