Studies of H-mode pedestal physics on Alcator C-Mod with enhancements to neutral pumping

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H-mode experiments on Alcator C-Mod continue to explore the physics mechanisms determining edge pedestal structure, with the ultimate goal of improving predictions of pedestal width (Δ) and height on ITER. Under typical operating conditions, Δ displays no significant systematic variation with operational parameters, in either the electron density or temperature pedestals. Pedestal height and gradient, however, are strongly influenced by plasma parameters. A significant result is that the average pedestal gradients appear limited to a critical value, even in the absence of ELMs. This is manifested in a measured normalized pressure gradient α_{MHD} ($\sim p/I_P^2$) that remains roughly constant at a given value of edge collisionality, and substantially increases in less collisional plasmas [1,2]. Plasma transport is also predominant in determining the density pedestal on C-Mod, such that in the presence of a strong edge transport barrier, even aggressive gas puffing has a limited effect on pedestal density and core fueling [2]. Pedestal fueling and H-mode density control studies are extended further with the recent implementation of an upper divertor cryopump. Experiments are designed to explore the leverage obtained on edge collisionality and the extent of core pump-out that can be obtained in H-mode. As in prior H-mode puffing experiments, these studies are meant to examine H-mode fueling in discharges with edge neutral opacity approximating that expected in ITER. Improved density control and access to a less collisional edge has potential implications for the character of H-modes on C-Mod. Pedestal physics goals include further exploration of both critical-gradient behavior and access conditions to H-mode regimes (e.g. EDA, ELM-free, ELMy), and the potential decoupling of ion and electron temperature profiles in order to compare and contrast pedestal width scalings.

[1] J.W. Hughes *et al.* Phys. Plasmas **13** 056103 (2006).

[2] J.W. Hughes *et al. Proc. of the 21st IAEA Fusion Energy Conference*, IAEA-CN-149, Chengdu, 2006, EX/P3-9.

This work was partly supported by US. Dept. of Energy Agreements DE-FC02-99ER54512 and DE-FG03-97-ER54415.