MHD WAVES AND INSTABILITIES IN ANISOTROPIC SOLAR WIND PLASMA

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16-moment transport equations (integrated relations derived from the Boltzmann-Vlasov kinetic equation) including the anisotropic MHD with thermal fluxes have been used to describe collisionless plasma in the solar corona and solar wind. Plasma waves and instabilities with anisotropic pressure along and across the magnetic field have been analyzed under this approximation, and the effects associated with the thermal fluxes have been studied. New compressible modes (thermal waves) as well as counterparts of the fast and slow MHD waves have been found and investigated in addition to the classical fire-hose modes, which do not change compared to the CGL approximation. It is established that in the presence of thermal fluxes, the phase velocities of all modes identified are asymmetric with respect to the direction of the ambient magnetic field; i.e., the waves propagate along and against the magnetic field with different velocities. At certain values of the plasma parameters, the modes interact with each other. A strong interaction takes place between the retrograde modes (propagating against the magnetic field). In the mode interaction region where the phase velocities of the waves coincide, an instability arises. Two types of instability – aperiodic and oscillatory - are possible. When resonant interaction of three retrograde modes (fast thermal, mirror, and slow thermal modes) occurs under the classical fire-hose conditions, a new type of instability arises. This instability has the maximum increment at oblique propagation, its value exceeding the maximum increment of the classical fire-hose instability. Unlike the latter, this instability is due to compressible plasma disturbances. Perturbations of pressure in the found modes have been evaluated. The results obtained are important to the description of wave processes in the solar corona and solar wind.

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