Observation of the double e-fishbone instability in HL-2A ECRH/ECCD plasmas

M. Jiang,¹,a) X. T. Ding,¹ Z. B. Shi,¹ W. Chen,¹,a) L. M. Yu,¹ J. Q. Dong,¹,² Y. Xu,¹ Y. Liu,¹
B. S. Yuan,¹ W. L. Zhong,¹ Y. Zhou,¹ Y. G. Li,¹ Z. C. Yang,¹ P. W. Shi,¹ Y. B. Dong,¹
Q. W. Yang,¹ X. R. Duan,¹ and HL-2A Team¹

¹Southwestern Institute of Physics, P. O. Box 432, Chengdu 610041, China
²Institute for Fusion Theory and Simulation, Zhejiang University, Hangzhou 310027, China

(Received 28 November 2016; accepted 23 January 2017; published online 7 February 2017)

Two m/n = 1/1 kink modes excited by energetic electrons (called double e-fishbone) have been observed near the q = 1 flux surfaces in the HL-2A discharges. The negative magnetic central shear configuration was achieved with localized electron cyclotron resonance heating and electron cyclotron current drive during plasma current ramp-up. The features of the modes have been first shown by advanced 2D electron cyclotron emission imaging (ECEI) system. From ECEI, two m/n = 1/1 modes propagating in the opposite directions poloidally have been clearly observed. These modes can be found only in low density discharge, and their frequencies are close to the precessional frequency of the trapped energetic electrons. More interestingly, the thermal energy transfer between the two modes was revealed by this new diagnostic, which is found to be related to the nonlinear interaction of the two modes and local electron thermal transport. Published by AIP Publishing.

[http://dx.doi.org/10.1063/1.4975667]