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はやぶさ２搭載中間赤外カメラによる小惑星 1999JU3 の熱物性観測
Thermal Property of Asteroid 1999JU3 by Infrared Imager TIR on Hayabusa2

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A thermal infrared (TIR) imager is a nominal remote-sensing instrument onboard Hayabusa2, to investigate physical properties of the surface of C-class Near-Earth Asteroid 1999JU3. The instrument is based on the LIR (Long-InfraRed imager) onboard Akatsuki, a Japanese Venus climate orbiter to be inserted into Venus orbit in 2015 or 2016. Science objectives and current status of the instrument are briefly reported.

Hayabusa2 is the follow-on mission after the Japanese asteroid explorer Hayabusa and primarily an NEO (Near-Earth Object) sample-return mission, but remote sensing also has much importance to characterize global nature of the target body, which is complementary to analysis of returned samples. Since the target body is a C-class asteroid, optimal set of instruments is different from that of Hayabusa: telescopic (multi-band) imagers, laser ranger, near-infrared spectrometer to identify 3 micron absorption band, and a thermal infrared imager.

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. The instrument adopts a non-cooled bolometer array as its detector. The instrument has a field of view of 16 x 12 degree, detector of 320 x 240 effective pixels, and its targetted detection temperature range of 250 to 400K. The total mass is about 3.3 kg including the detector unit, hood, and electronics.

The main scientific missions are to investigate the global and local areal distribution of the surface physical properties. Surface physical properties are determined in 10 m spatial resolution from the Home Position 20km sunward from the asteroid. Higher resolved images are taken at lower altitude during the descent operation for touchdown. Thermal properties reflect the condition of materials, i.e. porosity of regolith or rocks, or particle size of soils. It will help understand the surface sedimentation processes under microgravity. Condition of large boulders or inner wall of huge craters informs the internal condition and alteration processes of parent body or current asteroid, respectively. Yarkovsky or YORP effects will be investigated by thermal imaging. TIR will also measure the properties of the surface geologic feature, crater ejecta, surrounding moons or floating dusts if they exist.

The TIR imager will also play an imprtant role for giving an information on sampling site selection by its surface physical condition as well as for assessing the spacecraft safety operation for touchdown by thermal emission or temperature.

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