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Driving toroidally asymmetric current through the tokamak scrape-off layer to suppress edge-localised modes[1] I. JOSEPH, R.H. COHEN, D.D. RYUTOV, Lawrence Livermore National Laboratory — The dangerously high divertor heat fluxes impulsively delivered by edge localized modes (ELMs) can be controlled by non-axisymmetric magnetic perturbations that induce enhanced stellarator-like transport and reduce the edge pressure gradient below the peeling-ballooning MHD stability threshold. Unfortunately, the design of the needed perturbation coils is complicated by engineering constraints in a high field and high neutron-flux environment. We suggest driving the needed perturbation current through the scrape-off layer (SOL) plasma itself. Current densities as large as the ion saturation current density, can be driven if the sheath potential differs from the floating potential by $O(T_e/e)$. If the sheath potential is made to vary toroidally, a non-axisymmetric surface current is generated in the SOL, and the resulting magnetic perturbation can exceed the ELM suppression criterion, as shown by numerical calculations. The combination of non-axisymmetric SOL current and driven convection cells, which radially spread heat flux in the SOL, may be a powerful technique for solving the problem of high target heat fluxes.

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