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Global gyrokinetic simulation of the ITG mode in the ion Internal Transport Barrier with weak central magnetic shear

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Global gyrokinetic (GK) simulation has been an important way to understand the internal transport barrier (ITB) physics [1, 2]. Recently, the global gyrokinetic code NLT (Non-Linear Turbulence) has been developed to include the magnetic axis [3], which enables us to carry out the global GK simulation near the magnetic axis.

The characteristics of ion temperature gradient (ITG) mode near the magnetic axis is investigated by using NLT for the ion ITB with weak central magnetic shear. Linear stability analyses show that the only stabilizing effect of the mean flow can stabilize the ITG modes in the weak ion ITB region with weak central magnetic shear. However, both stabilizing effects of mean flow and ion-electron ratio (τ_i) need to be included in the global GK simulation to strongly decrease the linear growth rates of all ITG modes in the strong ITB region. Moreover, the change from weak to strong central magnetic shear [4] results in larger linear growth rates of ITG modes, regardless of whether there is the mean flow effect or the τ_i effect.

Mode structure analyses show two typical kinds of ITG modes in the weak magnetic shear region. One is located at the rational surface, consisting of three harmonics. The other is located at the midway between a pair of rational surfaces [5], consisting of two harmonics. Significant eigenvalue variations are observed during the transition between these two kinds of ITG modes.

References
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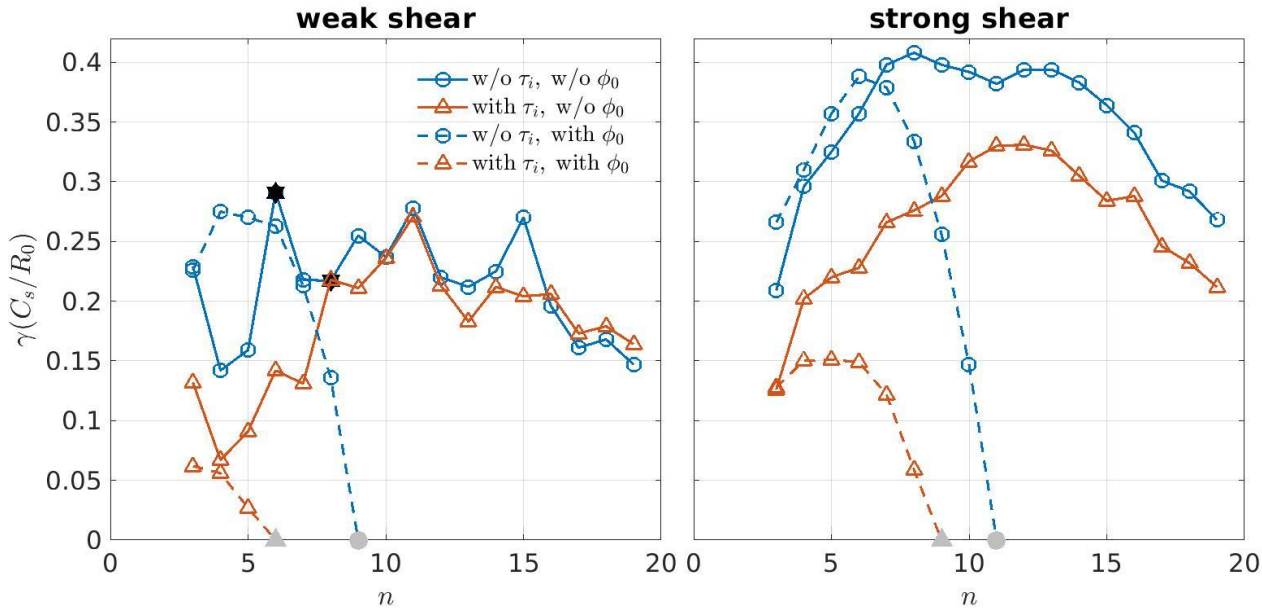

Figure 1. Linear growth rates of ITG modes in weak and strong magnetic shear region.