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DRIFT KINETIC ALFVEN WAVES WITH KAPPA DISTRIBUTION FUNCTION IN MAGNETOSPHERIC PLASMA

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Abstract:

We have present work on drift kinetic Alfven waves with kappa distribution function. Particle aspect analysis is used to evaluate expression for dispersion relation, growth rate and growth length of the drift kinetic Alfven waves in ionospheric region. Our purpose in this study is to be investigating the effect of kappa distribution function with temperature anisotropy on drift kinetic Alfven waves. It is observed that the growth rate and growth length is to increase with increase the wave vector for different values of kappa distribution function with temperature anisotropy. The result of the work are consistent for drift kinetic Alfven waves (DKAW's) are applicable of the magnetospheric and astrophysical ionospheric region.

Keywords:-Magnetosphere, Particle aspect analysis, Ionospheric region, Drift Kinetic Alfven waves (DKAW's), Temperature anisotropy, Drift velocity.

1. Introduction :

In this chapter we are presenting the work on drift kinetic Alfven waves with kappa distribution function in magnetospheric plasma. We want to see the effect of Kappa distribution function on drift kinetic Alfven waves in temperature anisotropy by using the gyrokinetic theory, the kinetic Alfven waves are discussed of the drift effect the density inhomogeneity and the temperature anisotropy on their dispersion characteristics and want to show the dependence of stabilities of mechanism of drift-Alfven wave instability on the temperature anisotropy is highlighted. The calculation of the growth rate and limited condition for a wide range of parameters are also discussed. The kinetic Alfven wave while propagates into the higher density side of plasma then the mode conversion scatters due to both linear and non-liner processes and then heat the plasma. Kinetic Alfven waves can be excited in plasma by temperature anisotropy, velocity shear, and inhomogeneties in density and magnetic field etc. The instability driven by temperature anisotropy can excited the kinetic Alfven waves.

First of all estimated the kinetic Alfven waves dispersion relation in a homogeneous plasma with ions and electrons gyoradii effects taking the approximations that $\omega << \Omega_i$, $\beta << 1$ and $\beta << K_\perp^2 \rho_i^2$ [43]. After that it has been calculated the same including temperature anisotropies of both the ions and electrons and used the dispersion relation to determine the expression for inertial and kinetic limits of kinetic Alfven wave. the particle aspect analysis of kinetic Alfven wave in inhomogeneous plasma for lose-cone distribution was stabilized.[44,45]. It has studied tat rift-Alfven waves, in both the linear and non linear regime in bounded inhomogeneous plasma. In this paper, we obtain general dispersion relation for drift-kinetic Alfven waves in the kinetic limit in beta plasma ($m_e/m_i << \beta_\Pi << 1$) and finite Larmor radii which includes the temperature anisotropy and density inhomogeneity by using the gyrokinetic theory [46].

This stability analysis applicable to the wide range of plasma parameters which performed along with the estimate of growth rate our purpose in this work is to be investigate the effect of kappa distribution function with temperature anisotropy on drift kinetic Alfven waves. It is observed that the growth rate and growth length is to increase with increase the wave vector for different values of kappa distribution function with temperature anisotropy.

We have found that to evaluate the dispersion relation we calculate the integrated perturbed density for non resonant particles. It is observed that essential feature of drift kinetic Alfven wave is retained even in this work for Maxwell's equation we have used the quasi-neutrality condition.

Our aim in this work is to discuss the dispersion of Alfven wave and its modulation with drift waves and to excogitate a process by which the drift Alfven wave instability by the density gradient, may be stifled by increasing the temperature anisotropy ratio ($T_{\perp e,i} > T_{\Pi e.i}$).

The kinetic Alfven wave can propagate through the magnetic field and faces both electron and ion Landau damping because of its pairing with the electrostatic mode. It is also important to note that the wave along with the electric field in the direction of the completely enveloping magnetic field.

2. Basic Trajectories :

The dift kinetic Alfven's wave is assumed to start at t=0 when the resonant particles are undistributed. The main interest lies in the behavior of kinetic Alfven waves, which satisfy the conditions.

$$V_{T\Pi i} << \frac{\omega}{K_\Pi} << V_{T\Pi e}, \omega << \Omega_i, \Omega_e, : K_\perp^2 \rho_e^2 << K_\Pi^2 \rho_i^2 < 1 \qquad (1)$$

Where $V_{T\Pi i}$,$V_{T\Pi e}$ are the mean velocities of ions, electrons particles along the magnetic field, $\Omega_{i,e}$ are cyclotron frequencies and $\rho_{i,e}$ the mean gyro radii of the respective species. $K_\perp$ And K_Π are the components of the real wave vector k perpendicular and parallel to the magnetic field.

We consider the two potential components of electric field a drift Kinetic Alfven waves of the form,

$$\bar{E}_\perp = -\nabla_\perp \phi \quad \text{and } \bar{E}_{\Pi|} = -\nabla_\Pi \psi$$

$$\bar{E} = \bar{E}_\perp + \bar{E}_{\Pi||}$$

$$\phi = \phi_1 \cos(K_\perp x + K_{\Pi|} z - \omega t)$$

$$\psi = \psi_1 \cos(K_\perp x + K_{|\Pi} z - \omega t) \qquad (2)$$

Where ϕ_1 and ψ_1 are assumed to be a slowly varying function of time t, and ω is the wave frequency which is assumed as real.

The equation of motion of ions and electron particles is

$$\frac{dv}{dt} = q\left(\bar{E} + \frac{1}{c}\bar{v} \times \bar{B}\right) \qquad (3)$$

$$u_x(\vec{r}.t) = -\frac{q}{m}\left[\phi_1 k_\perp - \frac{V_\Pi K_\Pi K_\perp}{\omega}(\phi_1 - \psi_1)\right]\sum_{-\infty}^{+\infty} J_n(\alpha) \sum_{-\infty}^{+\infty} J_i(\alpha)[\frac{\Lambda_n}{a_n^2}\cos\xi_{nl} - \frac{\delta}{2\Lambda_{n+1}}\cos(\xi_{nl} - \Lambda_{n+1} t)$$

$$-\frac{\delta}{2\Lambda_{n-1}}\cos(\xi_{nl} - \Lambda_{n-1} t)]$$

$$u_y(\vec{r}.t) = -\frac{q}{m}\left[\phi_1 K_\perp - \frac{V_\Pi K_\Pi K_\perp}{\omega}(\phi_1 - \psi_1)\right]\sum_{-\infty}^{+\infty} J_n(\alpha) \sum_{-\infty}^{+\infty} J_i(\alpha)[\frac{\Lambda_n}{a_n^2}\cos\xi_{nl} - \frac{\delta}{2\Lambda_{n+1}}\cos(\xi_{nl} - \Lambda_{n+1} t)$$

(4)

$$-\frac{\delta}{2\Lambda_{n-1}}\sin(\xi_{nl} - \Lambda_{n-1} t)]$$

$$u_z(\vec{r},t) = -\frac{q}{m}[\psi_1 K_\Pi - \frac{V_\perp K_\Pi K_\perp}{\omega}(\phi_1 - \psi_1)\frac{n}{\alpha}]\sum_{-\infty}^{+\infty} J_n(\alpha) \sum_{-\infty}^{+\infty} J_i(\alpha)\frac{1}{\Lambda_n}[\cos\xi_{nl} - \delta\cos(\xi_{nl} - \Lambda_n t)$$

Where δ =0 for non-resonant particles and δ =1 for resonant particles and

$$\alpha = \frac{K_\perp V_\perp}{\Omega}, \qquad \Lambda_n = K_\Pi V_\Pi - \omega + n\Omega$$

$$a_n^2 = \Lambda_n^2 - \Omega^2$$

$$\xi_{nl} = K_\perp x + K_\Pi z - \omega t + (l - n)(\theta - \Omega t)$$

θ is the initial phase of the velocity and $\Omega = qB_o / mc$, u_x and u_y are the perturbed velocities in the X and Y directions respectively. The slowly varying quantities ϕ_1 and ψ_1 are treated as a constant. The term represent by Bessel's functions shows the reduction of the field intensities due to finite gyoradius effects.

3. Distribution function :

We consider bi-Lorentzian distribution function as Ahirwar et al ., (2012)

The lorentzian which reduces to the anisotropic Maxwellian distribution when the spectral index κ

Tends to infinity is given by Ahirwaret al., (2012)

$$N_K(V) = \frac{1}{\pi^{3/2}} \frac{\Gamma(\kappa-1)}{\kappa^{3/2}\Gamma\kappa - 1/2\, v_{T\perp}{}^2 V_{T\Pi e}{}^2} \left[1 + \frac{v^2{}_\perp}{\kappa v_{T\perp}^2} + \frac{v_\Pi^2}{\kappa v_{T\Pi e}^2}\right]^{-(\kappa+1)} \quad (5)$$

In eq. (5) $V_{T\perp}$ and $V_{T\Pi e}$ are thermal velocity related to the mass m and the temperatures $T_\perp$ and $T_{\Pi e}$ respectively parallel and perpendicular to the magnetic field

$$V_{T\perp}{}^2 = \left[\frac{\kappa - 3/2}{\kappa} \frac{2K_B T_\perp}{m}\right] \quad (6)$$

$$V_{T\Pi e}{}^2 = \left[\frac{\kappa - 3/2}{\kappa} \frac{2K_B T_{\Pi e}}{m}\right]$$

The κ- Lorenz distribution has been introduced as more suitable for modeling magnetized plasma.

4. Density Perturbation and Dispersion relation :

In order to find the density perturbation associated with the velocity perturbation,

$\vec{u}(\vec{r}, t, \vec{V})$, We consider the equation.

$$\frac{dn_1}{dt} = -(\vec{V}.\vec{u})N - u_x \frac{dN}{dY}$$

We obtain the perturbed density for

$$n_1(\vec{r}, t) = N_\kappa(\vec{V}) \sum_{-\infty}^{+\infty} J_n(\alpha) \sum_{-\infty}^{+\infty} J_l(\alpha) \frac{q}{m} [\{\phi_1 - \frac{V_\Pi K_\Pi}{\omega}(\phi_1 - \psi_1)\}\{\frac{K_\perp^2}{a_n^2} + \frac{\Omega^2 v_{de} K_\perp m}{\Lambda_n a_n^2 T_\perp}\}$$
$$+ \frac{K_\Pi^2}{\Lambda_n^2}\{\psi_1 - \frac{n}{\alpha} \frac{V_\perp K_\perp}{\omega}(\phi_1 - \psi_1)\}] Cos\xi_{nl} \quad (7)$$

Non resonant and resonant particles in the presence of the drift kinetic Alfven's wave as

$$n_1(\vec{r},t) = N_\kappa(\vec{V})\sum_{-\infty}^{+\infty} J_n(\alpha)\sum_{-\infty}^{+\infty} J_l(\alpha)\frac{q}{m}[\{\phi_1 - \frac{V_\Pi K_\Pi}{\omega}(\phi_1 - \psi_1)\}\{\frac{K_\perp^2}{a_n^2} + \frac{\Omega^2 v_{de} K_\perp m}{\Lambda_n a_n^2 T_\perp}\}Cos\xi_{nl}$$

$$+\frac{1}{2\Omega\Lambda_{n+1}}Cos(\xi_{nl} - \Lambda_{n+1}t)\left(K_\perp^2 - \frac{\Omega v_{de} K_\perp m}{T_\perp}\right) + \frac{v_{de} K_\perp m}{\Lambda_n T_\perp}Cos(\xi_{nl} - \Lambda_n t) \quad (8)$$

$$-\frac{1}{2\Omega\Lambda_{n+1}}Cos(\xi_{nl} - \Lambda_{n+1}t)\left(K_\perp^2 - \frac{\Omega v_{de} K_\perp m}{T_\perp}\right) + \frac{K_\Pi^2}{\Lambda_n^2}\{\psi_1 - \frac{n}{\alpha}\frac{V_\perp K_\perp}{\omega}(\phi_1 - \psi_1)\}$$

$$\{Cos\xi_{nl} + \Lambda_n t Sin(\xi_{nl} - \Lambda_n t) - Cos(\xi_{nl} - \Lambda_n t)\}]$$

Where v_{de} is the diamagnetic drift velocity which is defined by

$$v_{de} = \frac{T_{\perp e}}{m_e \Omega_e}\frac{1}{N}\frac{dN}{dY}$$

5. Dispersion Relation :

To evaluate the dispersion relation we calculate the integrated perturbed density for non-resonant particles as

$$\bar{n}_{i,e} = \int_0^\infty 2\pi V_\perp dV_\perp \int_{-\infty}^{+\infty} dV_\Pi n_1(r,t)$$

With the help of eqs.(5) and (8) we find the average densities for inhomogeneous plasma as

$$\bar{n}_i = -\frac{N_0 e}{m_i}\left[\frac{K_\Pi^2 \phi}{\Omega_i^2} + \frac{K_\Pi^2 \psi}{\omega^2} + \frac{v_{di} K_\perp m_i}{T_{\perp i}\omega}\right]\left(1 - \frac{1}{2}K_\perp^2 \rho_i^2\right)\left(\frac{2\kappa - 1}{2\kappa - 3}\right) \quad (9a)$$

$$\bar{n}_e = \frac{\omega_{pe}^2}{4\pi e V_{T\Pi ce}^2}\psi \quad (9b)$$

it is observed that essential feature of the drift Alfven wave is retained even in this ideal case.

For Maxwell's equation we use the quasi-neutrality condition.

$$\bar{n}_i \cong \bar{n}_e$$

We get the relation between ϕ and ψ as

$$\phi = -\frac{\Omega_i^2}{K_\perp^2}\left[\frac{\omega_{pe}^2}{\omega_{pi}^2 V^2{}_{T\Pi e} A_1} - \frac{K_\Pi^2}{\omega^2}\right]\left[1 - \frac{v_{di}\Omega_i^2 m_i}{T_{\perp i} K_\perp^2 \omega}\right]^{-1}\psi \tag{10}$$

Where $A_1 = 1 - \frac{1}{2}K_\perp^2\rho_i^2\left(\frac{2\kappa-1}{2\kappa-3}\right)$

Using perturbed ion, electron and dust particle densities n_i ,n_e and Ampere's law in the parallel direction,We obtained the equation

$$\frac{\partial}{\partial z}\nabla_\perp^2(\phi-\psi) = \frac{4\pi}{c^2}\frac{\partial}{\partial t}J_z \tag{11}$$

Where $$J_z = \int_0^\lambda ds\int_0^\infty 2\pi V_\perp dV_\perp \int_{-\infty}^{+\infty} dV_\Pi \frac{m_j}{2}[(N+n_1)(V+u)^2 - NV^2] \tag{12}$$

J_z is the current density which is contributed by first-order perturbations of density and velocity.

We obtain the dispersion for the drift kinetic Alfven's wave in inhomogeneous plasma as:

$$\frac{\omega^2}{k_\Pi^2\omega_{pi}^2}\frac{\omega_{pe}^2}{V_{T\Pi e}^2\left(1-\frac{1}{2}K_\perp^2\rho_i^2\right)\left(\frac{2\kappa-1}{2\kappa-3}\right)} \times \left(1 - \frac{\omega^2\left(1-\frac{1}{2}K_\perp^2\rho_i^2\right)\left(\frac{2\kappa-1}{2\kappa-3}\right)}{K_\Pi^2 V_A^2} \times \left(1 - \frac{V_{di}^2 K_\perp \Omega_i^2 m_i}{T_\perp K_\perp^2 \omega}\right)\right)$$

$$= \frac{K_\perp^2\omega^2}{K_\Pi^2\Omega_i^2} \times \left(1 - \frac{V_{di}K_\perp\Omega_i^2 m_i}{T_{\perp i}K_\perp^2\omega}\right) - \frac{\omega_{pi}^2\omega^2}{C_s^2\Omega_i^2 K_\Pi^2}\left(\frac{T_{\Pi i}}{m_i}\right)\left(\frac{\omega_{pe}^2}{\omega_{pi}^2 V_{T\Pi e}^2\left(1-\frac{1}{2}K_\perp^2\rho_i^2\right)\left(\frac{2\kappa-1}{2\kappa-3}\right)}\right)$$

$$-\frac{K_\Pi^2}{\omega^2} - \frac{V_{di}K_\perp m_i}{T_{\perp i}\omega}\left(1 - \frac{V_{di}K_\perp\Omega_i^2 m_i}{T_{\perp i}K_\perp^2\omega}\right)\cdot\left(1-\frac{1}{2}K_\perp^2\rho_i^2\right)\left(\frac{2\kappa-1}{2\kappa-3}\right)$$

Where-

$$C_s^2 = \frac{\omega_{pi}^2 V_{T\Pi e}^2}{\omega_{pe}^2} \tag{13}$$

6. Energy Balance and Growth rate :

The oscillatory motion of non-resonant electron carries the major part of energy

The wave energy density per unit wavelength W_w is the sum of pure field energy and the changes in energy of the non-resonant particles $W_{i,e}$ it is observed that the wave energy is contained in the form of the oscillatory motion of the non-resonant electron 66.69. Thus

$$W_w = \frac{\lambda K^2 \phi_1^2}{8\pi} + W_i + W_e + W_d \tag{14}$$

$$W_j = \int_0^{\lambda} ds \int_0^{\infty} 2\pi V_\perp dV_\perp \int_{-\infty}^{+\infty} dV_\Pi \frac{m_j}{2}[(N+n_1)(V+u)^2 - NV^2] \tag{15}$$

With the help of basic trajectories and

$$\vec{K}.\vec{s} = \vec{K}.\vec{r} \quad \lambda = \frac{2\pi}{K}. \qquad \text{And} \qquad \omega_{pi,e}^2 = \frac{4\pi N_{0j} q^2}{m_j}$$

Where j=i, e and d for respective species, We arrive at the results

$$W_i = \frac{\lambda K_\Pi^2}{16\pi}\frac{\omega_{pi}^2}{\omega^2}\left(1 - K_\perp^2\rho_i^2\right)\left(\frac{2\kappa-1}{2\kappa-3}\right)[\psi_1^2 - \frac{2K_\perp^2\phi_1\psi_1}{\Omega_1^2}\left(\frac{T_{\Pi i}}{m_i}\right) - \frac{2K_\perp^2\omega\psi_1}{\Omega_1^2}(\phi_1 - \psi_1)\left(\frac{T_{\Pi i}}{m_i}\right)$$

$$-\frac{6K_\Pi^2}{\omega^2}\left(\frac{T_{\Pi i}}{m_i}\right)\psi_1^2] \tag{16}$$

$$W_e = \frac{\lambda K_\Pi^2 \psi_1^2}{16\pi}\frac{\omega_{pe}^2}{K_\Pi^2}\left(\frac{T_{\Pi e}}{m_e}\right) \tag{17}$$

Now we calculate the resonance energy W_e of the electrons per unit wavelength, that is

$$W_r = \int_0^{\lambda} ds \int_0^{\infty} 2\pi V_\perp dV_\perp \int_{(\omega/K_\Pi)-\Delta V_\Pi}^{(\omega/K_\Pi)+\Delta V_\Pi} (\frac{1}{2} N m_e u_z^2 + n_1 m_e u_z V_\Pi) dV_\Pi \tag{18}$$

with the help of eqs.(3), (6), and (18) expanding the integrand around

$V_\Pi = \omega/K_\Pi$ and following the procedure as discussed in the limiting case of $K_\perp\rho_e << 1$ we obtain.

$$W_r = \pi^{1/2} \frac{\lambda K_\Pi^2 \psi_1^2 \omega_{pe}^2 \omega t (1 + \frac{-m_e\omega^2}{2T_{\Pi ce}K_\Pi^2})^{-(\kappa+1)}}{8\pi K_\Pi^2 (\frac{T_{\Pi ce}}{m_e}) V_{T\Pi ce}} \tag{19}$$

Using the law of conservation of energy, we calculate the growth rate of the drift kinetic Alfven wave by

$$\frac{d}{dt}(W_w + W_r) = 0 \qquad (20)$$

With the help of (14), (15) and (19) we have found the growth rate of the drift kinetic Alfven Wave as

$$\frac{\gamma}{\omega} = \frac{\omega}{K_\Pi V_{T\Pi e}} \frac{\Gamma\kappa}{\kappa^{1/2}\Gamma\kappa - 1/2}\left[\frac{T_{\Pi e}K_\perp V_{de}}{T_{\perp e}\omega} - 1\right] \times \left[1 + \frac{-m_e\omega^2}{2T_{\Pi e}K_\Pi^2}\right]^{-(\kappa+1)}$$

It is noted that the kinetic Alfven wave can be excited only when $\left(\frac{T_{\Pi e}}{T_{\perp e}}\right)K_\perp V_{de} > \omega$,Thus the kinetic Alfven wave is excited as the usual drift wave.

7. Growth length :

$$D = \frac{\partial\omega}{\partial K_\Pi} = V_g, \qquad \gamma_L = \frac{V_g}{\gamma},$$

Find the V_g

Then $$\gamma_L = \frac{\dfrac{-2\kappa_\Pi V_A^2\omega_{pi}^2 V_{\Pi ie}^2}{\omega_{pe}^2}}{\dfrac{\left[\dfrac{-1}{\left(1-\frac{1}{2}K_\perp^2\rho_i^2\right)}\left(\dfrac{2\kappa-1}{2\kappa-3}\right) - \dfrac{T_{\Pi i}}{m_i\Omega_i}\left(1-\frac{1}{2}K_\Pi^2\rho_i^2\right)\left(\dfrac{2\kappa-1}{2\kappa-3}\right) - \dfrac{K_\Pi^2 V_A^2\omega_{pi}^2 V_{T\Pi e}^2}{\omega_{pe}^2}\right]^{1/2}}{\gamma}}$$

Where V_g is the group velocity of the drift wave.

Here ,it is noticed that κ has affected the growth length for the drift kinetic Alfven wave propagating obliquely to the magnetic field.

8. Results and Discussion :

The following ionospheric plasma parameters have been used for the growth rate and dispersion relation

of the drift kinetic Alfven wave.

$\frac{1}{N}\frac{dN}{dY} = 10^{-5} m^{-1}$ $\kappa_{\Pi} = 5 \times 10^{-8} m^{-1}$

$\rho_i = 3m$ $T_e = 500^{\circ} K$ $\Omega_i = 160 s^{-1}$ $\Omega_e = 8.4 \times 10^{6} s^{-1}$

$V_{de} = 0.85 \times 10^{-2} \, m/s$

$V_{Ti} = 4.8 \times 10^{-2} \, m/s$ $V_{Te} = 1.2 \times 10^{5} \, m/s$ $K_{\perp} = 10^{-1} - 10^{-3} m^{-1}$

Figure -1 shows the variation of wave frequency ω(s^{-1}) versus wave vector K_{Π} (cm^{-1}) for different values of kappa distribution function (κ). It is observed that the increase in the value of wave vector K_{Π} (cm^{-1}) the frequency increases for different values of kappa (κ) and obtain maximum value of frequency $\omega(\sec^{-1})$ at K_{Π} =2 after that again on increasing the value of K_{Π} (cm^{-1}) frequency ω (sec^{-1}) decreases at K_{Π} =4 and again on increasing K_{Π} (cm^{-1}) we obtained straight line. It is also observed that a higher value of kappa reduces the frequency.

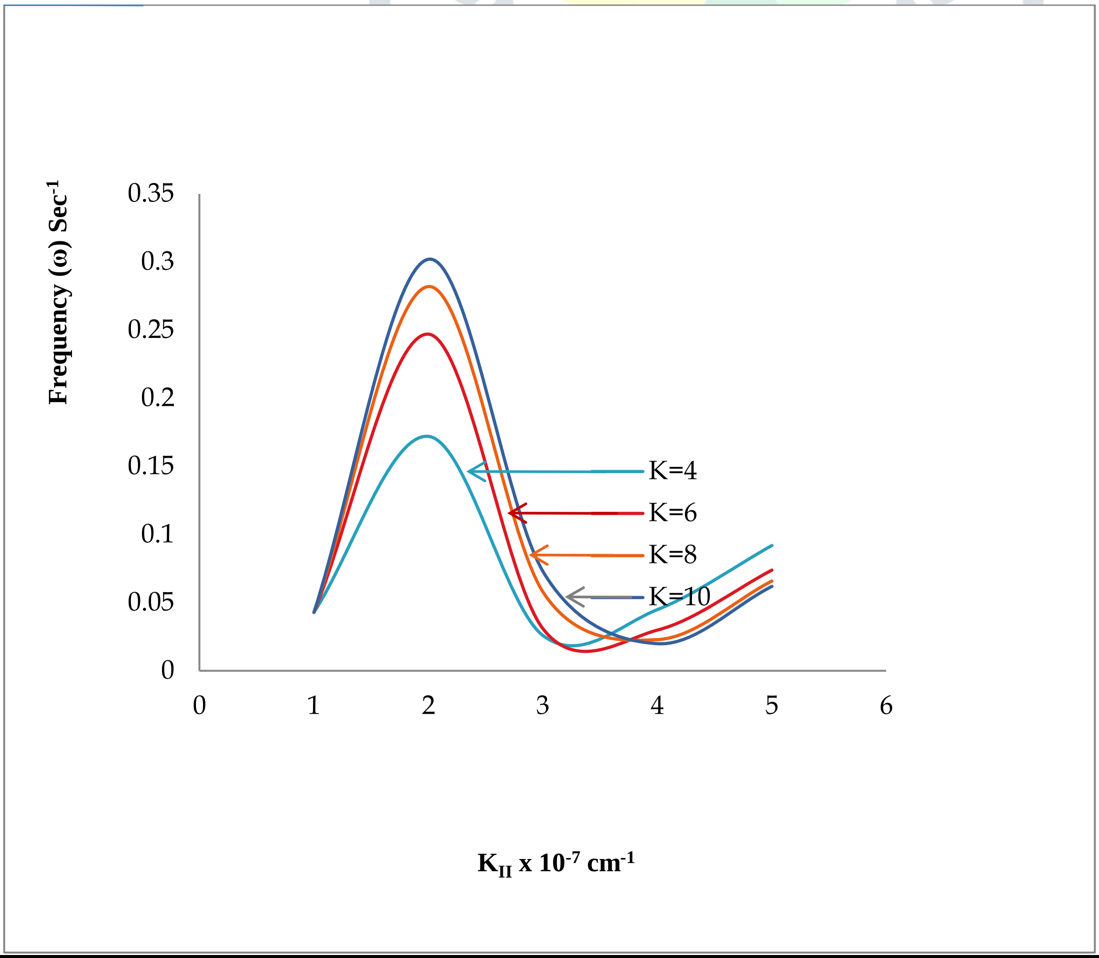

Fig. 1 The variation of real frequency (ω) sec^{-1} versus wave vector (K_{II}) cm^{-1} for different values of kappa distribution function (κ).

Figure -2 shows the variation of growth rate (γ) versus wave vector K_{Π} (cm^{-1}) for different values of kappa distribution function (κ) . It is observed that the increase in the value of wave vector K_{Π} (cm^{-1}) first growth rate (γ) increases and obtain maximum value of frequency K_{Π} =2 then on increasing the value of K_{Π}(cm^{-1}) growth rate decreases at K_{Π} =4 and then again on increasing K_{Π}(cm^{-1}) we obtained straight line. It is also observed that a higher value of kappa reduces growth rate.

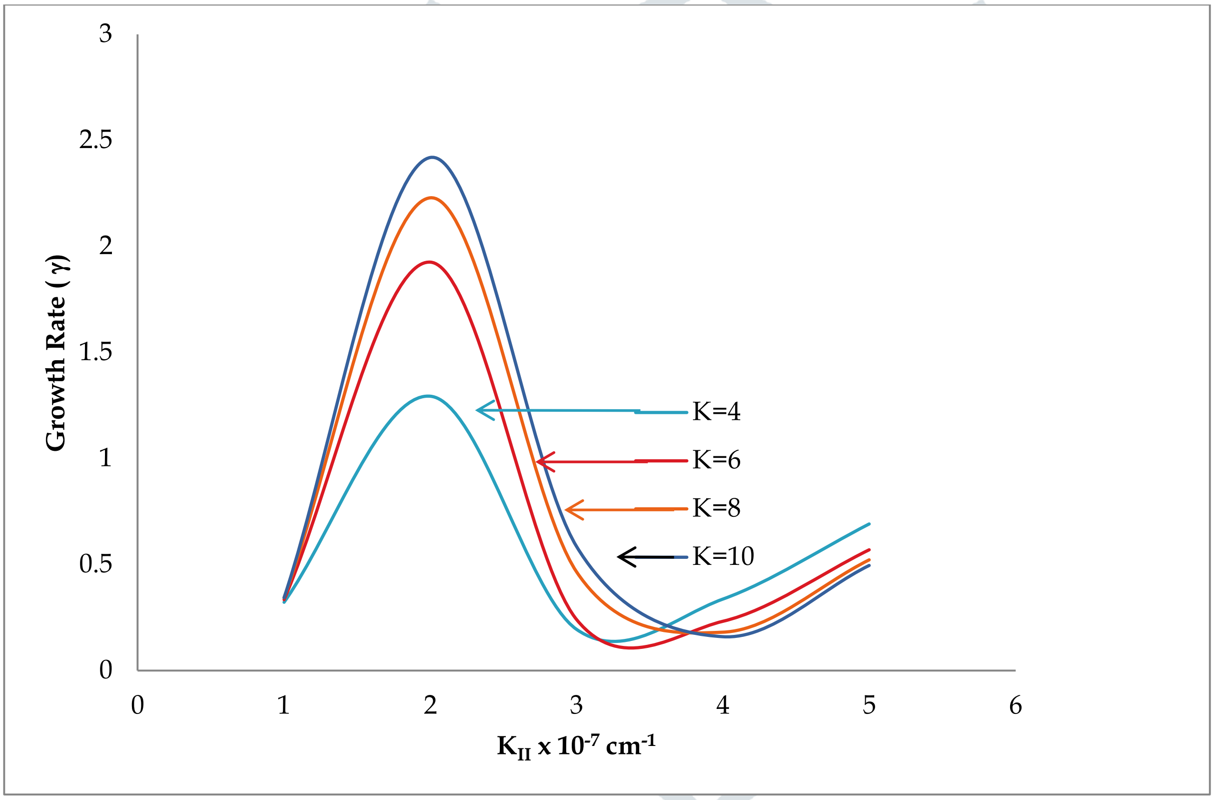

Fig. 2 The variation of growth/ damping rate (γ) versus wave vector (K_{II}) cm^{-1} for different values of kappa distribution function (κ).

Figure -3 shows that variation of growth length (R_E) versus wave vector K_{Π} (cm^{-1}) for different values of kappa distribution function (κ) for K_{Π} =4 the value of growth length is maximum between K_{Π}=3 to 5 for higher value of kappa growth length is maximum.

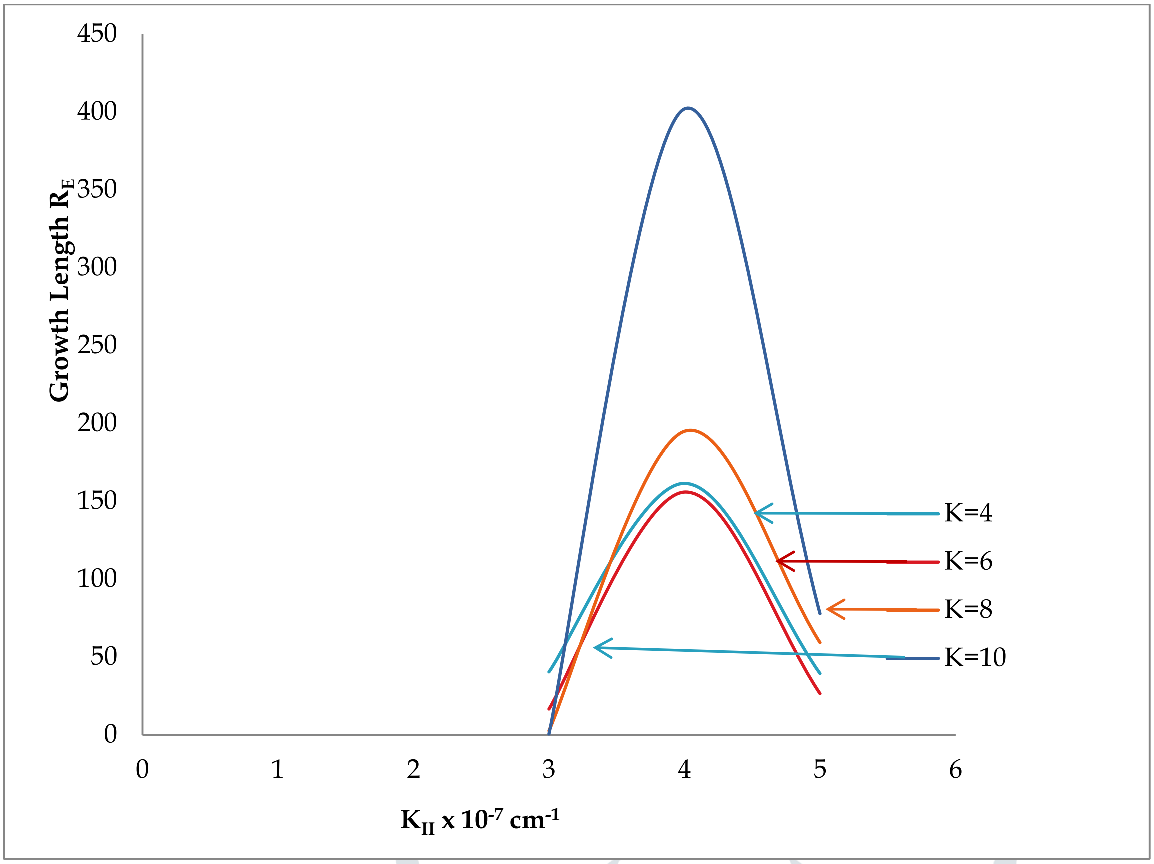

Fig. 3 The variation of growth length (γ_L) R_E versus wave vector (K_{II}) cm^{-1} for different values of kappa distribution function (κ).

Figure -4 shows the variation of growth rate (γ) versus wave vector K_{Π} (cm^{-1}) for different values of drift velocity V_{de} and kappa distribution function (κ). It is observed that the increase in the value of wave vector K_{Π}(cm^{-1}) first growth rate increases and become maximum at K_{Π} =2 then it get decreases and then we obtained straight line.

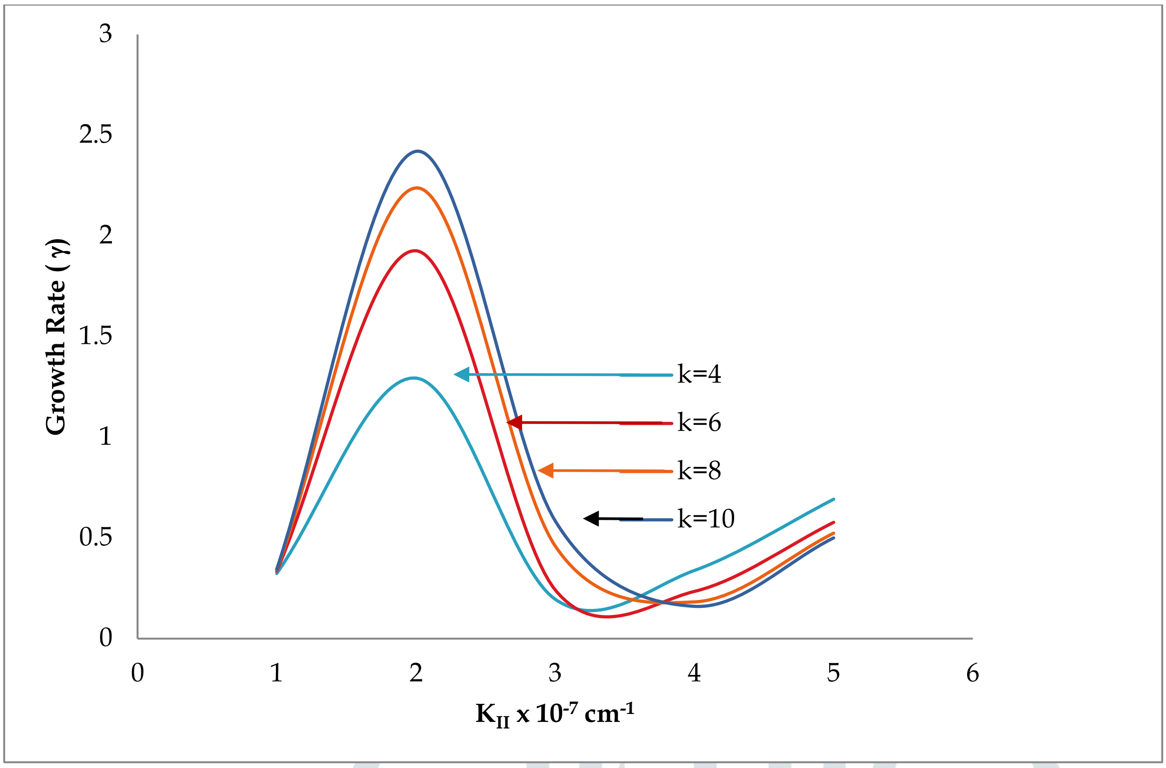

Fig. 4 The variation of growth/ damping rate (γ) versus wave vector (K_{II}) cm^{-1} for different values drift velocity V_{De} & κ.

Figure -5 shows the variation of growth length (γ_L) versus wave vector K_{Π} (cm^{-1}) for different values of drift velocity V_{de} and kappa distribution function (κ). It is observed that at the higher distribution function the growth length (γ_L) decreases at higher value of wave vector K_{Π} (cm^{-1}).

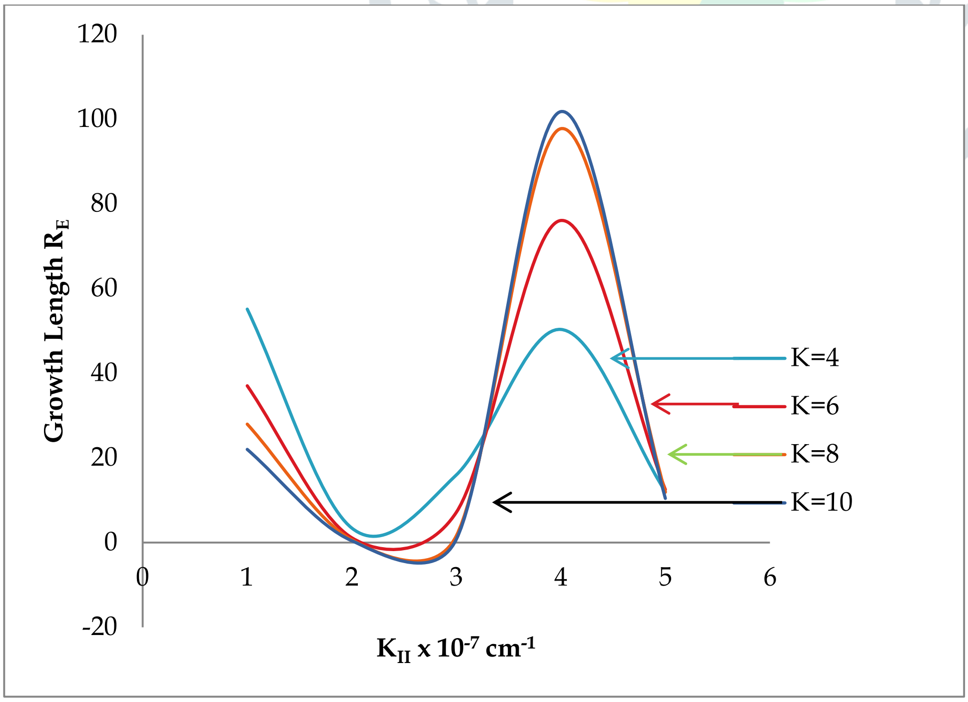

Fig. 5 The variation of growth length (γ_L) R_E versus wave vector (K_{II}) cm^{-1} for different values of drift velocity (V_{de})& kappa distribution function(κ).

1. SUMMARY

We have present work on drift kinetic Alfven waves with kappa distribution function. Particle aspect analysis is used to evaluate expression for dispersion relation. The theory of particle aspect analysis is extended to the drift wave in the presence of an inhomogeneous magnetic field, the dispersion relation and growth rate of the waves are calculated and analyzed when the magnetic field gradient is directed opposite to the density gradient. Again the particle aspect analysis are used to find growth rate and growth length of the drift kinetic Alfven waves in ionospheric region. Our purpose in this study is to be investigating the effect of kappa distribution function with temperature anisotropy on drift kinetic Alfven waves. The plasma under consideration is assumed to be anisotropy and the effects of temperature anisotropy on the dispersion relation and growth rate of the wave are also studied.

The dispersion relation and the growth rate are evaluated foe the space plasma parameters. It is observed that the growth rate and growth length is to increase with increase the wave vector for different values of kappa distribution function with temperature anisotropy. The growth rate and growth length of kinetic Alfven wave propagating in the inhomogeneous magnetospheric plasma. The effect of magnetic field inhomogeneity is examined in an anisotropy incorporating the effect of Larmor radius correction.

The result of the work are consistent for drift kinetic Alfven waves (DKAW's) are applicable of the magnetospheric and strophysical in ionospheric region. By using the gyrokinetic theory, the kinetic Alfven waves are discussed to underscore the drift effects through the density inhomogeneity and the temperature anisotropy on their dispersion relations. Inthis paper we have shown the mechanism of the drift Alfven wave instability on the temperature anisotropy is highlighted. The estimated of the growth rate and growth length are also discussed.

We have present work on drift kinetic Alfven waves with kappa distribution function. Particle aspect analysis is used to evaluate expression for dispersion relation, growth rate and growth length of the drift kinetic Alfven waves in ionospheric region. Our purpose in this study is to be investigating the effect of kappa distribution function with temperature anisotropy on drift kinetic Alfven waves. It is observed that the growth rate and growth length is to increase with increase the wave vector for different values of kappa distribution function with temperature anisotropy. The result of the work are consistent for drift kinetic Alfven waves (DKAW's) are applicable of the magnetospheric and astrophysical ionospheric region.

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