

MESSENGER Observations of the Composition of Mercury's Ionized Exosphere and Plasma Environment

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The MESSENGER Fast Imaging Plasma Spectrometer (FIPS) measured the plasma in the space environment of Mercury during the spacecraft's three flybys of the innermost planet on 14 January 2008 (M1), 6 October 2008 (M2), and 29 September 2009 (M3), producing the first measurements of low-energy ions at Mercury. These measurements present several challenges to detailed analysis that are addressed here using novel data analysis techniques. We have been able to extract some key heavy ion components measured during these three flybys, and we here discuss these results in the context of the Mercury space environment and exosphere.

Techniques used in this work address mainly two challenges. First, the low density of some components in the Mercury space environment results in a relatively low signal-to-noise ratio. We use a predictive technique for background removal and have applied it to data gathered during the three flybys. Second, only partial plasma velocity distribution functions can be measured by FIPS due to partial obscuration of the instrument's field of view by spacecraft structures. We employ a software model of the sampling of velocity space by FIPS to model these effects.