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# Mid-infrared imagery of asteroid on Hayabusa2

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A mid-infrared imager is a nominal remote-sensing instrument in HAYABUSA-2, to investigate physical properties and meteoritic classification of the surface of C-class asteroid 1999JU3. The instrument is based on the LIR (long-infrared imager) onboard AKATSUKI (former Planet-C), a Japanese Venus climate orbiter to be launched in 2010, possibly with multi-band filter added. Science objectives and current situation of the instrument are briefly reported.
HAYABUSA-2 is the follow-on mission after the Japanese asteroid explorer HAYABUSA and primarily an NEO sample-return mission, but remote sensing have much importance to characterize global features of the target body, complementary with the analysis of returned samples. Since the target body is a C-class asteroid, optimal set of instruments should be different from that of HAYABUSA. Telescopic (multi-band) imagers, laser ranger (LIDAR = Light detection and ranging), near-infrared spectrometer to identify 3 micron absorption band, and a mid-infrared imager are selected as nominal instruments. In HAYABUSA, measurement of thermal emission from asteroid has been done using the radiator of the XRS, but in HAYABUSA-2 the mid-infrared imager will take the role.
The original LIR instrument on AKATSUKI has been developed for mapping Venus clouds at the temperature range of 220-250K. The instrument is applicable to mid-infrared imaging to investigate thermal inertia of asteroid surface and classification of materials. The instrument uses a non-cooled bolometer as detector. We also has a heritage of filter wheel used in the imager in HAYABUSA. The instrument has a field of view of 16 x 12 degree, detector of 344 x 260 pixels, and its detection temperature range of 220 to 400K. The total mass is about 4 kg including the detector, hood, electronics, as well as a filter wheel.
The main scientific missions are to investigate 1) global and local areal distribution of the surface physical properties, and 2) the surface material classification. Surface physical properties are determined in 10 m spatial resolution from Home-Position. Images of higher resolution are taken by observation at lower altitude during the descent. Thermal inertia represents the surface physical condition. The surface thermal inertia is small (<50) for sandy material, moderate (100~300) for pebbles, and higher (1000) for monolithic rocks, respectively. Using a multi-filter from 7 to 14 micron with 1 micron width strongly helps material classification.
The study for the mid-infrared spectrometer for Hayabusa-2 is just started. This instrument should help understand the nature of the asteroid 1999JU3.

Keywords: Hayabusa2, asteroid, mid-infrared, surface temperature, thermal inertia, surface material