Contribution ID: **3477** Type: **not specified**

P4.1101 Simulation study of a net toroidal torque generation by suprathermal electrons of ECH in non-axisymmetric tokamak plasmas

Thursday, 11 July 2019 14:00 (2 hours)

See the full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P4.1101.pdf

Spontaneous toroidal flows have been observed during ECH without direct momentum input in tokamak and helical plasmas[1-3]. We have studied the j × B toroidal torque due to radial diffusion of suprathermal electrons during ECH in LHD applying GNET code[4]. It is found that the j × B torque related to the suprathermal electrons plays an important role in the toroidal flow generation in the LHD plasma[5]. On the other hand, in axisymmetric tokamaks, it is well known that this j × B torque and the collisional torque by the precession motion of suprathermal electron would cancel each other, and no net toroidal torque is generated. However, in the real tokamaks, there exists finite non-axisymmetric magnetic field; such as the toroidal field ripple, magnetic resonance perturbation, RMP, etc., and these nonaxisymmetric magnetic fields would generate the net toroidal torque.
In this study, we investigate the j × B and the collisional torques due to suprathermal electrons by ECH in the non-axisymmetric tokamaks (finite toroidal field ripples and RMP). To evaluate the toroidal torques, we apply the GNET code, which can solve the 5D drift kinetic equation for suprathermal electrons[4]. We assume a simple tokamak A=6.7 (LHD size) and add a toroidal field ripple as B = B_axisym + B_0,18 cos(18 ϕ) and the RMP (m, n = ±3) as B = B_axisym + B_m,±3 cos(mθ ± 3ϕ). We have found that the JxB torque is larger than that of collisional torque due to the radial motion of ripple trapped electrons, and have obtain significant net toroidal torques by ECH. The peak value of torques gradually increases as the nonaxisymmetric component increases. A simple model of the radial flux of suprathermal electrons has been derived and has shown relatively good agreements with the simulation results.

[1] M. Yoshida, et al., Phys. Rev. Lett. 103, 065003 (2009)
[2] J. S. deGrassie, et al., Phys. Plasmas 14, 056115 (2007)
[3] S. T. A. Kumar, et al., Plasma Phys. Control. Fusion 60 054012 (2018)
[4] S. Murakami, et al., Nuclear Fusion 40, 693 (2000)
[5] Y. Yamamoto, et al., Int. Stellarator-Heliotron Workshop, Kyoto P1-43 (2017)

Presenter: MURAKAMI, S. (EPS 2019)

Session Classification: Poster P4

Track Classification: MCF