Alfvén Eigenmode Spectroscopy by Application of External Magnetic-Field Perturbations in the Compact Helical System

G. Matsunaga, K. Toi[a], C. Suzuki[a], A. Shimizu[a], M. Takechi,
N. Nakajima[a], A. Fukuyama[b] and CHS Group[a]

Japan Atomic Energy Research Institute, Naka 311-0193, Japan
[a]*National Institute for Fusion Science, Toki 509-5292, Japan*
[b]*Dept. of Nuclear Engineering, Kyoto University, Kyoto 606-8501, Japan*

E-mail: matunaga@fusion.naka.jaeri.go.jp

In many tokamaks and helical devices, Alfvén eigenmodes (AEs) driven by energetic ions are intensively studied because of the importance in a fusion reactor. In particular, much attention is paid to the damping rates of AEs . In order to evaluate the damping rate of AEs, active Alfvén eigenmode (AE) spectroscopy was carried out for the first time in JET by applying external magnetic-field perturbations [1]. Damping rates of AEs were successfully measured by this method and compared with theoretically obtained results.

An AE spectroscopy system was constructed in the CHS heliotron/torsatron. In the system, alternating currents are induced along the magnetic field line using two inserted electrodes [2]. This system was applied to low temperature plasmas produced with 2.45GHz microwaves, for a basic study of damping mechanisms of AEs. The damping rate and AE frequency were derived from an analysis of frequency dependence of a transfer function measured by this system, where an example of a transfer function obtained by this system is shown in Fig.1. In low temperature hydrogen plasma produced at very low toroidal field $B_t = 0.0875\,\mathrm{T}$, fairly large damping rates of about 10% were obtained. The AE spectroscopy experiments in low temperature plasmas were carried also for helium and neon gasses by changing electron density and B_t, to study characteristics of the damping rates. These experimentally obtained damping rates of TAEs will be compared with results of a full wave numerical code, TASK/WM [3].

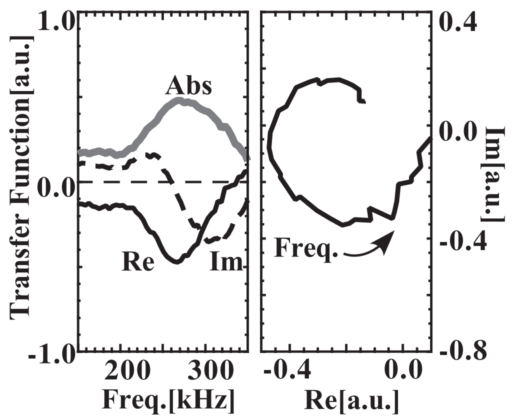

Figure 1: Transfer function in a hydrogen plasma.

References

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