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Whistler-mode Waves and Non-Adiabatic Electrons in Plasma Jet Braking

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We report in situ observations by the Cluster spacecraft in the Earth's magnetotail of wave particle interactions in the magnetic flux pile-up region created by a magnetic reconnection outflow jet. Two distinct regions of wave activity are identified: lower-hybrid drift waves at the front edge and whistler-mode waves inside the pile-up region. The whistler-mode waves are locally generated by the electron temperature anisotropy, and provide evidence for ongoing betatron energization caused by the magnetic flux pile-up. The whistler-mode waves cause fast pitch-angle scattering of electrons and isotropisation of the electron distribution, thus making the flow braking process non-adiabatic. The waves strongly affect the electron dynamics and thus play an important role in the energy conversion chain during plasma jet braking.