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Whistlers, Electron Trapping and Charge Transport in the Earth's Magnetosphere

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Large amplitude (Electric field >100 mV/m) Whistler-mode signals have been observed by Wind-Waves and STEREO-SWaves experiments on the Wind and STEREO spacecraft. The waveforms are distorted in a way that indicates appreciable trapping of electrons. This trapping is not at the cyclotron resonance, but is trapping at the Cerenkov resonance. The wavevectors of the observed whistlers are significantly oblique and the trapping is in the potential of the electrostatic part of such an oblique whistler. These electrons are therefore carried along at the phase speed of the whistler. The charge density of the trapped electrons is significant, and results in transport of enough electrons to generate potentials of kilovolts. These in turn must be able to accelerate electrons to tens and hundreds of keV.