



IAEA FEC 2014

Contribution ID: 413

Type: Poster

## Neoclassical Tearing Modes Triggered by Intrinsic Error Field in the HL-2A Tokamak

Friday, October 17, 2014 8:30 AM (4 hours)

Extrinsic magnetohydrodynamic (MHD) events such as sawtooth crash, fishbone or edge localized mode (ELM) instabilities are often required to provide the seed islands for triggering neoclassical tearing mode (NTM). However, the spontaneous onset NTM ( $m/n=3/2$ ) without any detectable extrinsic MHD events has been observed in the HL-2A tokamak. The intrinsic error field is considered as an alternative mechanism to provide the seed island for generating the NTM.

The spontaneous onset NTM on HL-2A was realized with  $PECRH = 1.7$  MW and co-current PNBI = 0.8 MW in an L-mode discharge. From the time-frequency spectrogram, the initial frequency of NTM is almost zero and its frequency rises around 13 kHz, the mode existent time coincides with the NBI duration. This is different from the seed island for the NTM is formed by toroidal coupling with the 2/1 tearing mode in the ELM free H-mode. The same oscillations appear in the  $\beta N$  and frequency spectrogram of the NTM. The amplitude of the magnetic field corresponding to the 3/2 NTM decreases gradually during the ramping up phase of the mode frequency. And then it keeps almost invariant until the disappearance of this mode. The NTM propagates in the ion diamagnetic drift direction. In addition, the frequency of the 3/1 mode with a frequency of about 6 kHz exists during most ECRH phase. This mode has similar characteristics with the edge harmonic mode (EHO), propagating poloidally in the direction of the electron diamagnetic drift and toroidally in the co-current and NBI direction. All the observations suggest that there is no direct interaction between the EHO and NTM. The error field in HL-2A mainly originates from the installation error of various coils. The 3/1 mode frequency is much larger than the error field one so that there is no clear interaction between them. The initial frequency close to zero for the 3/2 NTM should be related to the error field. Here bootstrap current fraction is estimated as  $\sim 15\%$  when  $\beta N = 1$ . Although  $n = 2$  error field is small, it is enough to provide the seed island for the NTM. Thus, the intrinsic error field is a suitable candidate for triggering the NTM on HL-2A.

### Country or International Organisation

China

### Paper Number

EX/P7-19

**Primary author:** Ms XU, Yuan (Southwestern Institute of Physics, Chengdu 610041 China)

**Co-authors:** Dr SUN, Aiping (Southwestern Institute of Physics); Dr XIA, Fan (Southwestern Institute of Physics); Dr WEI, Lai (Dalian University of Technology); Ms JIANG, Min (Southwestern Institute of Physics); Prof. YANG, Qingwei (Southwestern Institute of Physics); Mr SUN, Tengfei (Southwestern Institute of Physics); Mr ZHONG, Wulu (Southwestern Institute of Physics); Dr JI, Xiaoquan (Southwestern Institute of Physics); Dr DONG, Yunbo (Southwestern Institute of Physics)

**Presenter:** Ms XU, Yuan (Southwestern Institute of Physics, Chengdu 610041 China)

**Session Classification:** Poster 7