

Development of Mercury Sodium Atmosphere Spectral Imager (MSASI) onboard BepiColombo/MMO

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The Mercury Sodium Atmosphere Spectral Imager (MSASI), which is boarded on Mercury Magnetospheric Orbiter (MMO) of BepiColombo mission, is a high-dispersion spectrometer with Fabry-Perot interferometer. The target of the instrument is sodium D2 emission (589.0 nm) from Mercury's exosphere. Our measurement on the overall scale will provide new information on regolith-exosphere-magnetosphere coupling as well as new understanding of the dynamics governing the 'surface-bounded exosphere', which is different from the terrestrial atmosphere.

Continuous ground-based observations of sodium emission have revealed that the regolith of Mercury releases a fraction of its content to Mercury's exosphere. The responsible release processes are (1) Chemical sputtering, (2) Thermal desorption, (3) Photon-stimulated desorption, (4) Ion sputtering, and (5) Micro-meteoroid impact/vapourisation. Each of these candidates seems to be in operation, and no single process can explain completely the range of phenomena observed from the Earth. Also, the fate of ejecta from the regolith is still unknown. Some are expected to return to the lithosphere, the other are lost into interplanetary space. Circulation of lithospheric sodium atoms via exosphere-magnetosphere might bring a significant change in the composition of surface layer on Mercury.

The MSASI measurements clearly and definitely can identify the release mechanism, how exospheric sodium is born from the regolith, and bring comprehensive picture of global circulation of regolith materials by way of comparison with model calculations. BepiColombo/MMO is the first and unique opportunity to study the formation, circulation, and maintenance of this surface-bounded exosphere.