Edge Current Dynamics During ELMs*

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The edge current density j plays a key role in the stability behavior of the pedestal by interacting with the edge pressure gradient. Using active spectroscopy of a lithium beam we have been able to study the edge current development in the DIII-D pedestal region by examining the fine-scale structure of the poloidal magnetic field. These studies are limited in time resolution because of poor signal-to-noise. Conditional averaging of our signals over multiple Type-1 edge localized modes (ELMs) improves the sensitivity. By doing this in synchronization with the electron and ion pressure measurements, we can begin to say something about the dynamics of edge j (and ∇p) growth and decay during the ELM cycle. Initial analysis shows that the current density peak can relax by about a factor of two within 10 ms after an ELM, consistent with resistive decay times in the edge, although the resistivity profile itself has large gradients and makes an accurate evaluation problematical. The measured current also appears to be decoupled from the pressure gradient for much of the cycle. This is probably due to delayed relaxation of the current quench-induced electric field because of the relatively low resistivity in the pedestal. We will comment on what improvements we believe are needed to make progress in understanding this important component of pedestal physics.

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