A Tentative Numerical Study on the Effect of Aspect Ratio of Cylindrical Projectile on Crater Morphology using iSALE code

*Yuri Shimaki[1]

1. Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency

The small carry-on impactor (SCI) onboard the Hayabusa2 spacecraft successfully detonated on April 5, 2019, and created an artificial crater on the surface of asteroid Ryugu. Besides the main copper liner, the SCI produces irregular-shaped forward debris composed of copper or SUS that form concentric features on the target surface. These concentric features, including sub-crater candidates, were also observed on the surface of Ryugu. However, it is not obvious whether irregular-shaped debris produces typical bowl-shaped craters, although the effect of SCI-like hollow-shaped projectile has been investigated numerically (Kurosawa et al., 2015). In this study, I report a tentative numerical study on the effect of the aspect ratio of a cylindrical projectile on the crater morphology.

In this work, I use the iSALE shock physics code (Amsden et al., 1980; Collins et al., 2004; Wünnemann et al., 2006). A cylinder with an aspect ratio (height/width) and a uniform sand layer was used as the projectile and the target. The impact velocity was set to 2 km/s. The Tillotson EOS for iron and quartz were used. The aspect ratio was varied from 0.36 (disk) to 8.0 (rod), while the volume was almost constant. A gravity of 9.8 m/s^2 was included in the calculation. After the calculations, the depth and diameter of the crater were measured.

With the increase of the aspect ratio of the projectile, the depth of the crater increased, while its diameter was almost unchanged. In this poster, the detailed analysis of the crater morphologies will be described.

Acknowledgments: I appreciate the developers of iSALE, including G. Collins, K. W ünnemann, B. Ivanov, J. Melosh, and D. Elbeshausen. Numerical computations were carried out on PC cluster at Center for Computational Astrophysics (CfCA), National Astronomical Observatory of Japan. I am grateful for the iSALE users group in Japan, including K. Kurosawa, Y. Kanada, R. Suetsugu, and S. Wakita, and the LOC of iSALE workshop 2019 at CfCA.

Keywords: Asteroid, iSALE, Impact

