Thermophysical Properties of S-type Binary Didymos by Thermal Imaging in Hera Mission

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A thermal infrared imager TIRI is being developed to investigate thermophysical properties of S-type binary asteroid Didymos and Dimorphos in the ESA Hera mission. As was proven in the Hayabusa2 mission to the C-type asteroid 162173 Ryugu, thermal imaging is an established and essential method to investigate the surface physical state at high spatial resolution discriminating region to region, and boulder to boulder (Okada+, Nature 2020; Shimaki+, Icarus 2020). Asteroids are primitive bodies which might have experienced somewhat low degree of alteration and consolidation during its formation and evolution processes compared with larger planetary bodies, so that the micro-porosity in rocks and boulders should be a barometer of evolution of solar system bodies. TIRI is based on an uncooled micro-bolometer array of 1024 x 768 pixels and has the field of view of 13.3˚ x 10.0˚, which covers the total Didymos-Dimorphos binary system from 20 km distance to trace the whole one-rotation. The angular resolution is 0.013˚ (0.23 mrad) per pixel or 4.6 m per pixel from the distance of 20 km, which can resolve the artificial crater excavated by the kinetic impact of NASA DART spacecraft. TIRI also has the function of multiband thermal imaging with 8-point filter wheel. The filter wheel has a wide band of 7-14 μm, six narrow bands with the center positions of 7.6, 8.6, 9.6, 10.6, 11.6, 13.1 μm. The last one position is closed to be used as a reference temperature or a shutter to avoid insolation. TIRI also obtains the surface compositional information from the color ratios of these multi-bands, especially from the Christensen Feature (CF) and the Reststrahlen Feature (RF) to classify the surface material. We will report the progress report of the development of TIRI.

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