HYPERVELOCITY IMPACT IN ASTEROID SCIENCE AND SPACE MISSION

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Labolatory Simulation of Impact Disruption: My first publication in this field started in 1977 with the laboratory experiment of impact breakup of small rocky targets to simulate asteroids'collisional disruption. In a series of experiments fundamental knowledge of fragment size, ejection velocity, spin, etc. in impact disruption were outlined. After these works many laboratory experiments followed and lot of detailed data bases have been made in the world until now. Along with those experiments theoretical studies including scaling-laws and numerical studies to apply for natural large scale collisional events have had great success. Those studies have played a crucial role for understanding asteroid families, global asteroid evolution, and solar system history. Most of my related works are in [1].

Asteroid Sample Return Mission: In Japan in 1980s, with increasing interest in small bodies, desirement of sending space missions for comets and asteroids was growing gradually. We ourselves made experiments to develop technology of capturing dust particles or fragments ejected from minor-body surface analogs. After those preliminary works, preparation for asteroid sample return mission (HAYABUSA) started in 1990s. It was adopted as a technology demonstration mission, but it was still an important science mission for the planetary scientist community- we could obtain a big science product if the mission was successfully performed! In this mission impact sampling technique was adopted as an effective way in low gravity environment. The spacecraft was launched in 2003. In-situ observation was successful but the impact samling did not work in the expected way. However, luckily, many small grains were captured. As the result, meteorite specification of the targeted asteroid was made. From the initial phase of the mission planning, our main purpose of the asteroid sample return has been tocorrelate a small number of asteroids, each of which belongs to differing major spectral class, with the meteorite species. By doing so, we can understand materials of whole asteroids by sending minimum number of sample return missions, because we have already great number of asteroid samples at hand (Great number of asteroids samples we already have!). Hayabusa targeted an Stype asteroid, Hayabusa2 is going to a C-tpe asteroid, and US spacecraft going to a metallic target. Those missions are coherently collaborating each others and exactly following our initial scheme line. I am keep watching the results from those missions with great expectation. Most of my related works are in [2].

References: [1] Holsapple, K., et al. (2002) *Asteroids III* (Bottke, W. *et al. eds*. , Univ. Arizona) 443-462. [2] Yoshikawa, M. et al.(2015) *Asteroids IV*(Michel, P. et al. eds. , Univ. Arizona) 397-418.