The magnetic coherent mode driven by thermal gradient with trapped electron bounce resonance in tokamak plasmas

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To be compatible with high confinement performance and low collisionality of plasma with strong heating power, a Magnetic Coherent Mode (MCM) with toroidal mode number about 1 and characteristic frequency about 20–60 kHz appears spontaneously in the H-mode pedestal of the EAST tokamak, which has distinct capacity to regulate the deposition intensity of boundary particle flux on the divertor target. The experimental results on EAST show that the frequency of MCM is close to the kinetic resonance frequency of the trapped thermal electrons, which exhibits an Alfvénic scaling on plasma parameters but has no dependence on energetic particles. In order to understand the driving mechanism of MCM, the drift kinetic resonance between MCM and the thermal particles is applied to analyze pedestal instability and the energy channel via the resonance. Different from the excitation mechanism of high-energy particles, kinetic analysis shows that the free energy provided by the pressure-gradient of pedestal cooperating with the trapped electron resonance is able to excite the magnetic perturbation with Alfvénic properties. This work could provide a certain identification and demonstration of the pressure-gradient-driven Alfvénic mode by thermal resonance, which may broaden the horizon of interaction between plasma wave and particles.

References

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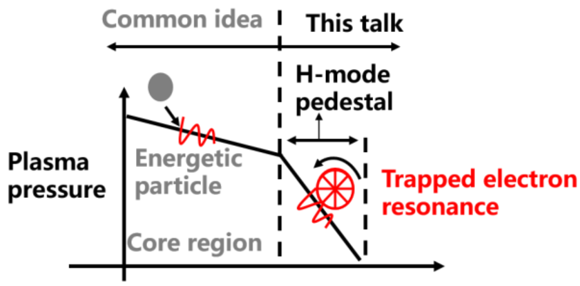

Figure 1. Schematic diagram of Alfven eigenmode driven by trapped thermionic resonance with free energy provided by pressure gradient in the pedestal region