Abstract

Since the time of their discovery, Alfvén waves have been the subject of fascination, due to their phenomenal applications, in both theoretical and experimental plasma physics. To date, many different aspects of these waves have been studied using various models. In this thesis, we invoke the standard Vlasov model and the steady-state Poynting's theorem to investigate one of the most important features of the Alfvén waves—energy transportation from one location to another location in a plasma. The Alfvén waves, in this work, are categorized as kinetic and inertial Alfvén waves. The plasmas that support these waves are modeled by two non-Maxwellian distribution functions: Kappa distribution function, characterized by the index κ; and the more generalized bi-Kappa distribution function, characterized, in addition to the index κ, by temperature anisotropy. The research in this thesis reveals that the energy transport of both the kinetic and inertial Alfvén waves is significantly influenced by the above-mentioned non-thermal features associated with the distribution functions. On the energy transport of the kinetic Alfvén waves, the effects of the index κ and temperature anisotropy are similar. When either κ or parallel temperature of electrons increases, the waves quickly deliver their energy to the plasma in their nearby regions. On the other hand, in the case of inertial Alfvén waves, the energy that is carried by the waves for small and large perpendicular wavenumbers decreases at different rates with respect to the distance. For small perpendicular wavenumbers, when either the non-thermal parameter κ or electron parallel temperature increases, the inertial Alfvén waves can efficiently transfer their energy to the plasma in their immediate vicinity. However, for relatively large perpendicular wavenumbers, an increase in either κ or electron parallel temperature enables the inertial Alfvén waves to effectively transport the energy to remote regions in the plasma. The possible explanations behind the above-mentioned cases are provided by the velocity distributions, which hold vital clues as to how the non-thermal features, together with perpendicular wavenumbers, dictate the resonance conditions that play a crucial role in the energy transport process.