

RECENT RESEARCH ACTIVITIES

Plasma wave investigation in Mercury magnetosphere

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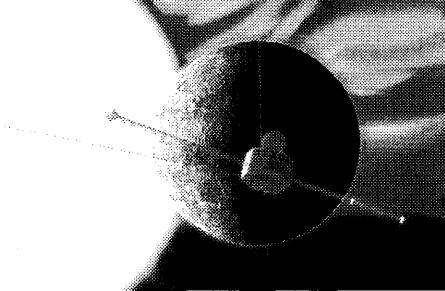


Figure 1: Mercury Magnetospheric Orbiter(MMO) of the BepiColombo mission (Artistic impression illustrated by C. Noshi.).

Mercury is the closest planet to the Sun. It is characterized by the highest density of all planets, very rarefied atmosphere and very weak intrinsic magnetic fields. Only American probe Mariner 10 has returned data from Mercury. It made three flybys of Mercury in 1974-1975 and obtained images of its surface and measured the plasma environments in Mercury. One of the most significant results in Mariner 10 mission to Mercury is to discover its intrinsic magnetic fields. Further, the data suggest the unexpected existence of the magnetosphere. However, the data in only three flybys of Mariner 10 are insufficient for revealing the features of this mysterious planet.

ESA (European Space Agency) and JAXA (Japan Aerospace exploration Agency) started the new mission to Mercury called “BepiColombo mission” under their collaboration. The BepiColombo mission consists of two independent spacecraft. They are the MPO(Mercury Planetary Orbiter) and MMO(Mercury Magnetospheric Orbiter). JAXA is responsible for developing the MMO spacecraft, which has the objective to investigate the Mercury magnetosphere.

To meet the scientific objectives of BepiColombo/MMO, we proposed the plasma wave receiver system called PWI (Plasma Wave Investigation) to the Announce of Opportunity issued by JAXA. Fortunately, JAXA selected and approved our proposal in November, 2004. We made a start for the detailed design of PWI. PWI is developed under the collaborations of Japanese and European scientists (Principal Investigator (PI): Hiroshi Matsumoto, Kyoto Univ.). The composition of PWI is summarized in Table 1.

PWI will address a wealth of fundamental scientific questions pertaining to the magnetosphere and exosphere of Mercury, the solar wind at Mercury location and solar radiation from the view point of Mercury. Together, these measurements will provide ample new information on the structure of the Herman magnetosphere as well as on its dynamics. New knowledge will be gained about energy transfer and scale coupling. We will learn more about wave-particle interactions in the Herman plasma environment. The MMO spacecraft is scheduled for launch in 2012.

Table 1: Composition of Plasma Wave Investigation

Sensors			
Component	Frequency	Development/Responsibility	
WPT	<i>E</i> : 0Hz – 10MHz	Japan	
MEFISTO	<i>E</i> ; 0Hz – 10MHz	Sweden	
LF-SC	<i>B</i> : 0Hz – 20kHz	Japan	
DB-SC	<i>E</i> : 0Hz – 20kHz <i>B</i> : 20kHz – 640kHz	France	
Receivers			
Component	Frequency	Data	Development/Responsibility
EWO	<i>E</i> : 0Hz – 120kHz <i>B</i> : 0Hz – 20kHz	Spectrum/Wave-Form /Spacecraft Potential	Japan
SORBET	<i>E</i> : 2.5kHz – 10MHz <i>B</i> : 2.5kHz – 640kHz	Spectrum/Electron temperature	France
AM ² P	< 120kHz	Antenna impedance	France

Onboard software: Japan and Hungary