Exclusive nature of ion temperature gradient mode and parallel velocity gradient mode

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When ion thermal Internal Transport Barrier (ITB) is obtained, a significant amount of co-current parallel flow can be generated by flux-driven Ion Temperature Gradient (ITG) driven turbulence [1]. In this literature, this flow has a radial gradient and the Momentum Transport Event (MTE) driven by this parallel shear flow can be the onset of back transition. This implies that ITG mode and Parallel Velocity Gradient (PVG) driven mode can be dominant separately over each other in some situation. In addition, it is already reported that the radial correlation length of fluctuations inside ITB is short corresponding to $k_r \rho_i \sim O(1)$. Since these literatures imply it is this small scaled PVG mode that could drive MTE, it is necessary to consider its stability.

In this study, we used a simplified set of fluid equations. Then, we obtained the region where ITG mode and PVG mode can be dominant separately as shown below. MTE shall be occured when PVG mode can be destabilized. In this vein, we calculated the quasilinear flux in PVG-dominant region to get its basic transport charcteristics clear. We found PVG mode can not convey particles but momentum even in a collisional situation [2].

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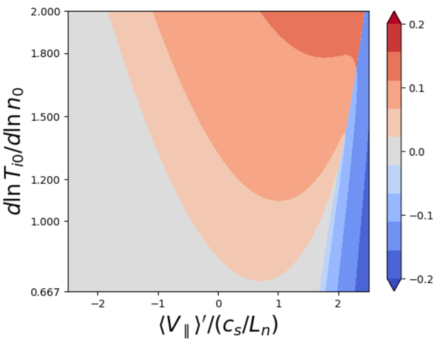
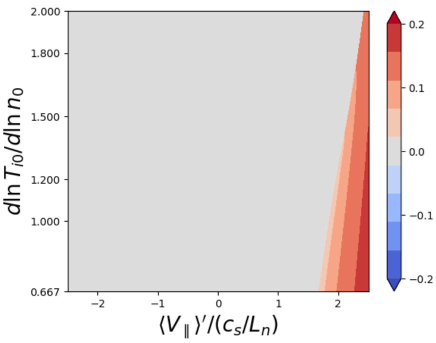


(a) ITG-dominant region. Here $T_e \sim T_i$ is assumed.



(b) PVG-dominant region. Here $T_e \sim T_i$ is assumed.

References

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