Geophysical Research Abstracts, Vol. 7, 10183, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10183

Observational implication of high frequency waves in coronal plasma

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The effects of high frequency (of order ion gyrofrequency) Alfvén and ion-cyclotron waves on ion emission lines is studied by solving the dispersion relation of these waves in a multi-ion coronal plasma using the multifluid, and Vlasov equations. The dispersion relation is also derived from velocity and magnetic field fluctuations produced by nonlinear one-dimensional hybrid kinetic simulations of the multi-ion plasma. Coronal parameters and abundances of Helium and oxygen ions are used in the models. When heavy ions are present it is well known that the dispersion relation of parallel propagating Alfvén /cyclotron waves exhibits the following branches: right hand polarized nonresonant, and left hand polarized resonant branch for protons, and each ion, with frequency gaps between the resonant branches. The ratio of ion to proton velocities perpendicular to the direction of the magnetic field for each wave modes for typical coronal parameters shows strong enhancement of the heavy ion perpendicular fluid velocity compared to proton perpendicular fluid velocity. The linear multifluid results (cold plasma) agree well with linear warm plasma Vlasov results. The results of the fully nonlinear and self consistent hybrid simulations confirm the multifluid and Vlasov theory findings. In view of these findings we discuss the possible observational signatures of high frequency wave motions, and the impact on minor ion emission line width.