

## Effect of the long-lived mode on the formation of ion internal transport barrier in HL-2A tokamak

Linge Zang, Xiaoxue He, Aiping Sun, Min Jiang, Wei Deng, Dong Li, Yufan Qu, Yuan Luo  
Center for Fusion, Southwestern Institute of Physics  
e-mail: zanglinge@swip.ac.cn

Recent experiment results show that there are close relation between MHD modes and internal transport barrier (ITB). In Heliotron J, the emergence of a magnetic island causes immediate reformation of eITB [1]. In HL-2A, the internal kink modes control the form of iITB[2], and fishbone could increase the gradient of ITB[3]. In EAST, ITB formation always appears after the fishbone instability [4]. In simulation work, a radial electric field can be generated by the fishbone itself, which may act as trigger for ITB formation [5].

In HL-2A tokamak, the long-lived mode (LLM) is an  $m/n=1/1$  internal kink mode,  $m$  and  $n$  standing for the poloidal and toroidal mode number, respectively. An LLM is a saturated, steady coherent mode [6]. LLM appears as an alternative to fishbone, which usually emerges intermittently and sweeping down its frequency. In Figure 1, the emergence of LLM significantly changes the time evolution of ion temperature during 840 - 890 ms: the core channel slows down its increasing, and the middle channels drops. The ion temperature difference between the core and the middle channels dramatically increases. This suggests a transport barriers forms in this duration. The time evolution of the ion thermal diffusivity is under analysis with ONETWO code. Detailed results will be presented in the conference.

### References

- [1] Kenmochi N et al, Sci. Rep. 10 5 (2020)
- [2] He X X et al, Plasma Phys. Control. Fusion 64 015007 (2022)
- [3] Deng W et al, Phys. Plasmas 29, 102106 (2022)
- [4] Liu Z X et al, Nucl. Fusion 60 122001 (2020)
- [5] Ge W L et al, Nucl. Fusion 63 016007 (2023)
- [6] Deng W et al, Nucl. Fusion 54, 013010 (2014).

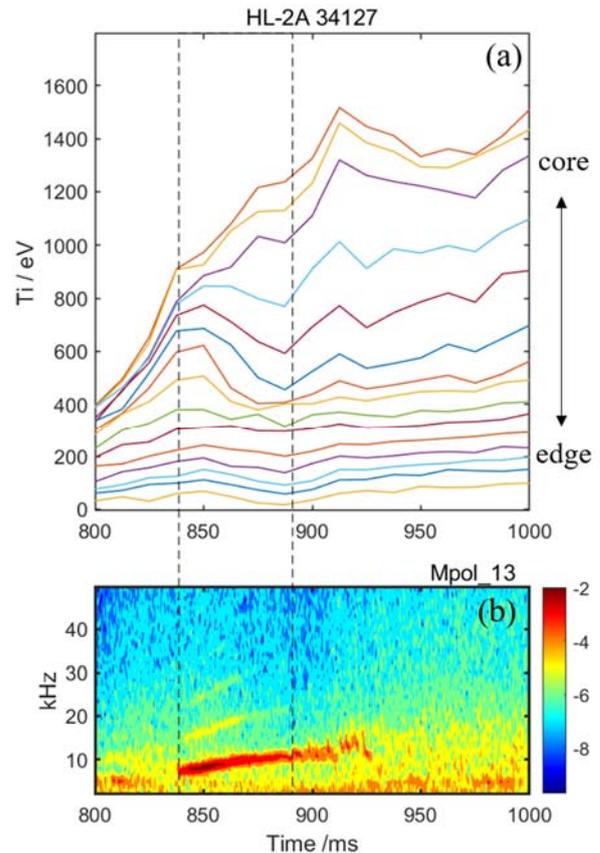


Figure 1. (a) Time evolution of the ion temperature from core to edge. (b) Time evolution of LLM on mirnov coil signal.