HAYABUSA2 SAMPLE RETURN FROM 1999 JU3: INITIAL ANALYSIS PLAN

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Hayabusa2: Hayabusa2 is an asteroid exploration mission to return surface samples of a near-Earth C-type asteroid 1999 JU_3. Because asteroids are the evolved remnants of planetesimals that were the building blocks of planets, detailed observation by a spacecraft and analyses of return samples will provide direct evidence of planet formation and dynamical evolution of the solar system. Moreover, C-type asteroids are expected to preserve the most pristine materials in the solar system, an interacted mixture of minerals, ice, and organic matter. Hayabusa2 will launch off in 2014, arrive at 1999 JU_3 in mid-2018, and sample the asteroid at three different locations during its 18-month stay. The samples will be delivered to the Earth in 2020.

Hayabusa2 sampler: The concept and design of the Hayabusa2 sampler are basically the same as the Hayabusa that successfully returned samples from asteroid Itokawa, and impact sampling with a 5-g Ta bullet will be made at three surface locations of the asteroid, one of which could be ejecta from an artificial crater made by a small carry-on impactor. The sample container has three separate chambers inside to store samples obtained at different locations separately. The container can be sealed by an aluminum metal seal to avoid a loss of extraterrestrial volatiles and contamination of the terrestrial air after the Earth-return.

Samples to be curated and analyzed: The characteristics of the Hayabusa2 sample container leads to classification of returned samples into three categories; (1) mm-sized coarse grains separately stored separately in three chambers, (2) <100 μm-sized fine particles that may be mixed in the sample container, and (3) volatiles extracted from the container prior to opening of the container. Coarse grains should represent the material properties at different locations, and petrologic and mineralogical studies of them will provide important constraints on understanding the history of the asteroid and the solar system. Fine particles will also provide insights into the global average surface feature and surface geologic processes such as space weathering and regolith formation. Volatile components will be the first-returned extraterrestrial volatiles and will be an important analysis target to investigate the origin and evolution of organic matter and water in the solar system and the final evolutional state of organics in asteroids prior to the delivery to the Earth.

Initial analysis of returned samples: The initial analyses of returned samples will be done for limited amounts of samples for limited duration. In order to accomplish the scientific goals of the mission, three categories of samples will be analyzed by multiple international analysis teams focusing on non-destructive analyses of grains, elemental and isotopic analyses of grains, petrology and mineralogy of coarse and fine particles, chemistry and isotopes of volatiles, and chemistry of insoluble and soluble organic materials. A team to integrate all the analytical results and link to remote-sensing data will also be organized, which can be done only for return samples.