

Initial results from the Hayabusa Near-infrared spectrometer (NIRS) observations of asteroid (25143) Itokawa

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NIRS is a near-infrared spectrometer on-board the spacecraft HAYABUSA, which rendezvoused with the near-earth asteroid, (25143) Itokawa in September through November 2005. HAYABUSA was launched by a Japanese M-V-5 rocket on May 9, 2003. After the Earth swing-by on May 19, 2004, the spacecraft successfully arrived at the Gate Position approximately 20 km from the asteroid on September 12, 2005. During the rendezvous phase with the asteroid, NIRS obtained more than 80,000 spectra of Itokawa.

The first spectrum from Itokawa was obtained by NIRS on September 10, and the distance at that time was 50 km from the asteroid. During mission operations, NIRS spectra were obtained at solar phase angles ranging from near 0 degrees up to 38 degrees, and footprint sizes ranging from 6 to 90 m excluding the Touchdown phase of the mission. After successfully arriving at the Gate Position at approximately 20 km from the asteroid on September 12, we started continuous observations with asteroid tracking using ONC-W on September 15, simultaneous observations with AMICA 7-color observations on September 17, and one-dimensional scan observations by slewing the altitude of the spacecraft on September 24. After switching to the Home Position at an altitude about 7 km from the asteroid on September 30, we moved the spacecraft to change the observation aspect angle and solar phase angle to obtain spectra of the polar regions under different lighting conditions. We observed almost the whole surface of Itokawa during the rendezvous phase of the mission.

NIRS found a variation of more than 10% in albedo and absorption band depth in the surface reflectance of asteroid (25143) Itokawa. Spectral shape over the 1-micron absorption band indicates that the surface of this body has an olivine-rich mineral assemblage, potentially similar to that of LL5 or LL6 chondrites. Diversity in the physical condition of Itokawa's surface appears to be larger than on other S-type asteroids such as Eros, Ida and Gaspra, which were previously explored by spacecraft.