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# P4.1059 Modelling of neoclassical toroidal viscosity from internal MHD modes in ASDEX-Upgrade

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Corrugations of tokamak magnetic flux surfaces in the location of a kink mode and/or around the islands created by a tearing mode introduce in combination with toroidal magnetic field inhomogeneity 3D modulations of magnetic field strength within the perturbed flux surfaces and, respectively, give rise to non-ambipolar neoclassical transport [1]. This transport polarizes the plasma changing its rotation, i.e. effectively causing the neoclassical toroidal viscous (NTV) torque onto it. Generally, NTV torque is a strong function of toroidal plasma rotation frequency with respect to the reference frame where perturbations are (quasi) static. Due to the summary toroidal momentum conservation of plasma and electromagnetic field, any torque onto the plasma from the internal modes, which do not interact with plasma exterior, comes from electromagnetic momentum change of the modes. Since this momentum is very small, the condition of zero torque determines mode eigenfrequency. In this work, the typical situation of coupled (3,2) tearing and (2,2) kink modes in ASDEX Upgrade (AUG) is modelled with help of the code NEO-2 [2, 3] for realistic equilibrium field and plasma parameters with perturbation field described in terms of radial flux surface displacement fitted to experimental observations. For mode amplitudes typical for AUG, values of NTV torque are of the order of a few Nm what is comparable with typical NBI torque values. Mainly, NTV torque is due to non-ambipolar transport of ions interacting with the perturbation field in the collisionless regime of bounce resonances, what is similar to Ref. [3]. Besides the effects of this transport on mode and plasma rotation, its implications for the impurity transport and other mechanisms of momentum transfer between plasma and perturbation field are also discussed.

References

[1] K.C. Shaing, Phys. Rev. Letters 87, 245003 (2001) [2] S.V. Kasilov, W. Kernbichler, A.F. Martitsch, et al, Phys. Plasmas 21, 092506 (2014) [3] A.F. Martitsch, S.V. Kasilov, W. Kernbichler, et al, Plasma Phys. Contr. Fusion 58, 074007 (2016)

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