



MESSENGER observations of magnetopause structure at Mercury

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MESSENGER Magnetometer (MAG) data from the first series of “hot-season” orbits at Mercury, when periapsis was positioned over the subsolar region, have been used to augment our initial studies to characterize the magnetopause structure as a function of local time. Minimum variance analysis (MVA) was applied to transform the MAG data into boundary-normal coordinates in order to determine (1) the thickness of the magnetopause, (2) the magnetic shear angle across the boundary, and (3) the normal magnetic field, B_N , across the current sheet and, by inference, the rate of reconnection and the magnetosphere electric potential. We applied the MVA to all distinct magnetopause crossings within the subsolar region between 0800 and 1600 local time and within $\pm 25^\circ$ latitude. A well-defined normal direction, specified by a ratio of the eigenvalue for intermediate variance to that for minimum variance that is greater than 8, was determined for 72 crossings. For this data set, 72.2% of the magnetopause traversals had a substantial normal component (i.e., $B_N > 4$ nT). For a mean boundary motion velocity of 10 km s^{-1} , the average current sheet thickness was 29 km, which is comparable to 2 gyroradii for solar wind protons. The mean ratio of the normal magnetic field component to the total field magnitude, a measure of the reconnection rate, was 0.2 and is independent of magnetic field shear angle across the magnetopause. We conclude that Mercury’s magnetopause structure is generally open to the solar wind plasma under a wide range of interplanetary magnetic field shear angles.