2nd Asia-Pacific Conference on Plasma Physics, 12-17,11.2018, Kanazawa, Japan

Access conditions for ELM suppression in ASDEX Upgrade using Resonant Magnetic Perturbations

A Kirk[1], W Suttrop[2], V Bobkov[2], M Cavedon[2], M Dunne[2], R M McDermott[2], H Meyer[1], R Nazikian[3], C Paz-Soldan[4], D A Ryan[1], M Valovic[1], E Viezzer[2,5], M Willensdorfer[2] and the ASDEX Upgrade and Eurofusion MST1 teams

[1]CCFE Culham Science Centre, Abingdon, Oxon OX14 3DB, UK [2]Max-Planck-Institute for Plasma Physics, 85740 Garching, Germany [3]Princeton Plasma Physics Laboratory, PO Box 451, Princeton, NJ 08543-0451, USA [4]General Atomics, PO Box 85608, San Diego, CA 92186-5608, USA [5]Dept. of Atomic, Molecular and Nuclear Physics, University of Seville, Avda. Reina Mercedes, 41012 Seville, Spain

e-mail (speaker): Andrew.kirk@ukaea.uk

The application of Magnetic Perturbations (MPs) is foreseen as a mechanism to ameliorate the effects of Edge Localised Modes (ELMs) on the ITER divertor. The complete removal of ELMs by the application of resonant magnetic perturbations (RMPs), called “ELM suppression”, which was first established on DIII-D, may in fact be the best solution for the divertor but the mechanism that results in the suppression need to be understood and must also be associated with sufficient impurity transport to avoid tungsten accumulation.

In this talk the access conditions for full suppression of Edge Localised Modes (ELMs) by RMPs in low density high confinement mode (H-mode) plasmas in the ASDEX Upgrade tokamak will be presented. The main empirical requirements for full ELM suppression in these experiments are: The poloidal spectrum of the MP must be aligned so as to produce the best plasma response from weakly stable kink-modes, 2) the plasma edge density must be below a critical value, 3.3×10^{19} m^{-3}, 3) the pedestal pressure must be kept sufficiently low to avoid destabilisation of small ELMs and 4) the edge safety factor q95 lies within a certain window. Surprisingly no threshold dependence on plasma rotation or plasma collisionality has been observed within the range of plasma studied to date.

In these ELM suppressed discharges the transport of tungsten has been studied using the controlled injection of tungsten impurities. The results of the perturbative tungsten injection studies suggest efficient outward transport of high-Z impurities despite the absence of ELMs.