Observation of Confinement Degradation of Energetic Ions by Alfvén Eigenemodes in Weak Shear Plasmas on JT-60U

M. Ishikawa, K. Shinohara, M. Takechi, G. Matsunaga, Y. Kusama, V.A. Krasilnikov[1], Yu. Kashuck[1], M. Isobe[2], T. Nishitani, A. Morioka, M. Sasao[3], C.Z. Cheng[4], N.N. Gorelenkov[5], R. Nazikian[5], G. J. Kramer[5], JT-60 team

Japan Atomic Energy Research Institute, Naka-shi, Ibaraki 319-0193, Japan
[1] Troitsk Institute of Innovating and Fusion Research (TRINITI), Troitsk, Moscow region 142092, Russia
[2] National Institute for Fusion Science, Toki-shi, Gifu 509-5292, Japan
[3] Tohoku Univ., Sendai-shi, Miyagi 980-8578, Japan
[4] National Space Organization, Hsin Chu City 300, Taiwan
[5] Princeton Plasma Physics Laboratory, Princeton, NJ 08543, USA

Magnetohydrodynamics (MHD) instabilities with a frequency sweeping and then saturation of frequency as q_{min} decrease have been observed during Negative-ion-based Neutral Beam (NNB) injection in JT-60U Weak Shear (WS) plasmas. The frequency evolution of those MHD instabilities can be explained by Reversed-Shear-induced Alfvén Eigenemode model or Alfvén Cascade model. In recent experiments, a confinement degradation of energetic ions by such instabilities was clearly observed. Figure 1 shows time trace of frequency spectrum of instabilities measured by Mirnov coils and total neutron emission rate in the NNB injected WS plasma (E43978, B_T = 1.7 T, I_P = 1.0 MA). An increase of total neutron emission rate was suppressed during instabilities (t ~ 4.5 – 5.5 s). After these instabilities disappeared at t ~ 5.5 s, the rate of its increase was enhanced rapidly. However, total neutron emission rate decreased over 20 % during another instabilities after t ~ 5.9 s. At the same time, an increase of fast charge-exchange neutral particle flux and a change in its energy spectrum during those instabilities were also observed.

In this work, we will present the confinement degradation of energetic ions by the instabilities from these different phases. Further, we will compare the confinement degradation by the above instabilities with that by Abrupt Large-amplitude Events (ALEs) [1], which are bursting modes.

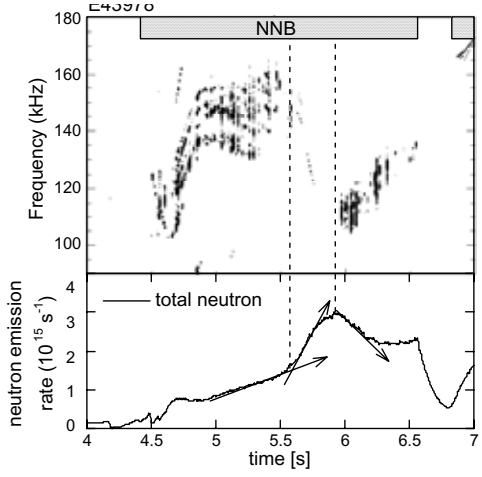

Fig.1 Time trace of a typical behavior of frequency spectrum (a), total neutron emission rate (b).

[1] ISHIKAWA. M., et al., Proceedings of 20th IAEA Fusion Energy Conference, Vilamoura, (Vienna: IAEA) IAEA-CN-116/EX/5-2Rb (2004)