BOUNCE RESONANT INSTABILITIES OF KINETIC ALFVEN WAVES ON AURORAL FIELD LINES

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Recent observations from the FAST satellite as well as a number of sounding rocket missions have shown two distinct modes of auroral electron acceleration: the classic inverted-V signature consisting of a beam broad in pitch angle but narrowly confined in energy, and a lower energy, field-aligned acceleration that has been attributed to kinetic Alfven waves. A non-local theory of the interactions of auroral electrons with these waves has been developed, and used to describe this Alfvenic acceleration process. However, observations indicate that these two acceleration mechanisms often co-exist, suggesting that Alfvenic acceleration can occur on field lines with a quasi-static potential drop. The presence of this parallel potential drop leads to several new populations of auroral electrons. Cold ionospheric electrons are reflected back to the ionosphere. In addition, electrons of appropriate energy and magnetic moment can be trapped between this potential drop and their magnetic mirror points. Calculations indicate that trapped electrons of a few hundred electron volts have bounce periods of 1-5 seconds, comparable to the period of waves in the ionospheric Alfven resonator, a structure produced by the gradients in the Alfven speed above the auroral ionosphere. This suggests that a bounce resonant instability may occur that would excite waves in the resonator that could play a role in the acceleration of low-energy field-aligned electrons. Such bounce resonant waves would have perpendicular scales comparable to the electron inertial length, which enhances the trapping of these waves in the ionospheric resonator. A non-local kinetic theory including trapped electrons has been developed to determine what role such bounce resonance plays in the auroral acceleration process.

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