

Development of Mercury Sodium Atmosphere Spectral Imager (MSASI)

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The Mercury Sodium Atmosphere Spectral Imager (MSASI), which is boarded on the Mercury Magnetospheric Orbiter (MMO) spacecraft of BepiColombo mission, is a high-dispersion spectrometer with Fabry-Perot interferometer. The target of MSASI is sodium D2 emission (Na-D2; 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.

Ground-based observations of Na-D2 emissions from Mercury's exosphere have revealed that the regolith of Mercury releases a fraction of its content to the exosphere. The responsible release mechanisms are thought to be as follows; (1) Thermal desorption, (2) Photon-stimulated desorption, (3) (Solar wind) Ion sputtering, (4) Micro-meteoroid impact/vapourisation, and (5) Chemical sputtering. Each of these candidates seems to be in operation, and no single process can explain completely the range of phenomena observed from the Earth. 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.

BepiColombo/MMO is the first and unique opportunity to study the formation, circulation, and maintenance of the exosphere. The MSASI measurements clearly and definitely can identify the release mechanisms, 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.