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Exclusion principle for very oblique and parallel lower band chorus waves

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Simultaneous measurements of intense very oblique and parallel lower band chorus waves are rare in the Earth's inner magnetosphere. A possible explanation is that very oblique and parallel waves generally cannot be generated simultaneously, due to a suppression of parallel wave growth by fast nonlinear modifications of the electron distribution induced by very oblique waves. The corresponding exclusion principle for intense lower band chorus waves is proposed based on in situ measurements and tested in particle simulations. Parallel acceleration of low-energy electrons trapped by very oblique waves up to the energy range of cyclotron resonance with parallel waves is very efficient and should usually result in a quick suppression of the temperature anisotropy necessary for parallel wave growth. Selected spacecraft observations have confirmed the main aspects of the proposed exclusion scenario. These results should help to better assess the respective roles of oblique and parallel lower band chorus in energetic electron dynamics.