

In-situ investigation of asteroid (162173) Ryugu by the Mobile Asteroid Surface Scout (MASCOT) as part of the Hayabusa 2 Mission

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JAXA's Hayabusa 2 asteroid sample return mission has been launched to asteroid (162173) Ryugu on Dec 3rd, 2014. It is scheduled to arrive at Ryugu in July 2018, and return samples to Earth in 2020. The German Aerospace Center (DLR) developed the lander MASCOT in partnership with CNES (France) (1). Ryugu has been classified as a Cg-type asteroid (2,3), believed to be a primitive, probably volatile-rich remnant from the early solar system. Its visible geometric albedo is 0.07 ± 0.01 , its diameter 0.87 ± 0.03 km (4). The thermal inertia indicates a cm-sized, gravel-dominated regolith surface layer (4,5). Ryugu rotates with a period of 7.63 ± 0.01 h. Spectral observations suggest iron-bearing phyllosilicates (2) on parts of the surface, suggesting compositional heterogeneity. MASCOT will enable in-situ mapping of the asteroid's geomorphology, the intimate surface, texture and composition of the regolith (dust, soil and rocks), and its thermal, mechanical, and magnetic properties in order to provide ground truth for the orbiter remote measurements, support the selection of sampling sites, and provide context information for the returned samples (1,6). MASCOT comprises a payload of four scientific instruments: a camera, a radiometer, a magnetometer, and a NIR hyperspectral microscope (1,6,7,8,9). Characterizing the properties of asteroid regolith in-situ will deliver important ground truth for the interpretation of telescopic and orbital observations as well as providing context for the collected samples. Furthermore, the regolith response to MASCOT impact and bouncing will greatly improve our understanding of granular material dynamics in the low-gravity environment of an asteroid. MASCOT will descend and land on the asteroid and will change its position by hopping (1). The scientific objectives for MASCOT are to investigate: the geological context of the surface; the global magnetization and any local magnetization at the landing positions; the mineralogical composition and physical properties of the surface and near-surface material including minerals, organics and the detection of possible, near-surface ices; the surface temperature over the entire expected temperature range for a full day-night cycle; the regolith emissivity and thermal inertia; the local morphology and in-situ regolith structure and texture including particle size distribution; the correlation of the in situ analysis with the remotely sensed global data. MASCOT will also provide documentation and context of the samples by qualifying its generic value and processed/pristine state and thus support the laboratory analyses by indicating potential alteration during sampling, cruise, atmospheric entry and impact phases.

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