Bukhari, S.; **Khan, S. A.**; **Ali, S.**

Unstable twisted modes in interpenetrating space plasmas containing superthermal species. (English) Zbl 1476.85008

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Summary: The electrostatic twisted modes with orbital angular momentum and associated kinetic instability are studied in a permeating space plasma containing streaming particle species. The plasma containing superthermal electrons and ions is modeled by using a non-gyrotropic Kappa distribution function which penetrates through a relatively slow moving (static) plasma and gives rise to dispersion, damping and growth of ion-acoustic mode under various conditions. Using the Vlasov-Poisson model, the solutions of twisted modes are defined by Laguerre-Gaussian mode functions, which decompose the plasma distribution function and electric field into components characterized by the axial and azimuthal wave numbers. The dielectric constant is derived and analyzed for threshold condition of wave dispersion and instability in the presence of helical electric field with illustrations. The wave excitations due to penetration of solar wind into cometary clouds or interstellar electron-ion plasmas is examined.

MSC:

85A30 Hydrodynamic and hydromagnetic problems in astronomy and astrophysics
76E20 Stability and instability of geophysical and astrophysical flows
82D10 Statistical mechanics of plasmas
81R25 Spinor and twistor methods applied to problems in quantum theory
35Q83 Vlasov equations

Keywords:

instability; twist; orbital angular momentum; threshold

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