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12.31 A Spectroscopic Wave Electric Field Diagnostic for Heating and Current Drive Systems

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External plasma heating and current drive systems are vital for magnetically confined fusion devices. These systems rely on exciting wave electric fields (10's MHz to 100's GHz) near the scrape off layer by use of an antenna or waveguide structure. Ion Cyclotron (IC), Lower Hybrid (LH), and Electron Cyclotron (EC) range of frequency waves have been quite successfully in fulfilling their purpose, however, each scheme has experienced its own unique issues stemming from parasitic interactions with the edge plasma. In an effort to identify the underlying physics and provide a path towards mitigation, a diagnostic capable of direct comparison with first principles full-wave simulations was designed. The diagnostic is based on measurement of Dß spectra in the edge plasma using polarized optical emission spectroscopy. The wave electric field vector is then determined by systematically fitting the Schrödinger equation, containing both magnetic and electric field operators, to orthogonally polarized Dß spectral line profiles. Experimental results obtained from an RF sheath test stand (IC), Tore Supra (LH) and Alcator C-Mod (LH) will be presented. Additionally, future diagnostic plans for the RF sheath test stand (IC), WEST (LH) and DIII-D (LH and EC) will be discussed.

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