Impact experiment on asteroid Ryugu by Small-Carry on impactor of Hayabusa-2 and observation of the impact ejecta by a Deployable CAMera-3

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A small carry-on impactor (SCI) equipped on Hayabusa2 is scheduled to be propelled toward to the surface of asteroid Ryugu this spring. Cratering process on Ryugu made by the impactor will simultaneously observed by a deployable camera 3 (DCAM3) detached from Hayabusa2. The mission objective of the impactor is to excavate the asteroid to expose a subsurface material as ejecta deposits around the crater. Thus, not only it enables us to give a good opportunity for obtaining a fresh or subsurface material by a sampler system, remote sensing instruments such as ONC, TIR, NIRS3 onboard Hayabusa2 will also have a good chance to observe the exposed subsurface material. Furthermore, this impact experiment on Ryugu is also a rare opportunity to verify the crater scaling law in the microgravity environment on the real asteroid materials, and is expected to enable us to improve the conventional scaling law, especially for the crater size and the ejecta velocity distribution.

After arrival at Ryugu, the surface morphology observation through remote sensing has turned out that a plenty of boulders cover throughout the surface, and many of the boulders are larger than 10 m. These boulders are distributed almost uniformly and the size frequency distribution of the boulders is a power law distribution with the power law index around -1, indicating relatively large boulders are dominant on the surface. Therefore, taking into account that the precision of an actual impact point toward an aiming point expands several 10 m, the impactor possibly collides with a large boulder, otherwise with small boulders having the power law size distribution, wherever the impactor would aim at on the surface of Ryugu. If the impactor collides with a large boulder, a crater should be formed in the strength regime, and if the impactor collides into a finer-boulder area, a crater will be formed in the gravity regime. The DCAM3 was designed for the observation of not only the impact cratering in the strength regime but also that in the gravity regime.

We believe that we will success to observe impact ejecta induced by the impactor when the SCI and DCAM3 operations are conducted as scheduled. We are planning to present a first report of the DCAM3

observation in this talk, and discuss how to search the impact point on the Ryugu surface using the DCAM3 images, beforehand the onboard imaging instruments. Moreover, the morphology of the ejecta curtain imaged by DCAM3 will bring us a lot of information about the crater formation process. We report the surface condition around the impact point, such as a large block or a small-boulders area, and an excavated area corresponding to the crater size. The DCAM3 will also observe individual dusts in the ejecta curtain to obtain information of the ejecta velocity distribution, so that we may have a chance to introduce these images. However, please note that this presentation strongly depends on the success of the SCI/DCAM3 operation.

Keywords: Asteroid Ryugu, Impact Experiment, Small carry-on impactor, Deployable camera3, Rubble pile body

