

## Impact of impurities on drift wave instabilities in reversed-field pinch plasmas

Jingchun Li<sup>1</sup>, S.F. Liu<sup>2</sup>, Y.L. Zhang<sup>2</sup>, Jiaqi Dong<sup>3</sup>, W. Kong<sup>4</sup> and P. Shi<sup>5</sup>

<sup>1</sup> *Department of Earth and Space Sciences, Southern University of Science and Technology, Shenzhen 518000, China*

<sup>2</sup> *School of Physics, Nankai University, Tianjin 300071, People's Republic of China*

<sup>3</sup> *ENN Science and Technology Development Co., Ltd., Langfang 065001, China*

<sup>4</sup> *College of Science, Civil Aviation University of China, Tianjin 300300, People's Republic of China*

<sup>5</sup> *United Kingdom Atomic Energy Authority, Culham Centre for Fusion Energy, Culham Science Centre, Abingdon, Oxon OX14 3DB, United Kingdom*

The drift wave in the presence of impurity ions was investigated numerically in reversed-field pinch (RFP) plasmas, using the gyrokinetic integral eigenmode equation. By comparing the results of regular and hollow plasma density profiles, it was found that the ITG mode for the hollow density profile case is much harder to excite. For the impurity effects, when the impurity density gradient is opposite to the primary ions, namely when  $L_{ez}$  is negative, the impurities can enhance the instability. On the contrary, when  $L_{ez}$  is positive, the instability is stabilized. Regarding the trapped electron mode (TEM), the growth rate for plasmas with a hollow density profile remains smaller than that of the standard density gradient. There exists a threshold in  $L_{ez}$ . When  $L_{ez}$  is less than this value, the impurities destabilize the TEMs, while when  $L_{ez}$  is greater than this value, the impurities stabilize the TEMs. In addition, the influence of the collisionality on the TEMs was also studied.

### References

- [1] C. Angioni, et al., 2017 *Nuclear Fusion* **57** 116053.
- [2] S. F. Liu, et al., 2014 *Nuclear Fusion* **54** 043006.

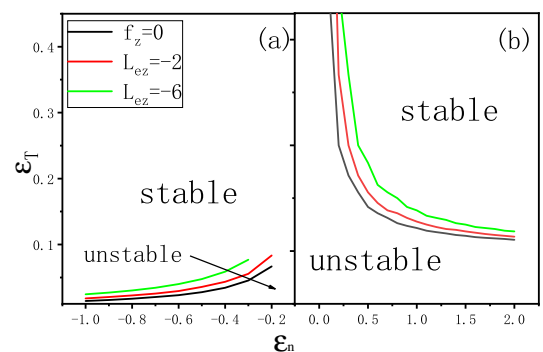


Figure 1: Thresholds for ITG in the ion temperature gradient ( $\epsilon_T = L_T/R$ ) and density gradient ( $\epsilon_n = L_n/R$ ) plane in pure and mixture plasmas with hollow (a) and normal (b) density profile.