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Monte Carlo test-particle model of Mercury's ionized exosphere: Global structure and dynamics

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The Mercury plasma environment is enriched in heavy ions (mass-per-charge ratio m/q > 4) from photo-ionization of the tenuous exosphere. The MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) time-of-flight spectrometer Fast Imaging Plasma Spectrometer (FIPS) has detected many planetary ion species of which He^+, the Na^+-group (including Na^+, Mg^+ and Si^+) and the O^+-group (including O^+ and several water group ions) are the most abundant. The Mercury Atmospheric and Surface Composition Spectrometer (MASCS) UltraViolet and Visible Spectrometer (UVVS) has also detected Ca^+ ions in the nightside plasma sheet. Models of the planetary ion distribution inside Mercury's magnetosphere have mostly concentrated on the abundant Na^+ and H^+ ion populations. Comparison with FIPS data has been limited to the first two MESSENGER flybys and no comparison has been made with MASCS/UVVS observations.

We have developed a Monte Carlo test-particle model which describes the ion density distribution produced from photo-ionization of several neutral species in Mercury's exosphere. The global ion density and energy distribution of Ca^+, Mg^+, Na^+, O^+ and He^+ will be presented here. We will review the influence of the interplanetary magnetic field (IMF) B_x and B_y components on the global structure of the ion density distribution, the composition of the nightside plasma sheet and the evolution of the Na^+ ion density along the Mercury year.