Particle Acceleration in Kinetic Eigenmodes from the Van Allen Probes

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The Van Allen Probes have revealed the presence of a broad spectrum of narrow scale Alfvén eigenmodes in the inner magnetosphere during geomagnetic storms. Here we use observations from the Van Allen Probes to build a reduced MHD model for these waves in a dipolar geomagnetic field. This model is then used to explore the manner through which particles may be accelerated in these wavefields. Test particle simulations show that the narrow perpendicular scale and parallel electric fields carried by these waves lead to the violation of the 1st and 2nd adiabatic invariants for ions. This can drive the heating of the thermal ion population to multi-keV temperatures and the acceleration of a small fraction of these particles to energies exceeding 100 keV. This process has obvious implications for the storm time ring current, but also for the acceleration/loss of radiation belt electrons.

Keywords: Particle acceleration, Alfven waves, van allen probes, field lines resonances, ring current, radiation belts