Study of asteroid interior using Hayabusa2 LIDAR

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LIDAR science team of Hayabusa2 has developed Laser altimeter named LIDAR (LIght Detection And Ranging). Hayabusa2 and LIDAR were launched on December 3, 2014, and are heading for asteroid Ryugu. Meanwhile, the science team has been studying surface processes and interior of minor bodies aiming to
- elucidate formation processes of small asteroids and examine models of their collisional evolution
- clarify geologic processes ocurring on the surfce of asteroids such as both horizontal and vertical transport of regolith and bolders to understand a context of return samles.
LIDAR provides range measurements as well as intensities of transmitted and reflected laser pulses. For details of instrument and observation plans, please refer Mizuno *et al.* (*Space Sci. Rev.*, 2017, **208**, pp 33–47) which describes LIDAR specifications and operation plans, Yamada *et al.* (*Space Sci. Rev.*, 2017, **208**, pp 49–64) for albedo observation, and Senshu *et al.* (*Space Sci. Rev.*, 2017, **208**, pp 65–79) that explains asteroid dust detection experiment.

We wish to study interior of Ryugu, however, we do not expect for the asteroid to have differenciated like the moon and Mars. Instead, we could possibly find heterogenity as a tracer of collision and accretion, both horizontal and vertical transfers of regolith and bolders, and an indication of consequent material evolution. Such findings will be an important a priori information to understand results of meteorite analysis. Currently, few meteorite scientists take into account material transport inside of asteroids or vertical movements of rocks within regolith layer. Remote sensing observations and an impactor experiment of Hayabusa2 may change such static view of asteroid surface. After Hayabusa2, Martian Moons eXplorer (MMX) and Phaethon flyby mission (DESTINY+) are scheduled already in Japan. New insights likely obtained by Hayabusa2 and LIDAR will be a critical source of information necessary to elucidate water transfer within the solar system and pre-biotic environmet.

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