

## Magnetosphere of Mercury - Science Target for BepiColombo -

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BepiColombo has been defined as the ESA-JAXA joint mission to Mercury with the aim to understand the process of planetary formation and evolution in the hottest part of the proto-planetary nebula as well as to understand similarities and differences between the magnetospheres of the Mercury and the Earth. The baseline mission consists of two spacecraft: the Mercury Planetary Orbiter (MPO) and the Mercury Magnetospheric Orbiter (MMO). The two orbiters will be launched together on one Ariane-5. JAXA is responsible for development and operation of MMO while ESA is responsible for development and operation of MPO and Mercury Transfer Module (MTM), launch, cruise phase operation, and Mercury orbit insertion.

The main objectives of MPO are to study planet Mercury and planetary formation in the inner solar system. For this purpose, MPO is designed as a 3-axis stabilized spacecraft and will be placed in a 400 km x 1500 km polar orbit, while the main objectives of MMO are to study Mercury's magnetic field and plasma environment around Mercury. For this purpose, MMO is designed as a spin-stabilized spacecraft and will be placed in a same orbital plane as MPO but has a 400 km x 12000 km. The orbital period of MMO and MPO is designed as 4:1 to achieve cross calibration and cooperative observations.

The main scientific objectives of the MMO spacecraft are: (1) Structure, dynamics, and physical processes of Mercury's magnetosphere (2) Structure and origin of Mercury's magnetic field (3) Structure, variation, and origin of Mercury's exosphere (4) Physical environment of inner solar system

Especially, "Creation of the comparative studies of planetary magnetic field & magnetospheres" is the most important topics. (a) Magnetosphere: Mercury's special magnetosphere, without ionosphere and with large "absorber" planet etc., will provide another view of a planetary magnetosphere (b) Magnetic Field: Why do planets have a magnetic field? Mercury provides the first chance to compare the planetary magnetic field structure of a terrestrial planet with that of the Earth.

MESSENGER is orbiting around the Mercury since March 2011 and many interesting phenomena were found by the MESSENGER. However due to the limitation of the observation of MESSENGER, it is expected that the most of the plasma related phenomena will remain unresolved until arrival of BepiColombo. The MMO will have observational capabilities for charged particles in wide energy range, energetic neutral atoms, magnetic field, electric field/plasma waves/radio waves, dust, and imaging. Also the orbit of the MMO (400km x 12,000km) covers wide region of the Mercury's magnetosphere and solar wind region which is important to investigate the science target of the MMO.