VELOCITY—SPACE SIGNATURES OF RESONANT ENERGY TRANSFER BETWEEN WHISTLER WAVES AND ELECTRONS IN THE EARTH'S MAGNETOSHEATH

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Wave—particle interactions play a crucial role in transferring energy between electromagnetic fields and charged particles in space and astrophysical plasmas. Despite the prevalence of different electromagnetic waves in space, there is still a lack of understanding of fundamental aspects of wave—particle interactions, particularly in terms of energy flow and velocity—space characteristics. In this study, we combine a novel quasilinear model with observations from the Magnetospheric Multiscale mission to reveal the signatures of resonant interactions between electrons and whistler waves in magnetic holes, which are coherent structures often found in the Earth's magnetosheath. We investigate the energy transfer rates and velocity—space characteristics associated with Landau and cyclotron resonances between electrons and slightly oblique propagating whistler waves. In the case of our observed magnetic hole, the loss of electron kinetic energy primarily contributes to the growth of whistler waves through the $n=-1$ cyclotron resonance, where n is the order of the resonance expansion in linear Vlasov — Maxwell theory. The excitation of whistler waves leads to a reduction of the temperature anisotropy and parallel heating of the electrons. Our study offers a new and self-consistent understanding of resonant energy transfer in turbulent plasmas.