Plasma wave investigation in Mercury: BepiColombo MMO mission

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In the Mariner10 encounters with Mercury in 1974, it was found that the planet has an internal magnetic field forming a magnetosphere through interaction with the solar wind. Since the scale of the Mercury magnetosphere is very small relative to the terrestrial magnetosphere, the ratio of the boundary layer-like regions to the whole magnetosphere is much larger than that of the terrestrial magnetosphere. The time scale in the response of the Mercury magnetosphere is very short and we can expect the very different type of the magnetosphere in Mercury, which is mainly controlled by kinetic effects. Its feature is very different from that of the MHD scale magnetosphere such as the terrestrial magnetosphere. Since the plasma waves are the important media in the energy transfer or energy exchange processes through the kinetic effects, the observation of the plasma waves in the Mercury magnetosphere is very essential. In order to study plasma wave phenomena in the Mercury magnetosphere, we propose the plasma wave observation system onboard the BepiColombo Mercury mission. The system mainly consists of 4 sets of different receivers and the digital processing unit. The onboard receivers observe both waveforms and FFT spectra in the frequency range from 0Hz to 3MHz for the electric field component and from 10Hz to 100 kHz for the magnetic field component. The digital processing unit contains the DSP and CPU. While the receivers for the low frequency range below 100kHz are mainly dedicated to study the in-situ wave-particle interactions on electrostatic waves and the propagating characteristics of electromagnetic waves such as Alfven waves and Whistler mode waves, the role of high frequency receiver of the electric field component is to monitor the solar activity, which affects the activity of the Mercury magnetosphere. The plasma wave observations also provide the important information of the in-situ plasmas such as plasma density, ion/electron temperatures. Since the characteristic time scale of plasma phenomena taking place in the Mercury magnetosphere is expected to be much shorter than that in the terrestrial magnetosphere, the observation time resolution should be much higher in spite of the restrictions on the telemetry capacity.