Evolution of edge profiles and fluctuations in two-phase L-H transitions in unfavorable magnetic configurations in Alcator C-Mod

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In the 'unfavorable' magnetic configuration, with the ion B×∇B drift pointing away from the active x-point, it is well known that the power threshold for the L-H mode transition is higher than with the 'favorable' configuration with drifts toward the x-point. The edge temperature and gradients have also been found on several experiments to be higher. Flow and rotation measurements on C-Mod have suggested that this difference may be related to a dependence of SOL flows on magnetic configuration [1]. We report here on evolution of the edge profiles and fluctuations in the phase leading up to, and during, the L-H transition [2]. Edge electron and ion temperatures begin to rise well (> 100 ms) before the transition in density, and the classic D_α drop, often showing a 'break-in-slope' about 30 ms ($\sim\tau_E$) before the L-H transition. Global confinement also increases, similar to observations on ASDEX Upgrade [3]. Strong T_e and p_e gradients develop in this pre-transition period, with $\nabla P_e/n_e$ reaching -200 keV/m over the outer 2-3 mm of the plasma; power balance analysis confirms significant decreases in edge thermal conductivity. At the same time, subtle changes in broadband fluctuations occur. These are most clearly observed by magnetic probes, with fluctuations decreasing in the 50-100 kHz band. The causality and origin of these changes is not yet clear. Further experiments are underway during the current campaign using new and upgraded diagnostics, including reflectometry and active CXRS. These aim to develop a better understanding of the physics of the L-H transition and of its dependence on magnetic configuration.

[1] B. LaBombard, J. E. Rice, A. E. Hubbard *et al*, Phys. Plasmas **12** 056111 (2005).
[2] A. E. Hubbard. J. W. Hughes *et al*, Physics of Plasmas **15** (5) 056109 (2007).
[3] F. Ryter, W. Suttrop *et al*, Plasma Phys. Control. Fusion **40**, 725-729 (1998).

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