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EX/P3-13: Turbulent Transport and Gyrokinetic Analysis in Alcator C-Mod Ohmic Plasmas

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Transport in ohmically heated plasmas in Alcator C-Mod was studied in both the linear (LOC) and saturated (SOC) confinement regimes and the importance of turbulent transport was established with gyrokinetic analysis. The presence of turbulence was measured with an absolutely calibrated phase contrast imaging (PCI) method and was compared with theoretical predictions. While in the SOC regime the measured electron an ion transport coefficients were comparable in magnitude and in agreement with GYRO predictions due to the dominance of ITG turbulence, in the LOC regime the measured transport coefficients disagreed with predictions [1]. Importantly, in the experiments electron transport was dominant, whereas GYRO found dominant ion transport due to prevailing ITG turbulence. After extensive analysis with TGLF and GYRO, in the present work it is found that in the LOC regime using an effective impurity ion species with $Zi \leq 8$, and moderately high Zeff (2.0-5.6, in agreement with experimental measurements as the density was decreased) electron transport became dominant due to excitation of dominant TEM/ETG turbulence [2,3]. The key ingredient in the present results is the observation that dilution of the main ion species (deuterium) by impurity ion species of moderate charge state ($Zi \approx 8$) results in the onset of TEM/ETG dominated turbulence. The turbulent spectrum measured with the Phase Contrast Imaging (PCI) diagnostic is in good agreement with predictions of a synthetic PCI diagnostic installed in global GYRO as long as the Doppler shift due to the measured ErxB is included. However, the measured flow shear is too weak to impact the stability of TEM or ITG modes in a significant way. Experiments are underway where low-Zi impurities are injected into C-Mod plasmas to test the impact of ion dilution.

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[3] M. Porkolab et al, Bull. Am. Phys. Soc. 56, no 12, 139 (2011)
[4] M. Porkolab et al, Bull. Am. Phys. Soc. 55, no 15, 312 (2010)

Country or International Organization of Primary Author

USA

Author: Mr PORKOLAB, Miklos (USA)

Co-authors: Dr HUBBARD, Amanda (MIT); Dr FIORE, Catherine (MIT); Dr ERNST, Darin (MIT); Dr MARMAR, Earl (MIT); Dr STAEBLER, Gary (General Atomics); Dr DORRIS, James (Fisker Automotive); Dr CANDY, Jeff (General Atomics); Dr RICE, John (MIT); Dr ROST, Jon Chris (MIT); Dr GREENWALD, Martin (MIT); Dr REINKE, Matt (MIT); Mr TSUJII, Naoto (MIT); Mr ENNEVER, Paul (MIT); Dr WALTZ, Ron (General Atomics); Mr MA, Yunxing (MIT); Mr PODPALY, Yuri (MIT)

Presenter: Mr PORKOLAB, Miklos (USA)

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