MF-O15

1st Asia-Pacific Conference on Plasma Physics, 18-23, 09.2017, Chengdu, China

Effect of anisotropic thermal transport on the resistive plasma response to resonant magnetic perturbation field

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Plasma response to the resonant magnetic perturbation (RMP) field is numerically investigated by an extended toroidal fluid model, which includes anisotropic thermal transport physics parallel and perpendicular to the total magnetic field.
The thermal transport is found to be effective in eliminating the toroidal average curvature induced plasma screening (the so called Glasser-Green-Johnson, GGJ screening) at slow toroidal flow regime, whilst having minor effect on modifying the conventional plasma screening regimes at faster flow. This physics effect of interaction between thermal transport and GGJ screening is attributed to the modification of the radial structure of the shielding current, resulted from the plasma response to the applied field. The modification of the plasma response (shielding current, response field, plasma displacement and the perturbed velocity) also has direct consequence on the toroidal torques produced by RMP. Modelling results show that thermal transport reduces the resonant electromagnetic torque as well as the torque associated with the Reynolds stress, but enhances the neoclassical toroidal viscous torque at slow plasma flow.

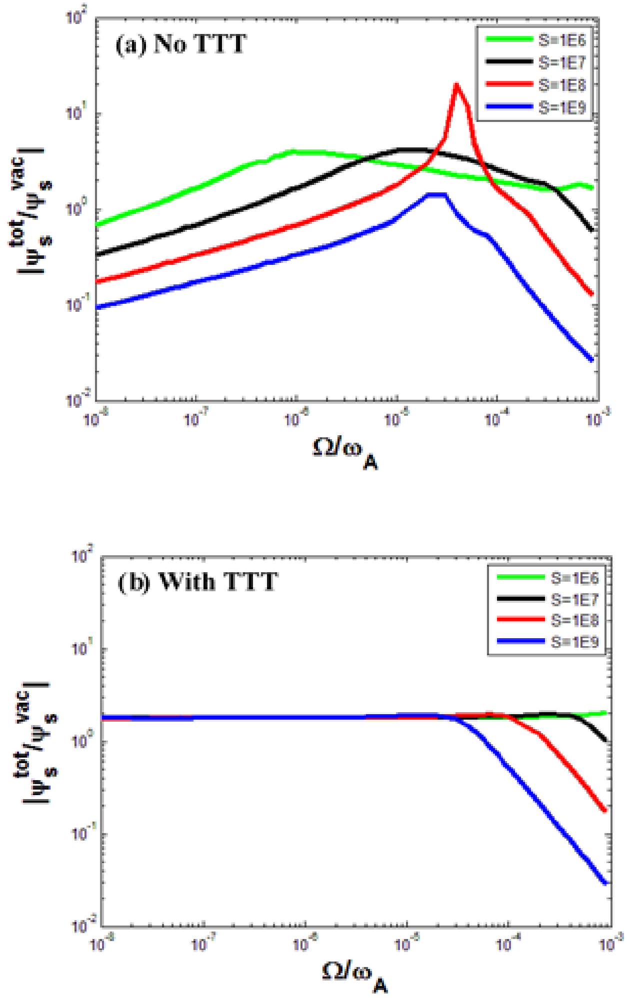

Fig.1 Comparison of the computed plasma response amplitude for the *m/n*=2/1 resonant harmonic of the flux associated with the perturbed radial magnetic field, with (a) or without (b) the thermal transport terms (TTT). The normalized thermal transport coefficients in (b) is assumed to be $\chi_\perp = 10^{-2}, \chi_\parallel = 10^5$. Ω is the toroidal rotation frequency of the plasma at the *q*=2 surafce. *S* is the Lundquist number.

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