Contribution ID: **48** Type: **Oral**

Multiscale Chirping modes Driven by Thermal Ions in a Plasma with Reactor-relevant Ion Temperature

Friday, 10 December 2021 17:20 (20 minutes)

A thermal ion driven bursting instability with rapid frequency chirping, assessed to be an Alfvénic ion temperature gradient mode [1], has been observed in plasmas having reactor-relevant temperature in the DIII-D tokamak [2] (see the Fig. 1). The modes are excited over a wide spatial range from macroscopic device size to micro-turbulence size and the perturbation energy propagates across multiple spatial scales. The radial mode structure is able to expand from local to global in ~ 0.1 ms, and it causes magnetic reconnection in the plasma edge, which can lead to a minor disruption event. The ηi (=∂lnT_i/∂lnn_i) exceeds the theory-predicted threshold for the destabilization of Alfvénic continuum due to compressibility of core ions. The most unstable modes belong to the strongly coupled kinetic ballooning mode and β-induced Alfvénic eigenmodes branch [3]. The key features of the observation are successfully reproduced by linear analysis solving the electromagnetic gyrokinetic equations (CGYRO code) [4]. Since the mode is typically observed in high ion temperature >10 keV and high-β plasma regime, the manifestation of the mode in future reactors should be studied with development of mitigation strategies, if needed.

https://i.ibb.co/9tH68Wt/001.jpg

*Supported by the US DOE under DE-FC02-04ER54698

[1] F. Zonca, L. Chen and R.A. Santoro, Plasma Phys. Controlled Fusion 38 2011 (1996).
[2] X.D. Du, R.J Hong, W.W. Heidbrink, X. Jian et al., Phys. Rev. Lett. 127, 025001 (2021).
[3] I. Chavdarovski and F. Zonca, Phys. Plasmas 21, 052506 (2014).
[4] J. Candy, E. Belli and R. Bravenec, J. Comput. Phys. 324, 73 (2016).

Speaker's Affiliation

General Atomics

Member State or IGO

United States of America

Primary authors: DU, Xiaodi (General Atomics); Dr HONG, Rongjie (University of California at Los Angeles, Los Angeles, CA 90095, USA); HEIDBRINK, William (university of california, irvine); Dr JIAN, Xiang (University of California at San Diego, San Diego, CA 92697, USA); WANG, Huiqian (General Atomics); EIDIETIS, Nicholas (General Atomics); VAN ZEELAND, Michael (General Atomics); AUSTIN, Max (Univ. of Texas); LIU, Yueqiang (General Atomics, PO Box 85608, San Diego, CA 92186-5608, USA); CROCKER, Neal (University of California Los Angeles); RHODES, Terry (UCLA); SÄRKIMÄKI, Konsta; SNICKER, Antti (Aalto University)

Presenter: DU, Xiaodi (General Atomics)

Session Classification: Multiscale Physics and Instabilities in Burning Plasmas

Track Classification: Multiscale Physics and Instabilities in Burning Plasmas