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Mode conversion from kinetic Alfvén waves to modified electron acoustic waves

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Possible mode conversion from kinetic Alfvén wave to modified electron acoustic wave is examined based on a multi-fluid model involving two electron populations. The mode conversion transpires when a kinetic Alfvén wave propagates through a transition between a hot-electron-dominant region and a cold-electron-dominant region.

We take advantage the fluid model in low-beta regime, and keep the parallel momentum equations of electrons with different temperatures

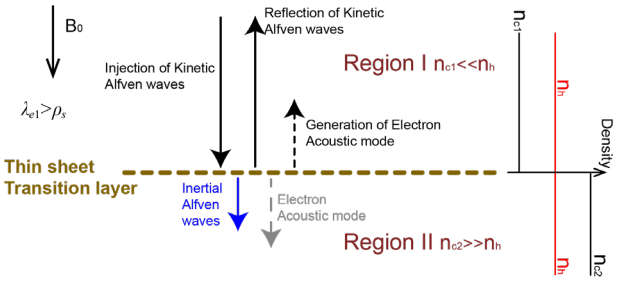

Figure 1

Region I denotes the region with dominantly hot electrons ($n_h >> n_{c1}$), and Region II is the region with dominantly cold electrons ($n_h << n_{c2}$). The transition layer is approximated as a thin sheet. The hot electron density is assumed constant, while the density of cold electrons features a stepwise distribution across the transition boundary. The ambient magnetic field is assumed constant in both Region I and Region II.

The coefficients of the wave reflection ϕ_{1r}/ϕ_{1i} (black), transmission ϕ_{2IAW}/ϕ_{1i} (blue), and mode conversion ϕ_{1EAW}/ϕ_{1i} (red) are illustrated in Figure 2. Figures 2a and 2b show the dependence on $k_\perp$ with fixed λ_{e1}, ρ_s, and $\varepsilon = \lambda_{e2}/\lambda_{e1}$. At smaller $k_\perp$, the electron acoustic mode plays a minor role. Both panels show that the mode conversion becomes significant with increasing $k_\perp$, while the KAW reflection becomes weaker. Figures2c exhibits the role of λ_{e1} with fixed $k_\perp$, ε and ρ_s. As expected, the magnitude of the mode conversion coefficient begins to increase as $k_\perp\lambda_{e1}$ approaches 1, and becomes stable when $k_\perp\lambda_{e1}>>1$. Figure 2d is the same as Figure 2a except that ρ_s is 10 times bigger and hereby leads to greater variation with λ_{e1}. Similar to the effect of λ_{e1}, the increase of ρ_s (Figures 2e and 2f) also leads to stronger mode conversion.

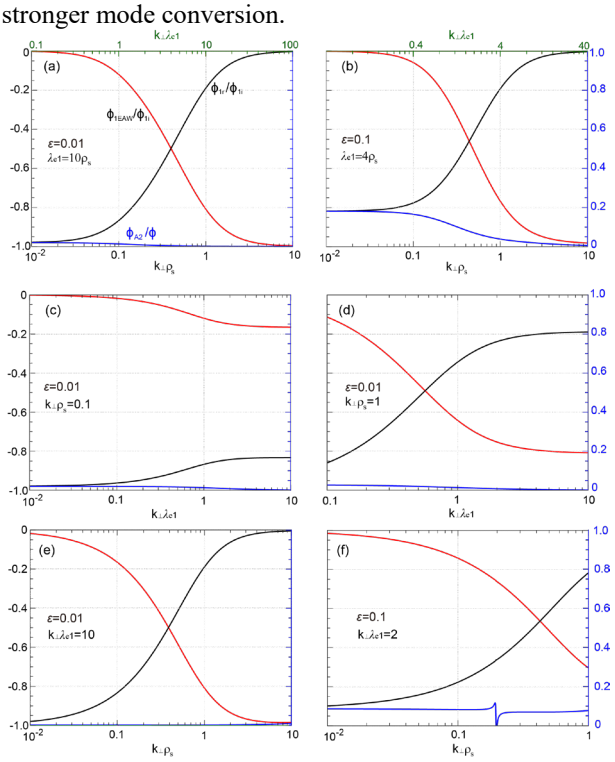

Figure 2

References

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