Abstract

The full kinetic dispersion relation for the Geodesic acoustic modes (GAMs) including diamagnetic effects due to inhomogeneous plasma density and temperature is derived by using the drift kinetic theory. The fluid model including the effects of ion parallel viscosity (pressure anisotropy) is also presented that allows to recover exactly the adiabatic index obtained in kinetic theory. We show that diamagnetic effects lead to the positive up-shift of the GAM frequency and appearance of the second (lower frequency) branch related to the drift frequency. The latter is a result of modification of the degenerate (zero frequency) zonal flow branch which acquires a finite frequency or becomes unstable in regions of high temperature gradients. By using the full electromagnetic drift kinetic equations for electrons and ions, the general dispersion relation for geodesic acoustic modes (GAMs) is derived incorporating the electromagnetic effects. It is shown that m=1 harmonic of the GAM mode has a finite electromagnetic component. The electromagnetic corrections appear for finite values of the radial wave numbers and modify the GAM frequency. The effects of plasma pressure β_e, the safety factor q and the temperature ratio τ on GAM dispersion are analyzed. Using the quantum hydrodynamical model of plasmas, the stability analysis of self-gravitational electrostatic drift waves for a streaming non-uniform quantum dusty magneto-plasma is presented. For two different frequency domains i.e., $\Omega_{0d} \ll \omega < \Omega_{0i}$ (unmagnetized dust) and $\omega \ll \Omega_{0d} < \Omega_{0i}$ (magnetized dust), we simplify the general dispersion relation for self-gravitational electrostatic drift waves which incorporates the effects of density inhomogeneity $\nabla n_{0\alpha}$, streaming velocity $v_{0\alpha}$ due to magnetic field inhomogeneity ∇B_0, Bohm potential and the Fermi degenerate pressure. For the unmagnetized case, the drift waves may become unstable under appropriate conditions giving rise to Jeans instability. The modified threshold condition is also determined for instability by using the intersection method for solving the cubic equation. We note that the inhomogeneity in magnetic field (equilibrium density) through streaming velocity (diamagnetic drift velocity) suppress the Jeans instability depending upon the characteristic scale length of these inhomogeneities. On the other hand, the dust-lower-hybrid wave and the quantum mechanical effects of electrons tend to reduce the growth rate as expected. A number of special cases are also discussed.