Flow shear driven instability in relativistic EMHD regime

Sita Sundar[1]

[1] *SoVSAS, Gautam Buddha University, India*

Velocity shear driven instability is ubiquitous in nature as well as laboratories. Flow shear driven instability in relativistic electron-magnetohydrodynamic (EMHD) regime is of utmost importance for fast-ignition scenarios.

At fast time scales, this velocity shear driven Kelvin-Helmholtz (KH) like instability has been investigated for non- relativistic electron fluids in past in considerable detail with the help of Electron Magneto hydrodynamic (EMHD) model.

The present talk provides a simple generalization of the EMHD model to relativistic regime in 2-D. Even in the relativistic regime by confining to phenomena occurring at time scales slower than the plasma period the density perturbations can be neglected. This leads to a simplified incompressible relativistic fluid model for electron motion in 2-D. It is observed that the usual normal KH like unstable mode gets modified due to the shear in the relativistic mass factor associated with the equilibrium velocity flow. Shear in the relativistic mass factor also leads to new modes in the shear driven EMHD system and considerably wider unstable domain of the wave-number space.

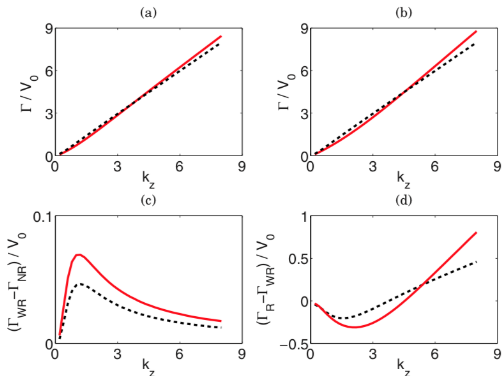

Figure 1: *Figure shows the plot of various limiting forms of the growth rates for a step velocity shear profile. Subplot (a) shows for* $V_0 = 0.8$ *the relativistic growth rate* Γ_R/V_0 *for* $\mathscr{A} = 1$ *(solid line) as a function of kz. The dashed line represents the nonrelativistic* γ_{NR}/V_0 *and also the relativistic growth rate* Γ_{WR}/V_0 *evaluated for* $A = 0$*. Subplot (b) is similar to (a) but here* $V_0 = 0.9$*. Subplot (c) shows the plot of* $(\Gamma_{WR}\Gamma_{NR})/V_0$ *as a function of* k_z *for* $V_0 = 0.8$ *(dashed line) and* $V_0 = 0.9$ *(solid line). Subplot (d) is for* $(\Gamma_R - \Gamma_{WR})/V_0$ *as a function of* k_z *for* $V_0 = 0.8$ *(dashed line) and* $V_0 = 0.9$ *(solid line).*

References

[1] S. Sundar and A. Das, Physics of Plasmas **17**, 022101 (2010)

[2] S. Sundar, A. Das and P. Kaw, Physics of Plasmas **19**, 052105 (2012)