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Heliotron J における電子内部輸送障壁形成に対する磁場の回転変換分布の影響

Effect of Rotational Transform Profile of Magnetic Field on Electron Internal Transport Barrier Formation in Heliotron J

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The electron internal transport barrier (eITB) has been observed widely in helical devices such as CHS, LHD, TJ-II, and W7-AS, and it is also observed in Heliotron J [1]. In helical plasmas, the eITB can be formed by generation of the positive radial electric field with centrally focused electron cyclotron resonance heating. The radial electric is known to be formed due to electron-root transition which is deeply related to the neoclassical transport with helical ripple. Because the internal transport barrier has also been established in reversed shear Tokamak plasmas, the physical mechanism of the barrier formation could be associated with the magnetic field configuration. Therefore, the role of the magnetic structure to form the eITB in the helical plasma is essential.

In the previous experiments, a low-order rational surface effect on the eITB formation was investigated in Heliotron J. We have obtained the two experimental results. The first result is that the correlated behaviors of the eITB foot point and the low-order rational surface location are observed. The former shows a jump at $I_p \sim 0.7kA$ and a subsequent outward shift by the current increase.

The second result is that the power threshold for the eTIB formation is reduced from $265 \times 10^{-19} kWm^3$ to $240 \times 10^{-19} kWm3$ when the plasma current increases above $I_p \sim 0.9kA$ (Fig.1). Because the plasma current of 0.9 kA is almost the same as the calculated value that is required to form 4/7 rational surface, it can be explained that the threshold reduction has occurred due to the formation of the 4/7 rational surface or the magnetic island. The similar mechanism that the magnetic island affects the plasma transport has also been observed in numerical simulation [2]. In this paper, we discuss the role of a rational surface of the magnetic field structure to form the eITB in helical plasmas.

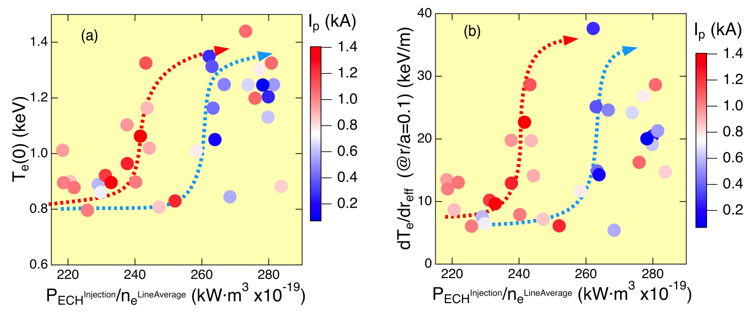

Fig 1: (a)$T_e(0)$, and (b)dT_e/dr_{eff}@ barrier location as a function of injected power divided by density. Increase has accordance with eITB formation.

[1] N. Kenmochi, T. Minami, et al., Plasma Phys. Control. Fusion **59** (2017) 055013.
[2] A. Ishizawa, N. Nakajima, Nucl. Fusion **49** (2009) 055015