Abstract Submitted
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The Role of Nonlinear Wave Processes in Saturating Instabilities with Frequencies between the Cyclotron Frequencies[1] CHRIS CRABTREE, GURUDAS GANGULI, ERIK TEJERO, Naval Research Laboratory, LEONID RUDAKOV, Icarus Research Inc. — Induced nonlinear scattering by particles and nonlinear 3-wave resonant processes redistributes (or scatters) wave action in frequency and wave-vector space. Since the rate of scattering increases with wave amplitude, there exists a point in time when the waves are scattered at the same rate that they are generated by the linear instability. Then saturation of the linear instability may occur, which cannot be described by quasi-linear theory. Failure to account for this nonlinear effect in the evolution of the instability leads to larger amplitude waves and rapid diffusion of the particles. We investigate this effect through particle-in-cell codes, analytical theory, wave kinetic simulations, analysis of *in-situ* spacecraft data, and dedicated laboratory experiments. We focus on two phenomena important to the dynamics of the Earth's magnetosphere: 1) the velocity ring instability (VRI) which generates lower-hybrid waves, and 2) chorus generated whistler-mode waves with a chirping frequency. We show that consideration of NL scattering plays a vital role in explaining the saturated state. We focus on the role of wave-particle trapping, wave-propagation effects, and energetic particle modification of the real part of the dispersion relation.

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