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Ion Heating by Alfven Waves and Reconnection in NSTX[1]

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The evolution of laboratory and astrophysical plasmas depends on the flow of energy between the "equilibrium" configuration, waves in the plasma and the thermal plasma. We explore two examples of this energy flow. In the first example, data from NSTX is examined for evidence that CAE in the frequency range from ~ 0.2 fci to ~ 1.2 fci excited by super-thermal ions might heat the thermal ions. Theory indicates that only a relatively small portion of the beam power would go into exciting the CAE on NSTX, and observations indicate that the amplitude of these waves, deduced from density fluctuations, is below the stochastic threshold for heating. Another example examines how internal magnetic reconnections can lead to heating of the thermal ions. One model postulates the excitation of a high frequency wave, which then damps on the ions. High frequency waves are indeed seen to follow some NSTX reconnection events. The second invokes direct acceleration of the thermal ions by the induced electric field [P. Helander, L.-G. Eriksson, R.J. Akers, et al.,Phys. Rev. Lett. 89 (2002) 235002-1].

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