# Effect of Magnetic Geometry on ELM Heat Flux Profiles*

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In this paper, we examine magnetic control of divertor plate heating caused by edge localized modes (ELMs) re-attaching a radiative divertor, causing rapid divertor plate heating (0.2–3 ms in DIII–D). We show here for DIII–D that the spatial distribution of Type-I ELM energy is strongly affected by variations in magnetic geometry and discuss the interaction of cross-field transport of ELM heat with magnetic geometry. We find that ELM energy is transported more than four times further into the scrape-off layer than the time-averaged heat flux, and show evidence that the cross-field energy transport during ELMs occurs predominantly on the outboard flux surfaces.

In double-null discharges (DN) in DIII–D, the fraction of ELM energy deposited in each divertor is controlled by the magnetic balance. To change the balance, we used discharges with ion ∇B drift downward and varied the quantity $dr_{SEP}$, which is the radial distance at the outer midplane between the two poloidal flux surfaces which pass through the respective X–points. For the time-averaged peak heat flux for attached divertor plasma, changing $dr_{SEP}$ ± 5 mm shunted the heat flux to a different divertor [1,2]. For the energy loss during attached divertor ELMs less precise magnetic control of $dr_{SEP}$ to within ±1.9 cm is needed to achieve to same degree of balance.

For the downward magnetic bias, energy was still deposited on the upper divertor structure, on a projecting baffle at a location more than 3 cm outside the separatrix when mapped to the outer midplane. This residual heat is consistent with the effective ELM energy scrape-off width found from the $dr_{SEP}$ variation. A hyperbolic tangent fit to the energy balance $(E_{up} – E_{lo})/(E_{up} + E_{lo})$ plotted vs. $dr_{SEP}$ showed an effective width of 1.9 cm. Here $E_{up}$ is the energy deposited in the upper divertor for an ELM, and $E_{lo}$ is the corresponding quantity for the lower divertor. This is more than 4 times the corresponding effective width for the time-averaged heat flux for attached [2]. This means small magnetic errors do not cause a large shift in ELM energy between divertors.

In high-triangularity magnetically balanced DN, little or no heat was observed at the inner strike points. This means the ELM instability mainly caused transport on the outboard flux surfaces.

[1] C.J. Lasnier, et al., Nucl. Fusion **38** (1998) 1225.
[2] T.W. Petrie et al., in the Proc. of the Proc. of the 26th Euro. Phys. Soc. Conf. on Contr. Fusion and Plasma Phys., Maastricht, The Netherlands, 1999, to be published.

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