Impact experiment on asteroid Ryugu using Small Carry-on Impactor and Deployable CAMera-3

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Small Carry-on Impactor (SCI) is one of the instruments carried on Hayabusa-2 space craft and it will be used for an active exploration on the surface of asteroid Ryugu The SCI consists of a disk impactor made of copper with a diameter of 30 cm. This disk will be deformed by an explosion to form a semi-spherical shell and be accelerated to a velocity ~ 2km/s for the collision onto the asteroid surface.

The SCI impact enables us to conduct sampling from the interior of the asteroid, so the sample will be recovered from the floor of the artificial crater or the surrounding area covered with the ejecta from the SCI artificial crater. The artificial crater will produce a new fresh surface that is expected not to be significantly suffered from space weathering. In addition to sampling, remote sensing from the space craft will be able to refer this fresh surface in order to recognize the degree of space weathering on other surfaces and also observe the subsurface structure on the crater wall.

The SCI impact will be observed with DCAM3. Recording images of the ejecta curtain or the impact fragments by means of DCAM3 will make it possible to investigate the sub-surface physical properties and the ejection process in impact cratering. DCAM3 is a palm-sized deployable camera device. It has two camera components inside: DCAM3-A and DCAM3-D. DCAM3-D is planned for the above scientific observation. The artificial crater will be explored by the remote sensing equipments onboard Hayabusa-2, i.e., Optical Navigation Camera (ONC), Thermal InfraRed Imager (TIR), and Near InfraRed Spectrometer (NIRS3) to obtain the basic parameters of the impact crater and the various kinds of information of the fresh surface and the subsurface structure. Such information will be used to determine the physical properties of the subsurface material and to refine the crater scaling rule for the ejecta velocity distribution and the crater diameter. The cooperation between the laboratory experiments and the numerical simulations is very important to utilize the obtained results and to conduct the realistic extrapolation of the scaling rule toward the large scale.

Keywords: Impact experiment, Small carry-on impactor, Deployable camera, Hayabusa-2

