Numerical Simulations of Edge Localised Modes in MAST-U Plasmas

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Edge localised modes (ELMs) are magneto-hydrodynamic (MHD) instabilities that drive filamentary plasma eruptions in high confinement tokamak discharges [1]. Gaining an improved understanding of ELMs is important [2]; in future fusion reactors such as ITER, ELM heat fluxes will need to be limited to ensure durability of divertor materials [3]. A new divertor configuration, the Super-X, will be tested on the MAST-U tokamak. The Super-X has a closed divertor designed to retain neutrals and could offer a solution for divertor heat flux control due to the increased connection length and magnetic flux expansion [4]. The effect of the new magnetic configuration on ELMs is unknown. First simulations of ELM dynamics in MAST-U plasmas are presented using the nonlinear MHD code JOREK [5], which is being developed to establish quantitative validation against current experiments [6]. The evolution of a model MAST-U plasma has been simulated, showing filamentary structures of higher density forming in the nonlinear phase. The simulations predict energy and particle losses that are compared with data from previous MAST experiments. A fluid neutrals model has been implemented in JOREK and will be presented, including the impact on ELM dynamics in MAST-U, considering configurations with varying divertor leg length.

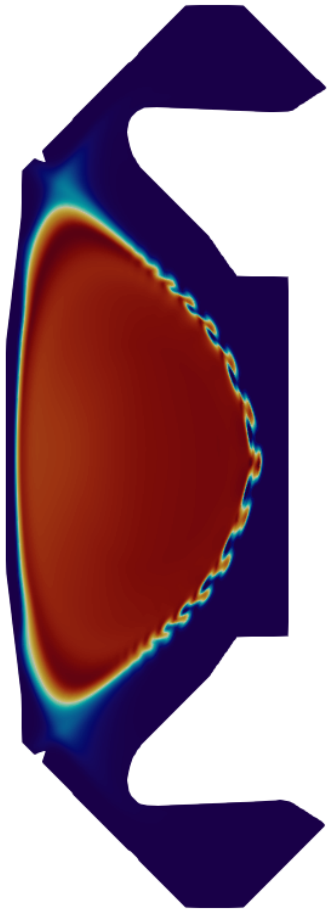

Fig: Poloidal plane during the simulation showing high density filaments forming in the plasma edge.

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