

# Ion cyclotron waves in space plasmas

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We study the linear and nonlinear properties of electromagnetic ion-cyclotron waves in the magnetosphere and the solar wind. In particular, we study parametric decays of large amplitude electromagnetic ion-cyclotron waves (EICW) due to a minor  $O^+$  and  $He^+$  ion components in the magnetosphere. It is shown that the presence of  $O^+$  and  $He^+$  ions lead to a number of new wave couplings which in turn lead to new instabilities. Some couplings involve sound waves carried mainly by the  $O^+$  ( $He^+$ ) ions, and a sideband electromagnetic ion-cyclotron wave which has a resonance at the  $O^+$  ( $He^+$ ) ion gyrofrequency. These are decay instabilities which can lead to  $O^+$  and  $He^+$  heating through Landau damping and/or resonance absorption. It is also shown that the decays to sound waves associated to the minority heavy ion species have growth rates comparable, or even larger, than the decays to the acoustic branch corresponding to the majority proton species. In a recent paper Hollweg et al. [1993] studied the param