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Electron response to kinetic Alfvén waves produced by large-scale Alfvén wave phase-mixing

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Cross-scale perturbations in astrophysical plasmas induce a preferential development of turbulent cascade along the direction transverse to the direction of the background magnetic field. Recent works showed how large-scale Alfvén waves propagating in plasmas (e.g. in the solar wind), in presence of an inhomogeneous guide field, can decay into kinetic Alfvén waves (KAWs), promoting energy exchange across multiple length-scales. Simulation-based studies of such phenomena in the linear and nonlinear regimes have been conducted with MHD, Hall MHD, and Hybrid Vlasov-Maxwell (HVM) models (Vasconez et al. 2015; Pucci et al. 2016; Valentini et al. 2017). The HVM model allowed also for investigating the ion response to the energy input from the large scales. However, recent observational measurements of KAWs in the Earth's magnetosphere hinted at the possible relevant role played by electrons (Gershman et al. 2017), whose behaviour has not been studied in simulations as of today. By means of full Particle-in-Cell (PiC) simulations, we investigate the KAW-electron interaction of KAW produced by the phase-mixing of large scale Alfvén waves.This work is relevant for assessing KAW-particle interaction up to the electron scale, which can play an important role in producing the nonthermal features of particle distribution functions observed in the solar wind and in other heliospheric plasmas.

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