AOGS 2006

Low Energy Ion Observation by BepiColombo MMO

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According to the previous satellite observation (Mariner10 fly-by), Mercury has a magnetosphere with its own strong intrinsic magnetic field. In order to elucidate the detailed plasma structure and dynamics around Mercury, an orbiter BepiColombo MMO (Mercury Magnetospheric Orbiter) is planned to be launched in 2013 as a joint mission between ESA and ISAS/JAXA. For measuring low energy ions, two sensors MIA (Mercury Ion Analyzer) and MSA (Mercury Ion Mass Spectrum Analyzer) will be onboard the MMO. MIA measures energy spectrum (5eV/q - 30keV/q) of ions around Mercury as well as solar wind ions while MSA measures mass discriminated energy spectrum (5eV/q - 40keV/q) of ions around Mercury. MIA is a toroidal top-hat type electrostatic analyzer, while MSA consists of a similar electrostatic analyzer followed by a time-of-flight section for mass discrimination. In order to realize the dynamic range as wide as 10^6, electrical sensitivity control is used for both MIA and MSA, and attenuation grid is additionally used for MIA. Since the measurement of heavy ions (ex. sodium ions) in Mercury's magnetosphere is very important, the mass resolution of MSA should be high. MSA is an LEF-TOF (Linear Electric Field-Time Of Flight) mass spectrometer that can realize the mass resolution as high as 40. In order to minimize the effect of the spacecraft potential, MIA and MSA are installed at the corner of the spacecraft. Since the response time of Mercury's magnetosphere with respect to the solar wind variation is about 10 times faster than that of the Earth's magnetosphere, the time resolution of the instruments on MMO should be high. Highest possible time resolution is realized by installing MIA and MSA on the spacecraft 90 deg. apart from each other. The thermal environment around Mercury is so severe that the thermal design of the instrument is very important. Each sensor should have its own thermal shield in order to minimize the thermal input and to maintain the sensor temperature within an acceptable range.