Perturbative radiative damping of RSAEs in NOVA-K code

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Abstract

Several independent simulations were bechmarked to understand the fast-ion driven plasma transport due to Alfvénic eigenmodes in the linear regimes [Taimourzadeh et al., Nucl. Fusion (2019) submitted]. The total growth rates of the Reversed Shear Alfvén Eigenmodes (RSAE) show reasonable agreement between the gyrokinetic codes and NOVA-K at low to medium toroidal mode mumbers, $n = 2 - 4$. But they start to deviate from NOVA-K code results at $n > 4$. There are two damping mechanisms neglected by NOVA-K in those simulation, which are radiative damping and continuum dampings. In this presentation we focus on the radiative damping, which is one of the most important damping mechanisms for present day tokamaks (such as DIII-D) and future burning plasmas.

We develop a new module for NOVA-K code to compute the radative damping of RSAEs in NOVAK code. The results show that the radiative damping can not significantly reduce the total growth rate of the RSAE mode in NOVAK. Fast particles contribute to the total radiative damping at the same level as thermal particles due to their large groradius and high pressure which is comparable to the thermal ion pressure.

We note that the ignored continuum damping could be important for the balance of the total growth rate and need to investigated further.