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EDGE LOCALIZED MODE CONTROL IN DIII-D USING MAGNETIC PERTURBATION-INDUCED PEDESTAL TRANSPORT CHANGES

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Edge Localized Mode Control in DIII-D Using Magnetic Perturbation-Induced Pedestal Transport Changes*

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Edge localized modes (ELMs) induce transport across the H-mode pedestal that enables steady-state operation with good particle exhaust and low impurity contamination. However, the impulsive heat load from ELMs is predicted to erode the divertor target plates and limit the divertor lifetime. Consequently, a technique that replaces the ELM-induced transport with more steady transport while preserving the good H mode confinement would enhance the viability of ITER and future tokamak reactors. This paper describes the results of experiments in DIII-D that use edge resonant magnetic perturbations (RMPs) with n=3 toroidal symmetry to eliminate large Type I ELMs at pedestal collisionalities $\nu_e^* \sim 0.2$, typical of those expected for ITER, by enhancing the radial transport across the H mode pedestal, thereby reducing the pedestal pressure gradient ∇p^{TOT} enough to stabilize the MHD modes that trigger ELMs (Fig. 1).

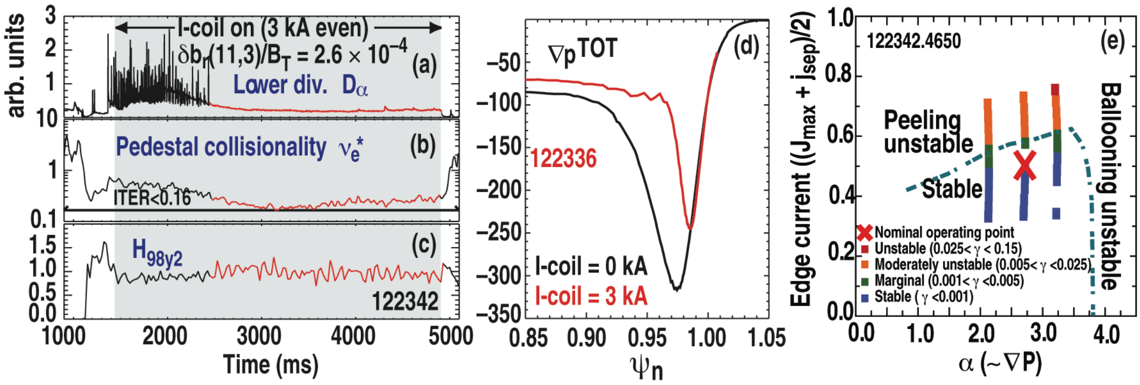

Fig. 1. (a) Large ELMs (as indicated by D_α) are suppressed by I-coil magnetic perturbations (grey shaded region) (b) at ITER-relevant ν_e^* (c) without degrading confinement as indicated by the H-mode quality factor H_{98y2}. (d) Pedestal profile of ∇p^{TOT} during the ELM suppressed phase (red) is reduced well below its value in the ELMing phase (black). (e) ELITE MHD stability calculations show that the reduced ∇p^{TOT} during ELM suppression (red X) is well inside the stability boundary (schematically indicated by the green line).

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