LANDAU-FLUID DESCRIPTION OF MHD WAVES AND MIRROR MODES IN COLLISIONLESS PLASMAS

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Landau fluid models, obtained by closing the hydrodynamic hierarchy in a way consistent with the linear kinetic theory taken in the large-scale limit, accurately reproduce the dispersion relation of the various MHD waves and correctly describe their modulational or parametric instabilities, together with their weakly nonlinear dynamics. The threshold and growth rate of the large-scale mirror instability that develops in environments with high $\beta_\perp$ and strong proton temperature anisotropy, are also well captured. Nevertheless, the increase of the maximal growth rate with the transverse wave number up to scales comparable with the ion Larmor radius, indicates that these scales are to be retained to ensure a well-posed formulation in the nonlinear regime. We thus developed a generalized Landau fluid model including small-scale finite Larmor radius corrections, that accurately reproduces the predictions of the linear kinetic theory for the dynamics of quasi-transverse low-frequency waves, including the small-scale quenching of the mirror mode instability. This model should provide an efficient description of nonlinear mirror mode dynamics, at least near threshold. Preliminary results concerning the existence of stationary mirror mode structures, based on a generalized equation of state for the quasi-static regime, will be presented.