EXPERIMENTAL STUDIES OF THERMAL AND NON-THERMAL ELECTRON CYCLOTRON PHENOMENA IN TOKAMAKS

by

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Abstract

A direct measurement of wave absorption in the ISX-B tokamak at the second harmonic of the electron cyclotron frequency is reported. Measurements of the absorption of a wave polarized in the extraordinary mode and propagating perpendicular to the toroidal magnetic field are in agreement with the absorption predicted by the linearized Vlasov equation for a thermal plasma. Agreement is found both for an analytic approximation to the wave absorption and for a numerical simulation of ray propagation in toroidal geometry.

Observations are also reported on a non-linear, three-wave interaction process occurring during high power electron cyclotron resonance heating in the Versator II tokamak. The measured spectra and the threshold power are consistent with a model in which the incident power in the extraordinary mode of polarization decays at the upper hybrid resonance layer into a lower hybrid wave and an electron Bernstein wave.

Finally, measurements of non-thermal emission at the second harmonic of the electron cyclotron frequency and below the electron plasma frequency are reported from low density, non-Maxwellian plasma in the Versator II tokamak. The emission spectra are in agreement with a model in which waves are driven unstable the anomalous Doppler resonance while only weakly damped at the Čerenkov resonance.

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