§12. Excitation of Fishbone-like Burst Modes and Their Effects on Energetic Ion Less

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In CHS, two kinds of distinct MHD instabilities are observed on the presence of energetic ions. One is so called "burst mode (BST)" and the other TAE mode. The latter is discussed separately in this issue[1]. Here, the former instabilities are discussed about excitation and the effects on energetic ion loss. The mode structures are discussed separately [2]. The former mode is often observed in NBI heated plasmas at relatively low electron density and lower toroidal magnetic field. The BST mode is speculated to be interchange mode destabilized by the presence of energetic ions. It is important to study the parameter range of the BST mode excitation and correlation of the mode with energetic ion loss.

Figure 1 shows time evolution of magnetic fluctuations in a low density plasma heated by co-injected beams with 37 keV energy. As seen from this figure, the magnetic fluctuation amplitude and the burst interval tend to decrease with increase in line averaged electron density. However, they seem to depend also the density profile, that is, they are enhanced for a peaked profile. Effect of electron heating on the BST mode is much more complicated. During the time interval from 100 ms to 110 ms at which ECH is applied, the amplitude and interval are increased. However, the density is also decreased during ECH. When the density is kept constant or gradually increased during ECH, we often observed suppression of the BST mode immediately or with some time delay for the ECH pulse. It is required to distinguish which parameters are most critical for excitation of the BST mode.

Recently, a detector to monitor energetic ion loss flux has been installed away from the last closed flux surface(LCFS) on CHS[3]. Obvious correlation between large amplitude BST mode and energetic ion loss flux is observed. Figure 2 shows temporal behaviour of energetic ion loss flux, together with floating potentials measured just inside LCFS(ρ=0.94 and 0.95). In the lower density phase($t \geq 108$ ms) the energetic ion loss flux is clearly enhanced, following large magnetic fluctuations. However, no obvious increase in ion saturation current is observed, while floating potential behaves similarly to that of energetic ion loss flux. Note that the energetic ion loss flux is not necessarily enhanced, even if the magnetic fluctuations are considerably enhanced. This may depend upon establishment of resonance condition between the phase velocity of the MHD modes and fast ion velocity.

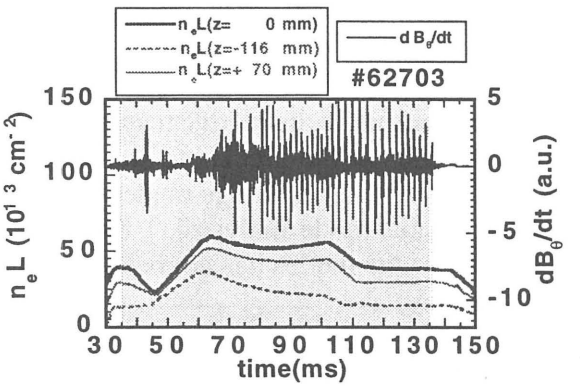

Fig.1 Burst modes observed in a low density plasma(~1×10^{19} m^{-3}) heated by co-injected neutral beams, where the toroidal field is 0.9 T.

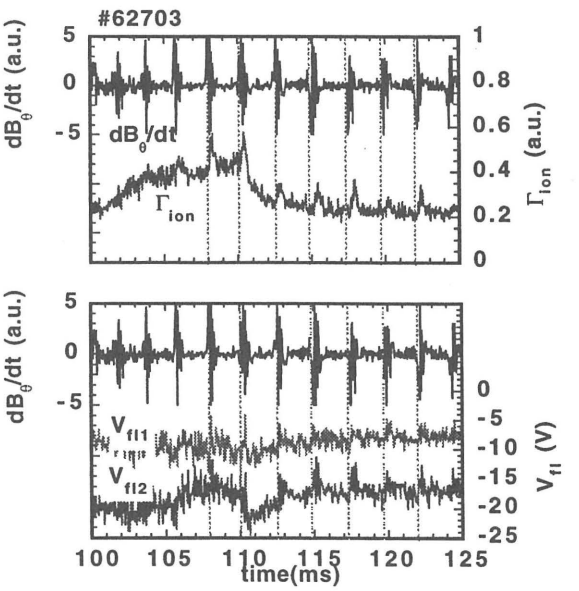

Fig.2 Time evolution of magnetic probe signal, energetic ion loss flux and floating potentials in the discharge shown in Fig.1, where V_{fl1} and V_{fl2} are measured at ρ=0.94 and 0.95, respectively.

References

[1] M. Takechi et al., this issue.
[2] S. Ohdachi et al., this issue.
[3] M. Isobe et al., this issue.