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OPERATION RESULTS OF MINERVA-II TWIN ROVERS ONBOARD HAYABUSA2 ASTEROID  
EXPLORER

**Abstract**

Hayabusa2 is a Japanese asteroid explorer which aims to get some fragments from the C-type asteroid “Ryugu” and bring them back to the Earth. It was launched in December 2014 and arrived at the target asteroid at the end of June 2018 after 3.5 years’ interplanetary cruise using an Ion engine propulsion system.

The authors developed two tiny twin rovers for Hayabusa2 spacecraft. The rovers had a mass of approximately 1.1 kilograms and were packed into one container.

The purposes of the rovers were to make two technical experiments on the asteroid surface. They had a hopping capability fitted for the microgravity environment of small planetary bodies, which was to be evaluated on the asteroid surface. They were equipped with fully autonomous capability to move over the surface and make some observations such as taking images on the asteroid surface. This autonomous capability was to be demonstrated on the asteroid surface.

The rovers were deployed onto the Northern hemisphere of the target asteroid on 22 September 2018 at the altitude of approximately 50 meters above the surface. The deployment operation was perfectly made and the rovers successfully landed on the asteroid, followed by the autonomous surface explorations. This was the World first surface exploration on asteroid attained by unmanned robot. The obtained data and images were transmitted by radio to the relay module of the mother spacecraft which stayed at the altitude of 20 kilometers away from the asteroid, and then downlinked to the Ground.

One of the rovers (Rover 1A) survived for 113 Asteroid days after the deployment whereas the other (Rover 1B) worked for 10 Asteroid days. Both rovers made autonomous surface explorations by hopping, and took surface images while they were on the surface or were away from the surface after the hopping action had been made.

Total of 609 images were transmitted to the Ground from Rover 1A, and 39 images from Rover 1B. The images unveiled the detailed surface condition of the asteroid Ryugu.

This paper summarises the explorations by MINERVA-II twin rovers as well as the scientific contribution using the obtained data by the rovers.