Paper Title:

High Harmonic Fast Wave Coupling Through The NSTX Plasma Edge

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Abstract Text:

High Harmonic Fast Wave (HHFW) power modulation studies on NSTX have shown both a wavelength and a phase dependence on the power coupling efficiency. Typical efficiency values are 70-80% for $k_z = \pm 14$ m^{-1} (heating), 60-70% for $k_z = +7$ m^{-1} (counter-CD), and 40-55% for $k_z = -7$ m^{-1} (co-CD). The perpendicular T_i in the edge plasma increases an order of magnitude (50 eV to 500 eV) for 4.3 MW at $k_z = -7$ m^{-1}. A candidate mechanism for edge ion heating is an Ion Bernstein Wave (IBW) arising from parametric decay of the 30 MHz HHFW. The characteristic PDI spectra have been observed with both a Langmuir probe and an X-mode microwave reflectometer. The number of sidebands and the strength of each peak increase for plasma conditions and array phasing where the core heating efficiency is poor. Time resolved appearance of the sidebands indicate the power threshold to be in the range of 100-400 kW for co-CD phasing at $k_z = -7$ m^{-1}. Estimates of the power absorbed by the edge ions are about 17% at $k_z = \pm 14$ m^{-1} and 25% at $k_z = -7$ m^{-1}. Other edge loss mechanisms under investigation are surface waves (both propagating and evanescent), collisional heating, direct IBW excitation, scattering off fluctuations and near and far-field sheaths. The above edge diagnostics, along with newly installed B-dot loops, will be used in 2006 to delineate the role of surface waves and/or collisional damping of evanescent waves in power propagation through the edge plasma.

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Category:

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