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# Early Observations of Divertor Detachment on MAST Upgrade

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Future large, high power fusion devices such as ITER and its successors will require strong dissipation of the plasma energy, momentum and particles reaching open field lines before reaching the surfaces of the divertor; detachment will play a dominant role in that dissipation. This contribution presents initial observations of divertor detachment from the MAST Upgrade spherical tokamak in conventional and Super-X divertor configurations, emphasising the physical processes governing the onset and evolution of detachment.
In the first physics campaign intensive studies of Ohmic discharges with plasma current of 600kA and 750kA were performed in a double null topology. In experiments where the core density increases continuously, the roll-over in the outer divertor ion saturation current is coincident with the surface heat flux dropping to levels close to the detection limit of the infrared cameras, in both conventional and Super-X divertor configurations. In the conventional divertor configuration, the roll-over in the outer divertor ion flux is driven by a reduction in both the power entering the divertors and upstream plasma pressure. Analysis of passive spectroscopy measurements of atomic deuterium Balmer and molecular Fulcher band emission suggest that the ion flux rollover is caused by a reduction in the divertor ionisation source. The onset of detachment in the Super-X configuration occurs when the line-average density is ~10% of the Greenwald density limit, 50% lower than in a conventional divertor configuration. These observations are supported by visible imaging measurements of Balmer and Fulcher emission withdrawing from the divertor target with increasing upstream density, and will support more quantitative analysis of the divertor conditions. Divertor spectroscopy and Thomson scattering suggest that the divertor Te during most of the detached phase is very low, $0.1 < Te < 0.5$eV.
This contribution will present a synthesis of these initial observations of divertor detachment on MAST Upgrade, including a description of novel data analysis techniques including Bayesian approach to estimate the upstream density from mid-plane Thomson scattering profiles and analysis of divertor spectroscopy data. A comparison with SOLPS-ITER modelling will be presented, showing very good agreement with the results from the Super-X configuration, including detachment threshold and divertor fluxes.

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