Edge-localized-modes (ELMs) in tokamaks

A.W. Leonard

General Atomics, PO Box 85608, San Diego, CA 92186-5608, USA

Abstract. Edge-localized-modes (ELMs) are a ubiquitous feature of H-mode in tokamaks. When gradients in the H-mode transport barrier grow to exceed the MHD stability limit the ELM instability grows explosively rapidly transporting energy and particles onto open field lines and material surfaces. Though ELMs provide additional particle and impurity transport through the H-mode transport barrier, enabling steady operation, the resulting heat flux transients to plasma facing surfaces project to large amplitude in future low collisionality burning plasma tokamaks. Measurements of the ELM heat flux deposition onto material surfaces in the divertor and main chamber indicate significant broadening compared to inter-ELM heat flux, with a timescale for energy deposition that is consistent with sonic ion flow and numerical simulation. Comprehensive ELM simulation is highlighting the important physics processes of ELM transport including parallel transport due to magnetic reconnection and turbulence resulting from collapse of the H-mode transport barrier. Encouraging prospects for ELM control and/or suppression in future tokamaks include intrinsic modes of ELM free operation, ELM triggering with frequent small pellet injection and the application of 3D magnetic fields.

PACS Nos: 52.55.Fa, 52.55.Tn, and 52.55.Rk