

## Japanese contribution to CAESAR: comet astrobiology exploration sample return

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Comet is the most ideal target for Japanese planetary scientists who investigate the origin of the solar systems, particularly the origin of habitable planets. However, the mission scale of the comet sample return exceeds the Japanese space mission capability. Thus, the involvements to an international mission is more realistic strategy to share the science values of cometary sample return. A NASA NEW Frontier 4 cometary sample return proposal team requested JAXA to participate in the proposal, providing key devices and knowledge which have acquired in previous successful missions. This Master Plan proposal explains the science and engineering contributions to the NEW Frontier 4 proposal from Japan so far and in the future and how this mission provides valuable opportunities to the Japanese planetary science community.

Comets contain minerals, volatiles, and organic compounds that formed before the formation of the solar system. Thus, the cometary sample is a key material to access the origin of our solar system and the origin of life's building blocks in space. Comet astrobiology exploration sample return (CAESAR) is the first mission to bring the macro cometary materials to the Earth without significant alteration. Japanese planetary science community have a strategy to promote the missions which investigate the formation of habitable planetary environments and its continuation. The target of CAESAR fits the strategy and particularly, investigates the materials which formed our planetary system and the origin of prebiotic organic compounds. This mission is one of the two finalist of NASA New Frontier 4 mission that has been selected from 12 proposals. JAXA is a major partner in the CAESAR mission, developing a sample return capsule based on the heritage of Hayabusa mission. Japanese sciences have also involved in the proposal planning and will be responsible for several sample analysis. The sample return of CAESAR is the most challenging among of the history of human's sample return mission, trying to get the most abundant sample form the most far objects with the lowest temperature. This provides significant science values and also provides significant engineering heritage for Japanese communities

The early evolution of solar system stars from the conversion of interplanetary dusts into planetary materials. Hayabusa and Hayabusa 2 have strategy to investigate materials formed in the inner region of the solar system. CAESAR have complementary strategy to investigate the samples form outer region of the solar system in which material before the formation of the solar system present abundantly than inner solar system. In the astrobiological motivation, CAESAR has complementary strategy to Hayabusa 2 mission. CAESAR investigates cometary organics which have been provided mostly with micrometeorites to the Earth whereas Hayabusa 2 investigates organic compounds which have been provided mostly with meteorites. These achievements will contribute significantly to understand the origin of solar system and the origin of prebiotic organic compounds on the Earth.

CAESAR-JAPAN is working as a preproject (Phase A), developing components of sample return capsule and revising the proposal. The final selection for NASA New Frontier 4 will be open this summer. After the first step analysis, the CAESAR sample will be distributed to international science community including Japan. This will contribute significantly in planetary science, astrobiology, astronomy, and related

disciples.

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