

Science Target and Outline of BepiColombo Mission

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Mercury is most unknown planet in the terrestrial planets. Knowledge of Mercury is based on limited ground based observations and 3 fly-by observations which was made by Mariner10 about 30 years ago. Mercury shows quite unique properties. Understanding Mercury greatly increase the knowledge of history of the solar system.

BepiColombo which is collaborate mission between Europa and Japan is third but biggest Mercury mission. The aim of this mission is to clarify present and past of Mercury by investigating interior, surface, atmosphere, and magnetosphere.

BepiColombo mission is consist of 2 orbiters and 1 lander which are MPO(Mercury Planetary Orbiter), MMO(Mercury Magnetospheric Orbiter), and MSE(Mercury Surface Element). Those components will be launched by either 2 Soyuz-Fregat or 1 Ariane 5 on Summer 2009 and will arrive at Mercury on Fall 2012. Two orbiters will observe Mercury for 1 earth year and MSE will observe surface of Mercury for more than a week.

Currently we know Mercury very little. Though this limited knowledge of Mercury, we know that Mercury is quite unique planet. First of all, in spite of the small body size, Mercury has intrinsic magnetic field though Venus has no intrinsic magnetic field and Mars has localized crustal magnetic field. This fact implies that Mercury has liquid core. Whether Mercury could have liquid core or not is one of the open questions. To understand the generation mechanism of Mercury's magnetic field, precise information of magnetic field and inner structure is needed.

Mercury is also quite important to study plasma processes since Mercury has magnetosphere and its size is smallest as far as we know. Mariner 10 observed magnetic field structure which is interpreted as magnetosphere. During the passage of the magnetosphere, high energy electron bursts were observed which is similar to that of substorm in earth's magnetosphere. However due to limited observation of Mariner 10, structure and dynamics of the magnetosphere and physical processes are still unknown. Since magnetosphere is quite common feature in wide range of scale size, to understand the universal features in the Mercury magnetosphere is important to understand general law in the magnetospheric physics.

Since Mercury has only exosphere and weak magnetic field, there is no ionosphere and plasmasphere. Therefore magnetosphere directly interacts with surface. In the earth's magnetosphere, ionosphere and plasmasphere plays important role. The effect of the lack of these regions is unknown. Furthermore there is no established theory about the structure and stability of Mercury magnetosphere and how solar wind energy is deposited/released in the Mercury magnetosphere. Understanding of Mercury magnetosphere leads to better understanding of magnetosphere in space. To investigate the Mercury magnetosphere is also required to determine inner structure of Mercury.

Japan has responsibility for development and operation of MMO. MMO will be launched in a part of a composite. Scientific instruments will be selected by international A/O.

Feasibility study of MMO system and development of required technology is started from Aug. 2000. Those activities show that the system is feasible under the severe heat inputs and radiation environment near the Mercury. As for the interface between composite and MMO is now under study based on the information provided by the ESA.