Influence of toroidal rotation on magnetic islands in tokamaks

Huishan Cai[1], Jintao Cao[2],

[1]*University of Science and Technology of China*

[2]*Institute of Physics, CAS*

Corresponding email:hscai@mail.ustc.edu.cn

The dynamics of magnetic islands including toroidal rotation in tokamaks is studied. It is found that the contribution of toroidal rotation to the dynamics of magnetic islands is mainly through the coupling of magnetic curvature with pressure and density. In the presence of toroidal rotation, pressure and density are poloidal asymmetric. Then, their coupling with magnetic curvature provides a perpendicular current, and a corresponding return parallel current is induced to affect the dynamics of magnetic islands. It is found that the effect of toroidal rotation depends on its magnitude, rather than the shear. It also depends on the relative magnitude of the island propagation frequency to sound frequency. When the Mach number is large enough, the effect of toroidal rotation is stabilizing and dramatic, and overcomes the contribution of polarization current, namely the onset threshold of NTMs increases. Further, it is also suggested that the toroidal rotation plays an important role in the stability of small scale magnetic islands.

References

[1] Huishan Cai, Jintao Cao, Nucl. Fusion 57, 056006(2017)
[2] Huishan Cai, Jintao Cao, Nucl. Fusion 58, 036008(2018)