Nonlinear Wave–Wave Coupling Related to Whistler-mode and Electron Bernstein Waves Observed by the Parker Solar Probe

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We report nonlinear wave-wave coupling related to whistler-mode or electron Bernstein waves in the near-Sun slow solar wind with Parker Solar Probe (PSP) data. Prominent plasma wave power enhancements usually exist near the electron gyrofrequency (f_{ce}), identified as electrostatic whistler-mode and electron Bernstein waves (Malaspina et al. 2020). We find that these plasma waves near f_{ce} typically have a harmonic spectral structure and further classify them into three types identified by the characteristics of wave frequency and electric power. For short, we will call these type I, type II, and type III waves. The first (type I) is the quasi-electrostatic whistler-mode wave and its second harmonic, which resembles the quasi-electrostatic multiband chorus in the Earth's magnetosphere. The second (type II) is the pure electron Bernstein wave. The last (type III) is an intermixture of whistler-mode and electron Bernstein waves, where the wave mode driven by the coupling between them was also detected. During the first five orbits of PSP, the type III spectra have the largest occurrence rate, then the type I spectra. The type II spectra are the rarest type of wave. Our study reveals that nonlinear wave-wave coupling in the solar wind may be as common as in the Earth's magnetosphere.

References:

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