Identifying Electron Landau Damping in MMS Data

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Abstract

Turbulence likely provides an important energy source for the heating of the solar wind plasma. The transfer of energy from the turbulent cascade to the plasma particles can occur via a number of different processes. However, the relative contributions of each of these to the overall heating rate, and the conditions under which they occur, remains largely uncertain. Using the Field-Particle Correlation (FPC) technique, a method of correlating in time electric field and velocity distribution measurements, it is possible to identify which mechanisms are occurring and to assess their energy transfer rates. Using the FPC technique, studies have found that in a selection of 20 intervals, electron Landau damping is almost ubiquitous and plays a primary role in the heating of the Earth's magnetosheath plasma. In this work, we adapt the methods used in these studies to make them applicable under a wider variety of plasma conditions. We search for the signatures of electron Landau damping in over 185 intervals of Magnetic Multiscale (MMS) Mission data in a variety of environments and quantify its associated heating rate. Additionally, we look for statistical correlations in the plasma and turbulence parameters to determine the conditions under which this mechanism dominates.

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