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A theory of radio emissions by nonlinear coupling of Langmuir and Alfven waves in solar and auroral plasmas

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Space obsevations of solar and auroral radio emissions have provided growing evidence of nonlinear wave-wave interactionsinvolving the electron-beam generated Langmuir waves. Large-amplitude Langmuir waves can produce radio waves by nonlinearly couple to low-frequency MHD waves such as shear Alfven waves, fast magnetosonic waves, and kinetic Alfven waves (Chian et al. 2002; Voitenko et al. 2003). We present a nonlinear theory of parametric interaction of Langmuir, whistler and kinetic Alfven waves. In the absence of wave growth and damping, the traveling wave solutions of the coupled three-wave equations admit both periodic and solitary waves. In the presence of linear wave growth and damping, the numerical solutions of the coupled three-wave system admit both periodic and chaotic waves. In particular, various types of intermittency can be observed. Applications of our theory and simulations to solar and auroral plasmas will be discussed.

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