§22. Parameter Dependence of Two-fluid and Finite Larmor Radius Effects on Rayleigh-Taylor and Kelvin-Helmholtz Instabilities in Finite Beta Plasmas

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The parameter dependence of Rayleigh-Taylor (RT) and Kelvin-Helmholtz (KH) instabilities in an extended MHD model for finite beta plasmas was examined. The extended MHD model includes effects of two-fluid (TF) and finite Larmor radius (FLR). These diamagnetic effects modify both real frequency and growth rate of the modes. Figures 1 and 2 are results of local analysis of the RT instability. They were found by solving local dispersion relation obtained by assuming large wavenumber k. Figure 1 shows the growth rates as functions of the wavenumber for different beta values for the cases with TF effects (upper panel) and with both TF and FLR effects (lower panel). In both cases the complete stabilization disappears when the beta value is increased. However, the growth rate is smaller[1] and the critical beta value is larger for Figure 2 shows real frequency (upper panel) and growth rate (lower panel) as functions of the wavenumber for different MHD models. The real frequency appears when TF and/or FLR effects are included, but the wavenumber dependences for the three cases with diamagnetic effects are quite different. The growth rate is decreased for the three cases but it is not completely stabilized when only TF effects are included. This analysis also provided parameter sets for nonlinear extended MHD simulation. For the parameter set of Fig. 2, real frequency due to diamagnetic effects and growth rates are comparable so that they can be also studied in nonlinear simulation[2]. The eigenmode analysis for RT and KH instability were also carried out and the results agreed well with simulation results for long wavelength modes.

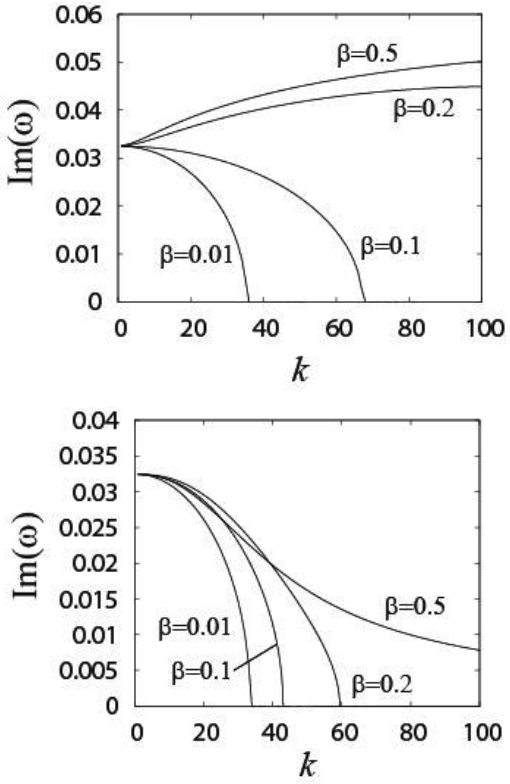

Fig. 1. Dependence of the growth rates of RT mode on the wavenumber for different beta values.

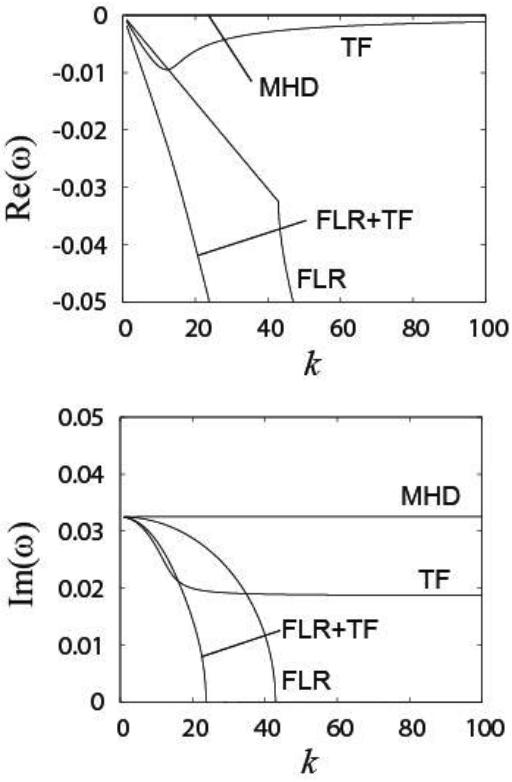

Fig.2. Dependence of the growth rates of RT mode on the wavenumber for different fluid models.

1) R. Goto, H. Miura, A. Ito, M. Sato and T. Hatori, Plasma and Fusion Res. **9**, 1403076 (2014).
2) R. Goto, H. Miura, A. Ito, M. Sato and T. Hatori, Phys. Plasmas **22**, 032115 (2015).