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Overview of recent physics results from MAST

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New results from MAST will be presented that focus on validating models in order to extrapolate to future devices. Particular attention will be given to the areas of scenario development, fast particle physics and plasma exhaust. Understanding filamentary transport across the scrape off layer is a key issue for the design and operation of future devices as it is crucial in determining the power loadings to the divertor and first wall of the machine. A detailed characterisation of the MAST Scrape Off Layer has been performed including results from new diagnostics giving plasma potential and ion temperature measurements. Detailed studies have revealed how filament characteristic are responsible for the broadening of the midplane density profile. These measurements have been compared to extensive modelling, including 3D effects on filaments dynamics with the BOUT++ code, and benchmarking the SOLPS code. Impurity transport studies have shown how the balance between neoclassical and anomalous transport leads to carbon and nitrogen being screened from the core plasma compared to helium which is peaked at the centre. These results, combined with SOLPS modelling, suggest that a stable detachment region can be produced if the impurity puffing is localised. Measurements from a Doppler Backscattering system combined with GS2 simulations have shown that both micro-tearing modes (MTMs) and electron temperature gradient (ETG) modes can be unstable at the top of the pedestal, along with kinetic ballooning modes at the bottom of the steep gradient region. The experimental observations of the relative amplitudes and wavelengths of the density and magnetic field fluctuations at the top of the pedestal are more similar to the linear characteristics of the ETG than the MTM. Comprehensive measurements from a suite of diagnostics on MAST have shown the effect that core MHD modes and resonant magnetic perturbations (RMPs) have on the confinement and redistribution of fast ions arising from neutral beam injection (NBI). Subsequent experiments on MAST demonstrated that by vertically displacing the plasma to achieve off-axis NBI fast ion injection or by changing plasma density or NBI power to vary the fast ion pressure gradient the redistribution could be mitigated.

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