Thermal models of asteroid: XRS thermometer observation

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Several thermal models have been applied to explain near-infrared and infrared spectroscopic measurements. Fast rotating thermal model (FRM) is known to provide better results for a large thermal inertia or a rapidly rotating asteroid. To derive albedo and diameter of an asteroid, the standard thermal model (STM) (Lebofsky et al. 1986) is the most commonly applied. STM is assumed to be smooth, spherical, and slowly rotating body at 0 degree solar phase angle with a temperature distribution decreasing from a maximum at the subsolar point to zero at the terminator. While STM provides better estimations for main belt asteroids, neither STM nor FRM produce realistic values of albedo and diameter. To resolve this problem, semiempirical model was developed: the near-Earth asteroid thermal model (NEATM) (Alan W. Harris, 1997). In another method, thermophysical model (TPM) (Lagerros, 1996) was developed considering with the asteroid size, the global shape, spin vector, and energy balance, which showed the relation between thermal inertia and mid-infrared before and after opposition observations.

The thermal inertia of 750 J m^-2 s^-0.5 K^-1 for the HAYABUSA target body: Near-Earth asteroid (NEA) 25143 Itokawa (1998SF36) was determined by Muller et al. This high thermal inertia indicates a bare rock dominated surface, and then a thick dust regolith can be excluded.

In this study, the surface temperature and thermal inertia of Itokawa are estimated by thermometer on HAYABUSA X-ray spectrometer. The thermometer was attached on HOOD by which X-ray CCDs were cooled passively. Therefore, the thermometer was well calibrated through the thermal vacuum test of HAYABUSA before launch, and can be available for the estimation of the temperature of Itokawa. We report here which thermal models for ground observation has consistent result to explain the XRS thermometer measurement.