

Ion hole formation and nonlinear generation of Electromagnetic Ion Cyclotron waves: THEMIS observations

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Electromagnetic plasma waves are thought to be responsible for energy exchange between charged particles in space plasmas. Such an energy exchange process is evidenced by phase space holes identified in the ion distribution function and measurements of the dot product of the plasma wave electric field and the ion velocity. We develop a method to identify ion hole formation, taking into consideration the phase differences between the gyro-motion of ions and the electromagnetic ion cyclotron (EMIC) waves. Using this method, we identify ion-holes in the distribution function and the resulting nonlinear EMIC wave evolution from THEMIS observations. {These} ion holes are key to wave growth and frequency drift by the ion currents through nonlinear wave particle interactions, which are identified by a computer simulation in this study.

Keywords: Wave-particle interaction, Nonlinear wave growth