Technical University of Denmark

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Militello, F.; Fundamenski, W.; Naulin, Volker; Nielsen, Anders Henry

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Simulations of Edge and Scrape Off Layer turbulence in MAST plasmas

F.Militello[1], W. Fundamenski[1], V. Naulin[2], A. Nielsen[2]

[1]EURATOM/CCFE Fusion Association, Culham Science Centre, Abingdon, Oxon, OX14 3DB, UK
[2]Association EURATOM-Risø National Laboratory, OPL-128 Risø, DK-4000 Roskilde, Denmark

The L-mode interchange turbulence in the edge and Scrape Off Layer of MAST is investigated numerically. The tight aspect ratio of MAST (which increases the interchange drive) and its magnetic geometry (which produces large values of the safety factor at the edge) put this machine in a peculiar plasma regime for the edge turbulence.

The dynamics of the boundary plasma is investigated using the 2D fluid code ESEL [1], which has previously shown good interpretative capabilities for large aspect ratio machines [2,3]. Scans on various engineering parameters, such as magnetic field, plasma current, input power (i.e. edge temperature) and fuelling (i.e. edge density), are performed with the aim of characterising the profiles, fluctuation level and statistics of the edge/SOL density and temperature. The goal of this particular approach, which was not previously attempted with this code, is not to match a particular experimental result but to provide an broad overview of the turbulent dynamics in an experimentally relevant parameter space.

In addition to these scans, we also discuss how the system changes when the length of the divertor leg is modified. This allows to identify the regime of operation of the Super-X divertor which will be implemented on MAST-Upgrade.

The analysis of the results will focus on both equilibrium (average profile) features and fluctuation statistics. In this context, particular attention will be devoted to the scaling of the temperature and density e-folding lengths with engineering parameters with the aim of determining the particle and energy width of the Scrape Off Layer in different experimental conditions. In addition, the variation of relevant statistical quantities, such as the skewness and flatness of the PDF and amplitude of the turbulence, will be discussed. Finally, the results obtained will be related to drift-fluid dimensionless parameters [4] in order to find universal trends.

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