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MESSENGER observations of planetary ion characteristics within Kelvin-Helmholtz vortices

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Abstract

The MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft regularly observed the magnetospheric flanks of Mercury during its orbital phase, 2011-2015. Data from the magnetometer (MAG) and Fast Imaging Plasma Spectrometer (FIPS) allow us to investigate the statistical properties of planetary ions in the presence of Kelvin-Helmholtz (KH) vortices near the duskside magnetopause. We collect data from orbits with clear signatures of KH waves, as well as consecutive orbits that do not have KH signatures, and we compare energy characteristics between KH and non-KH events. Although low planetary counts in FIPS data make the comparison of these characteristics difficult, we find that : (1) large counts of planetary ions are observed in the presence of KH waves, (2) differences in Na⁺ energy spectra are only seen inside the magnetosphere, where they show a decelerating signature for KH events for ions with energies above 2.0 keV/e. These results suggest that planetary ions can stagnate within KH vortices and that electric field structures related to KH waves can decelerate planetary ions originating from the magnetotail region.