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On activities in the interdisciplinary science of Hayabusa-2

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Hayabusa-2 is an asteroid sample return mission of which target asteroid is 1999JU3, a near Earth asteroid of type C, and it is scheduled to be launched late in this year. As on-board scientific instruments, Hayabusa-2 has a near infrared spectrometer (NIRS3), thermal IR imager (TIR), optical navigation camera (ONC-T) used as a multi-band imager with seven band-pass filters, laser altimeter (LIDAR), sampler (SMP), small carry-on impactor (SCI), separation digital camera (DCAM-D), and small lander (MASCOT). Using these instruments, we try to characterize the surface properties and materials of 1999JU3 and select three sampling points from which material samples will be obtained to reveal physical and chemical processes on the asteroid and its history from the formation to the present. Thus scientific success of Hayabusa-2 strongly depends on a strategy for characterizing the surface and selecting sampling sites, which can be achieved making the best use of data from the above all sensors. We, for this purpose, organize a working team called as the Interdisciplinary Science Team (IDST) of Hayabusa-2. In this presentation, we introduce the activity of the IDST.

The IDST was established in the first meeting held on Dec. 2012. Its purposes are to obtain the general picture of a scientific scenario of Hayabusa-2, define interdisciplinary science themes and contribution of individual instruments to the themes, define scientific constraints and validations on the mission scenario, and promote planetary sciences and think out planetary sciences from a standpoint of the asteroid mission. The discussion in the IDST is open to the project members. So far, we have discussed deeply a strategy in return sample analyses, heterogeneity detection by the remote sensing sensors, surface temperature detection, crater chronology, morphology produced by meteoroid impacts, reflectance spectra of C-type asteroids, space weathering, and so on. As a result of these discussion, we produce a logical flow chart to characterize the surface material and property. In the chart, mutual relations between basic observation quantities, quantities inferred by multiple sensors, their indexes, identified characters and general inferences on primitiveness are described. Contributions from each sensor are clarified in the chart. In addition, we also depicted an operational picture of SCI which is a grand experiment for an impact process in the low gravity space and exposes material in a depth that can be less suffered by space weathering, but SCI is wasteful of the satellite resources. It is necessary to polish up the operation plan of SCI from the view point of the system resources.

The logical flow chart is a guiding principle in the science of the Hayabusa-2 mission. We continue to refine the chart and complete the logic. For this purpose, we make several working groups to reinforce the logic flows. As closing the development phase of on-board instruments, we now rush up to make the IDST of Hayabusa-2 more active. We think that the activity in the IDST is a key point to succeed in the science mission and promote planetary sciences and explorations in Japan.

Keywords: Hayabusa-2, asteroid, exploration, surface material, interdisciplinary science, sample return