

## Ryugu's surface change formed by SCI forward debris

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The small carry-on impactor (SCI) on the Hayabusa2 spacecraft is designed to create an artificial crater on an asteroid surface for the collection of sub-surface materials and validation of crater scaling laws [1]. The SCI launches a hollow hemisphere copper liner with a diameter of 13 cm at a velocity of 2 km/s, accompanied by numerous debris [2]. In the ground tests, the SCI forward debris generated concentric damage on the target surface. The SCI successfully created an artificial crater on the surface of Ryugu in 2019 [3]. Besides the artificial crater, surface changes around the crater, such as rim formation, boulder movement, and the emergence of new boulders were observed by the optical navigation camera telescope (ONC-T) [4]. Additionally, concentric surface changes were observed ~70 m distance from the artificial crater, created by the SCI forward debris. Here we report the distribution of the surface changes formed by the SCI forward debris both in the ground test and Ryugu. Based on the SCI detonation position [5], we found that the polar angle of the forward debris in the ground tests is ~11°, whereas that in Ryugu is ~15°, probably due to the absence of ambient pressure.

[1] Arakawa et al. (2017), *Space Science Review* 208, 187–212. [2] Saiki et al. (2017), *Space Science Review* 208, 165–186. [3] Arakawa et al. (2020), *Science* 368, 67–71. [4] Honda et al., submitted to *Icarus*. [5] Saiki et al. (2020), *Astrodynamics* 4, 289–308.

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