Pedestal Turbulence and Transport Response to an External Magnetic Perturbation in DIII-D*

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ELM control experiments in DIII-D with edge resonant magnetic perturbations (RMPs) have presented a paradox in pedestal transport: the Type I ELM stabilization is consistent with reduction of the pedestal pressure gradient (∇p^{ped}) below the stability limit for peeling-ballooning modes primarily by increasing the effective particle—not electron thermal—transport. This result appears to be inconsistent with theoretical expectations for transport in strongly stochastic layers. Experimental results show that the toroidal rotation, radial electric field E_r, and fluctuations in the boundary are altered by the RMP. In the pedestal, fluctuations due to both broadband turbulence and coherent modes increase. The foot of the density pedestal broadens into the scrape-off layer (SOL) and the level of intermittent particle transport in the SOL increases. These results suggest an increase in turbulent particle transport as the cause of the global particle balance change. The E_r well becomes narrower and steeper, such that the E_r shear at the top of the pedestal (on the inboard side of the negative E_r well), decreases, consistent with increased turbulent particle transport. We are exploring several mechanisms for the increase in effective particle transport, such as the formation of ExB convection cells at the separatrix during the RMP pulse. In this paper, we will 1) detail the RMP-induced pedestal changes, 2) compare these results with several models for the RMP-induced transport changes, and 3) discuss future directions for both the experiments and modeling.

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