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The investigation of QCM on EAST using DR diagnostics

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A low frequency electrostatic Quasi Coherent Mode (QCM) with frequency around 5-80kHz has been investigated by Doppler Reflectometry (DR) on Experimental Advanced Superconducting Tokamak (EAST) H-mode operation. QCM is a kind of instability, which is relevant to Dissipative Trapped Electron Mode (DTEM) [1], and plays an essential part in the transportation process in H mode discharges.

Fig.1 is a typical H-mode discharge with the parameters: I_P ~502KA, B_T ~2.4T, q_{95} ~5.3, κ~1.6. It's a RF-dominant discharge with LHCD~ 1.7 MW, and ECRH ~ 0.35 MW. Around 2.68s, the D_a emission features a sharp decrease, the stored energy and density increasing quickly, indicating an L – H transition. After L-H transition, the QCM appears at around 2.7s in the spectrum of velocity fluctuation measured by DR system.

The eight-channel V-band DR and five-channel W-band DR systems are used for the QCM investigation in EAST, and they can cover the radial region rho =0.1~1. In many discharges, the QCM was observed in both the V-band and W-band DR systems, indicating that the QCM exists from the edge to the core plasma, which is quite different from the Edge Coherent Mode (ECM)[2]. The radial distribution of QCM intensity is demonstrated here, which gives more information about the stimulation and spreading of QCM. By the analysis of evolutions of the poloidal velocity and the frequency of QCM during NBI modulation, we found that the QCM rotates along the electric diamagnetic direction at the poloidal direction. The ELM behaviors with or without QCM has been investigated in the experiments, indicating that QCM relates to outward transportation of particles.

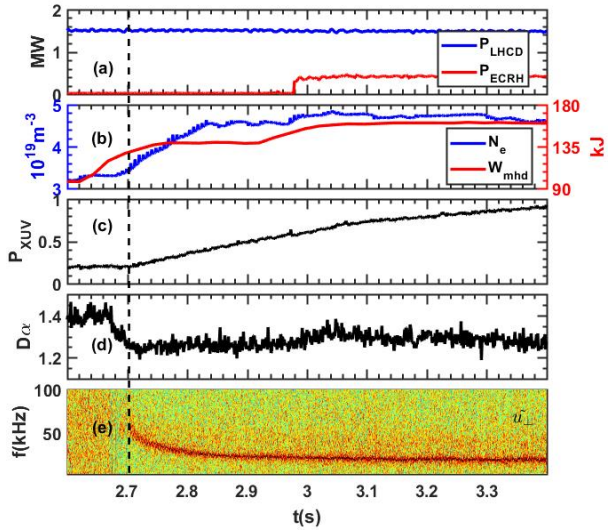

Fig.1. Example of QCM in H-mode (#93358). Evolution of (a) the parameters of the heating: LHCD, ECRH; (b) the average chord density and the stored energy; (c) XUV radiation ; (d) Da radiation. (e) The spectrogram of the fluctuation of the poloidal velocity detected by DR.

References:

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[2] A stationary long-pulse ELM-absent H-mode regime in EAST[J]. Nuclear fusion, 2017, 57(8):086041.1-086041.19