



Mercury's Surface-Bounded Exosphere as Seen from Orbit during the MESSENGER Mission: Mercury Atmospheric and Surface Composition Spectrometer Results

William E. McClintock (1), Matthew Burger (2), Timothy Cassidy (1), Rosemary Killen (3), Aimee Merkel (1), Menelaos Sarantos (4), and Ronald Vervack (5)

(1) Laboratory for Atmospheric and Space Physics University of Colorado, (2) Space Telescope Science Institute, (3) Solar System Exploration Division, NASA Goddard Space Flight Center, (4) Heliophysics Science Division, NASA Goddard Space Flight Center, (5) The Johns Hopkins University Applied Physics Laboratory

The Mercury Atmospheric and Surface Composition Spectrometer (MASCS), on the MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft, conducted orbital observations of Mercury's dayside and nightside exosphere from 29 March 2011 to the end of the mission on 30 April 2015. Over slightly more than four Earth-years, MASCS measured emission profiles versus altitude for calcium (Ca), sodium (Na), and magnesium (Mg) at a daily cadence. These species exhibit different spatial distributions, suggesting distinct source processes. MASCS observed seasonal variations in all three species that are remarkably repeatable from one Mercury year to the next, and did so consistently during the entire 17-Mercury-year duration of the orbital phase of the mission. Whereas MASCS has characterized the seasonal variation, it has provided, at best, only weak evidence for the episodic behavior observed in ground-based studies of Na. Joint analyses of MASCS observations and surface precipitation patterns for energetic particles inferred from observations by the Energetic Particle Spectrometer (EPS) and the Fast Imaging Plasma Spectrometer (FIPS) on MESSENGER have not yielded clear correlations. This lack of correlation may be due in part to the MASCS observational geometries. MASCS has conducted a number of searches for other, weakly emitting species. Hydrogen data from the orbital phase are consistent with profiles observed during MESSENGER's flybys of Mercury. Oxygen detections have proven elusive, and the previously reported observation with a brightness of 4 R may only be an upper limit. Recent analysis of weak species data indicates that manganese (Mn), aluminum (Al), and ionized calcium (Ca⁺) are present in the exosphere.