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Properties of kinetic Alfvén waves along Jupiter's auroral magnetic field lines

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Abstract

For the first time, the Juno spacecraft probes particles and fields in the region of Jupiter's magnetosphere, where Jupiter's energetic auroral particles are accelerated. Surprisingly, energetic bidirectional electron distributions, as well as broadband energy distributions, are observed in the high-latitude region. These measurements indicate that an acceleration mechanism of stochastic nature plays a dominant role for the generation of the intense main auroral oval.
As discussed in previous work, kinetic Alfvén waves can significantly contribute to this stochastic acceleration process. Therefore, we investigate the kinetic Alfvén wave properties along various dipole auroral field lines with L-shell parameters between 20 and 30. Based on simple models for the required physical quantities such as density and temperature profiles along these field lines, we model the phase velocity and the associated wave damping rate for increasing wavenumbers with the help of the hot plasma dispersion relationship. Furthermore, we calculate the polarization relationships to infer on the strength of the accelerating wave electric fields. We aim to conclude which amount of energy this wave mode is able to effectively transfer towards charged particles by wave-particle interaction.