Heating of ions by Alfvén waves via non-resonant interactions

C. B. Wang (1), C. S. Wu (1,2) and P. H. Yoon (2)

(1) CAS Key Laboratory of Basic Plasma Physics and School of Earth and Space Sciences, University of Science and Technology of China, Hefei, Anhui 230026, China, (2) Institute for Physical Science and Technology, University of Maryland, College Park, MD 20742, USA (cbwang@ustc.edu.cn / Fax: +86 551-3607615 / Phone: +86 551-3607657)

Large-amplitude intrinsic Alfvén waves exist pervasively in astrophysical and solar-terrestrial environments. It is generally believed that within the context of linear kinetic theory, effective interactions between thermal protons and Alfvén waves are unlikely, when the proton beta is low. In this discussion we show that, due to pitch-angle scattering, thermal ions can be significantly heated by Alfvén waves via non-resonant nonlinear interactions. As a result of this process, the kinetic temperature attained in the perpendicular direction is significantly higher than that in the parallel direction, a result consistent with observations. We conclude that the lower the plasma beta value, the more effective is the heating process. Moreover, ions can also be significantly heated by cyclotron waves via the similar non-resonant scattering process. A discussion on the anisotropy heating of coronal ions will be presented based on this heating scenario.