Attempt to identify a source machanism of Mercury's sodium exosphere by remote-sensing technique

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The Mercury's Sodium AtmoSphere Interferometer (MSASI) on BepiColombo will address a wealth of fundamental scientific questions pertaining to the Mercury's exosphere. Together, our measurement on the overall scale will provide ample new information on regolith-exosphere-magnetosphere coupling as well as new understanding of the dynamics governing the surface-bounded exosphere. It arises quite clearly from continuous ground-based observations that the regolith of Mercury releases a fraction of its content to Mercury's exosphere. Some processes are identified up to now as leading to this ejection. These processes are associated with different energies of ejection, behavior in different regions of Mercury's surface and eject different types of population from the surface. The responsible processes are (1) Chemical sputtering, (2) Thermal desorption, (3) Photon-stimulated desorption, (4) Ion sputtering, and (5) Micro-meteoroid impact/vaporization. Each candidate seems to be fairly operative, but any cannot completely explain 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 to 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. Also, MSASI/BepiColombo is the first and unique opportunity to study the formation, circulation, maintenance of the 'surface-bounded exosphere', which is a different type of terrestrial atmosphere.

MSASI is a high-dispersion visible spectrometer working in the spectral range around sodium D2 emission (589nm) and devoted to the characterisation of the MercuryĄfs exosphere. A tandem Fabry-Perot etalon is used to achieve a compact design. A one degree-of-freedom scanning mirror is employed to allow obtaining full-disk image of the planet and selected region of interest, e.g. polar regions, Caloris Basin, and magnetosphere. Also, simultaneous and complementary data from Limb camera, in-situ measurements of ENA, plasma, and dust, surface composition investigation by X- and gamma-ray are expected to support our mission.