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Effects of field-aligned inhomogeneity on plasma wave coupling

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The plasma wave equations become coupled in inhomogeneous plasmas, it is often difficult to obtain the theoretical solution. We study the coupled plasma wave problem by introducing new theoretical and numerical techniques. In this work, we attempt to examine the wave coupling problem when parallel inhomogeneity is assumed in a magnetized plasma. By adopting the 3-D multi-fluid wave model, we study how R and L modes are coupled to the cyclotron wave and Lamgmuir wave in real time and real space. Our results show that the mode conversion occurs at each resonance, and both modes of initial R and L waves become damped to the local resonances of electrostatic waves via a resonant absorption. The wave spectra and time histories of all electric and magnetic fields are presented. We also compare our results with analytical calculations based on the recent invariant imbedding method. Our simulation model is found to be very useful in studying how the coupled waves behave when the mode conversion takes place.