Photometry of Ryugu and SCI crater as inferred by ONC images

A. Longobardo[1], M. Angrisani[1], E. Palomba[1], F. Dirri[1], Y. Yokota[2], T. Kouyama[3], R. Honda[4] and the Hayabusa2/ONC Team

[1] *INAF-IAPS, via Fosso del Cavaliere 100, 00133 Rome, Italy*
[2] *JAXA-ISAS, 3-1-1 Yoshinodai, Chuo-ku, Sagamihara City, Kanagawa Prefecture, 252-5210, Japan*
[3] *National Institute of Advanced Industrial Science and Technology, Umezono 1-1-1, Tsukuba, 305-8568, Japan;*
[4]*Kochi, University, Kochi, Japan*

The JAXA/Hayabusa2 rendezvoused with the Ryugu asteroid from June 2018 to November 2019, performing an artificial impact experiment on 5th April 2019.
The goal of this work is to study the photometric properties' variation of the target area (latitude 4.5-10°N; longitude 299-305°E) after the artificial impact experiment. This is done by applying an empirical method based on the statistical analysis of the ONC camera's dataset (in particular, the *v* band, centred at 0.55 μm), similar to that applied to several asteroids (e.g., Longobardo et al., 2014; 2018) and to the NIRS3 dataset of Ryugu (Longobardo et al., 2022).
The method has been firstly applied on the entire dataset acquired between March and April 2019, covering most of the Ryugu surface. The first step was the retrieval of the equigonal albedo, by applying the Akimov disk function. The obtained equigonal albedo is independent of incidence and emission angle when phase angle is lower than 60°, while a slight dependence is still present for larger phase angles.
Then, the average phase function of Ryugu was obtained. This is very similar to that obtained on the NIRS3 dataset (i.e., in a different spectral range), according to our expectations.
Then, we calculated two photometric parameters *R20* (i.e., the radiance factor at 20° phase) and PCS_{1540} (i.e., the phase function steepness between 15° and 40° phase angles) and compared them to photometric parameters calculated on phase functions of other asteroids visited by space missions and on both disk-integrated and disk-resolved phase functions of Ryugu obtained by Tatsumi et al. (2019). The disk-resolved phase functions by Tatsumi et al. (2019) and obtained in this work are in good agreement.
Nevertheless, the Ryugu's disk-resolved phase function is much flatter than other dark asteroids. Otherwise, the disk-integrated phase function of Ryugu is in good agreement with other dark asteroids. This is the ascribed to the fact that dark bodies' phase function flattens with improving spatial resolution due to the reducing role of shadowing. A similar behaviour was observed on other dark asteroids, i.e., Ceres (Longobardo et al., 2019) and Bennu (Golish et al., 2021).
Finally, we focused the analysis on the artificial impact area by comparing phase curves before and after the impact. Currently, the only variations observed are within uncertainties, but we need to enlarge the dataset before to give any definitive conclusion.

Acknowledgements. We thank the ONC development/operations Team.

References

Golish et al. (2021), *Icarus* 357, 113724
Longobardo et al. (2014), *Icarus* 240, 20-35
Longobardo et al. (2019), *Icarus* 320, 97-109
Longobardo et al. (2022), *A&A* 666, A185
Tatsumi et al. (2019), *A&A* 639, A83