

Study on asteroid sample collection for Hayabusa-2 spacecraft

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Hayabusa-2 is the follow-on sample return mission of Hayabusa. Hayabusa-2 spacecraft was launched by H-IIA rocket from Tanegashima Space Center in 2014 to retrieve rock samples from C-type asteroid called 1999 JU3. The spacecraft will return to Earth in 2020 to deliver the samples of 1999JU3. C-type asteroids are believed to be more primitive than S-type asteroids such as Itokawa explored by Hayabusa. The rock sampling from C-type asteroid is crucial to understanding of the interactions among minerals, water and organics in the planetary system. The sampling system of Hayabusa-2 spacecraft was designed to efficiently collect asteroid samples from the unknown surface. The sampling method is impact sampling by a powder gun which enables to be applied to the various surfaces from silicate hard bedrock to regolith layers with gravel. The sampling system is composed of powder guns, a metal horn and a catcher. Impact cratering on the asteroid surface is performed by the powder gun. After its shot, the asteroid fragments are collected in the catcher along the inside wall of the metal horn. In this study, we performed impact experiments at JAXA using the analog sampler which is faithfully reproduced its flight-model in order to clarify the elementary process of sample collection by the sampling system. Furthermore, we conducted numerical simulations using a hard sphere model to expand experimental data under 1G into estimation of collection mass under microgravity. Therefore, we experimentally and numerically clarified the process of sample collection from C-type asteroid by Hayabusa-2.

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