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Simulation of thermal inertia measurement of an asteroid by Thermal Infrared Camera onboard HAYABUSA 2

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The asteroid explorer HAYABUSA 2 launched in 2014 will visit a C-type asteroid 1999JU3 which may preserve composition when the solar system was formed. One of the scientific purposes of the HAYABUSA 2 mission is to infer the surface physical properties and internal structure of the asteroid by measuring its thermal inertia. In this study observation of the asteroid surface by Thermal Infrared Camera onboard HAYABUSA 2 was simulated by an experiment. Surface temperatures of a rock, grave and sand of feldspar were measured by a commercial infrared camera, and accuracy of thermal inertia derived from the temporal variation of the surface temperature was examined. Albedo of the samples and spectral luminosity of a halogen lamp were measured by a spectrometer. The surface temperature of the sample was obtained from temperatures of two aluminum plates simultaneously measured by thermocouples and their gray levels in the infrared image obtained by the infrared camera, and thermal inertia of the sample was derived. The experiment was performed for two cases in which the angle subtended by the lamp and infrared camera seen from the sample was about 10 and 45 degrees. As a result the thermal inertia of same material depends on sample size; it increases from sand, grave to a rock. This simulation experiment shows that HAYABUSA 2/TIR is able to derive thermal inertia of an asteroid by measuring its surface temperature variation due to rotation and to provide information on surface physical properties and internal structure of the asteroid.