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Transverse Ion Heating/Acceleration in the Magnetosphere by Dispersive Alfvén Waves

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In this presentation we present observations from various contexts within Earth's magnetosphere and in the magnetosheath which demonstrate the action of transverse ion heating in a broad spectrum of Alfvénic field variations. It is shown how in the auroral acceleration region this process drives mass outflow from the topside ionosphere, in the inner magnetosphere how this process acts to pump up magnetospheric ion energy density during geomagnetic storms, in the plasma sheet how this process may act to brake inward plasma transport in fast flows, and in the magnetosheath how this process creates significant temperature anisotropies. The observations in each of these contexts are unified by the occurrence of distinctive power-laws in wave spectral energy density with fluctuations having the properties of dispersive Alfvén waves. Modelling shows that the observed wave amplitudes are sufficient to disrupt the regular adiabatic motion of the ion plasma leading to characteristic features in observed ion distributions that are the hallmark of a stochastic mechanism. In the magnetosphere the global implications of the action of this micro-scale process are readily apparent and are suggestive of analogous large-scale consequences which may be observed upstream from upcoming missions such as THOR and Solar Probe Plus.