Abstract Submitted for the Thirteenth Topical Conference on Applications of Radio Frequency Power to Plasmas April 12–14, 1999, Annapolis, Maryland

Category Number and Subject:

[ ] Theory [**x**] Experiment

Experiments on Ion Cyclotron Damping at the Deuterium Fourth Harmonic in DIII–D,* R.I. Pinsker, J.S. deGrassie, C.C. Petty, and the DIII–D Team, *General Atomics*, F.W. Baity, *ORNL*, S. Bernabei, N. Greenough, *PPPL*, W.W. Heidbrink, *University of California, Irvine*, T.K. Mau, *University of California, San Diego*, M. Porkolab, *MIT* — Damping of fast Alfvén waves (FW) at high ion cyclotron harmonics ($\omega = n\Omega$, $n > 3$) can be an important competing damping mechanism where direct electron damping is intended. Recent DIII–D experiments described here have demonstrated strong ion cyclotron damping on energetic deuterons at harmonics as high as $4\Omega_D$. Most of the discharges in this study combine deuterium neutral beam injection (NBI; $P_{NBI} \geq 2$ MW) with 60 MHz FW ($P_{FW} \sim 1$ MW, $B_T = 2.0$ T). The hydrogen minority fraction in deuterium majority discharges was varied from ≤ 2% to ~30% by hydrogen puffing to study the transition from damping on the hydrogen minority at $2\Omega_H$ to damping at $4\Omega_D$ on the 80 kV injected deuterons. We have also compared $4\Omega_D$ damping on an injected deuterium beam (deuterium majority) with $2\Omega_H$ damping on a hydrogen beam in hydrogen majority plasmas. In all cases, substantial central electron heating is observed. We attempt to determine the electron heating mechanism; direct electron damping of the FW via electron Landau damping and TTMP, electron heating by rf-accelerated deuterium beam ions, and electron heating from an rf-produced proton tail from the hydrogen minority at $2\Omega_H$ all occur to varying extents. Observations of the D-D reaction rate (neutrons) clearly indicate significant damping at the fourth harmonic, transitioning to second harmonic damping on hydrogen as the hydrogen fraction increases. These experiments indicate the importance of high harmonic damping in the presence of an energetic ion species and demonstrate the usefulness of this scenario for plasma heating.

*Work supported by U.S. Department of Energy under Contracts DE-AC03-99ER54463, DE-AC05-96OR22464, DE-AC02-76CH03073, and Grants DE-FG03-95ER54299, and DE-FG02-90ER54084.

[**x**] Prefer Poster Session
[ ] Prefer Oral Session

R.I. Pinsker
pinsker@gav.gat.com

General Atomics
P.O. Box 85608
San Diego, CA 92186-5608

(619)455-2074/(619)455-4156
Phone/Fax