Motional Stark effect diagnostic measurements on MAST-U

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The conventional motional Stark effect (MSE) diagnostic gives a radial profile of the magnetic pitch angle in a plasma by measuring polarized Stark split emission from high energy neutral beam atoms. The aims of future work are to compare the capabilities of the conventional MSE diagnostic on MAST-U and alternative MSE approaches: The interferometry based imaging MSE (IMSE) and polarization free MSE line splitting (MSE-LS) to measure magnetic field components, current and q profiles in advanced tokamak scenarios.

Future work using the MAST-U MSE diagnostic include analyzing current profile evolution during H-mode plasmas from MAST, which are to be compared with those produced by MAST-U in late 2018. The IMSE diagnostic, realized by researchers at Australian National University (ANU) and deployed on the K-STAR tokamak in South Korea, applies interferometric techniques to provide a 2D profile of the magnetic field component B_z. IMSE offers enhanced spatial resolution over conventional MSE diagnostics [2]. Future work consists of a study into the feasibility of an IMSE diagnostic for MAST-U, considering the overlapping of emission lines due to the low magnetic field. This is a joint project undertaken in collaboration with ANU and will lead to the development of a prototype IMSE system for MAST-U.

Finally we look towards alternative ITER relevant techniques, such as MSE-LS. The expected background polarized light and first mirror degradation due to radiation in ITER may inhibit conventional MSE measurements. MSE-LS is a novel alternative approach which provides the magnitude and direction of the magnetic field [3] through spectral analysis. MSE-LS will be tested in ITER-like scenarios in the upcoming JET DT campaign.

References

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