Motional Stark effect diagnostics for measurements on MAST-U

S. Gibson[1], J. Howard[2], N. C. Hawkes[3] and R. Sharples [1]

[1] *Center for Advanced Instrumentation, Durham University, Durham, UK*
[2] *Plasma Research Laboratory, Australian National University, Canberra, Australia*
[2] *Culham Center for Fusion Energy, Culham Science Center, Abingdon, Oxford*

The motional Stark effect (MSE) diagnostic is used routinely in fusion devices to measure magnetic pitch angle and q profiles. The MAST-U MSE diagnostic is capable of providing radial q and current profiles, as well as constraining equilibrium reconstructions between pulses [1]. An imaging MSE (IMSE) diagnostic has been realized by researchers at Australian National University (ANU) and deployed on the K-STAR tokamak, South Korea [2]. The IMSE diagnostic applies interferometric techniques to provide a 2D profile of the magnetic field component B_z, offering enhanced spatial resolution and insensitivity to background polarized light.

This PhD aims to assess the capabilities of various MSE diagnostic techniques for measurements of current and q profiles in advanced tokamak scenarios. Activities using the MAST-U MSE diagnostic include analyzing current profile evolution during H-mode plasmas from MAST, to be compared with those produced by MAST-U in late 2018. Other future work consists of a study into the feasibility of an IMSE diagnostic for MAST-U, undertaken in collaboration with ANU. This will lead to the development of a prototype IMSE system for MAST-U. Finally we look towards alternative ITER relevant techniques, as background polarized light and first mirror degradation due to radiation will affect conventional polarimetry measurements. MSE line splitting is a novel alternative[3] approach which can provide the magnitude and direction of the magnetic field, and its capabilities assessed in the upcoming JET DT campaign.

References

[1] N. J. Conway, *et al.*, Rev. Sci. Instrum., **81**(10), 2010.

[2] J. Howard *et al.*, J. Instrum **10**(09), 2015.

[3] N. A. Pablant *et al.*, Rev. Sci. Instrum, **81**(10), 2010.