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Dispersive Alfvén Waves in Geospace: Observations and Effects

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Recent measurements of electric and magnetic fields coupled with high-time resolution sampling of particle distributions and imaging have delivered a fascinating physical picture of energy release, transport and deposition through near-Earth space. A characteristic feature of these processes is the central role played by Alfvén waves. These waves serve as conduits for electromagnetic energy transport through space and across scales that ultimately dissipates on kinetic scales through particle energization, plasma heating and emission. In this presentation observations from spacecraft including the FAST, Cluster, Reimei, Image, THEMIS, Van Allen Probes and Magnetospheric Multi-Scale missions are brought together to expose these dynamics. A system of driven, non-linearly interacting Alfvén waves prevalent throughout Earth's magnetosphere over a broad range of scales during geomagnetically actives times emerges [Chaston et al., 2008; 2012; 2015]. It is shown how this system serves to heat the plasma sheet [Chaston et al., 2014], enhance the ring current [Chaston et al., 2016; Hull et al., 2019,2020], scatter radiation belt particles [Chaston et al., 2018a, b], drive aurora [Chaston et al., 2011] and fill the magnetosphere with ionospheric ions [Chaston et al., 2007; Hatch et al., 2016] These processes, mediated by Alfvén waves, in part define the response of our near-Earth space environment to space weather events.

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