Geophysical Research Abstracts,
Vol. 11, EGU2009-5964-1, 2009
EGU General Assembly 2009

Sampling a torched planet: MESSENGER observations of Mercury's ionized exosphere

T.H. Zurbuchen (1), J.M. Raines (1), G. Gloeckler (1), J.A. Slavin (2), S.M. Krimigis (3,4), R.L. McNutt, Jr. (3), M. Sarantos (2), and S.C. Solomon (5)

(1) University of Michigan, Atmospheric Oceanic and Space Sciences, Ann Arbor, MI, United States (thomasz@umich.edu, jraines@umich.edu, gglo@umich.edu / +1 734 615-9723), (2) Heliophysics Science Division, NASA Goddard Space Flight Center, Greenbelt, MD, United States (James.A.Slavin@nasa.gov, menelaos.sarantos-1@nasa.gov / +1 301 286-1648), (3) The Johns Hopkins University Applied Physics Laboratory, Laurel, MD, United States (Ralph.McNutt@jhuapl.edu / +1 240 228-5435), (4) Research Center for Astronomy & Applied Mathematics, Academy of Athens, Greece, (5) Department of Terrestrial Magnetism, Carnegie Institute of Washington, Washington, DC, United States (scs@dtm.ciw.edu / +1 202 478-8821)

During its two 2008 flybys, the Fast Imaging Plasma Spectrometer (FIPS) sensor on MESSENGER observed Mercury's ionized exosphere during the probe's passage through the planet's magnetosphere. These unprecedented observations over the range 100 eV/e to 14 keV/e provide signatures of the intense interactions of the heliospheric space environment with Mercury through ion sputtering, chemical sputtering, and micrometeoroid impact. Ion sputtering leads to the release of Mg and Na, as well as Fe and other components. The existence of these components was predicted from the observation of neutrals from Earth and in situ. FIPS observations from both encounters indicate that these neutrals must extend to altitudes of several planetary radii where they are photoionized in the solar wind and magnetosheath. The change in interplanetary magnetic field direction between these two flybys is observed to produce major changes in the spatial distribution of these planetary ions at high altitudes. However, the ionized exosphere contains substantial contributions of molecular species, such as H2O ions. These ions either could be released when micrometeoroids bombard the planetary surface, or they could come from chemical sputtering, when heliospheric ions react with particles on Mercury's surface. The presence of substantial molecular fluxes during both flybys is indicative of a distributed source and possibly favors the chemical sputtering explanation. The presence of doubly ionized C and O components in the ionized exosphere is possibly a signature of heliospheric particle or dust populations or magnetospheric plasma processes, as well as micrometeoroid bombardment of Mercury's surface. Here we offer a summary of FIPS measurements and their interpretation in the context of simulations of Mercury's strong interactions with its heliospheric neighborhood.