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Design and construction of a multi-spectral MSE system for Alcator C-Mod ROBERT T. MUMGAARD, MIT PSFC, STEVEN D. SCOTT, PPPL — Extensive studies of polarized inside the Alcator C-Mod tokamak have identified the sources of partially polarized light which contaminates the Motional Stark Effect (MSE) measurement. A multi-spectral MSE approach has been developed utilizing a narrow-bandpass, interference-filter-based polychromator which measures the polarization simultaneously at multiple wavelengths on the same viewing sightline. This allows the MSE polarized background to be wavelength interpolated in real time using off-MSE wavelengths. A 10 sightline, 4-wavelength, high throughput imaging polychromator system was designed, based on experience from a successful prototype. This system incorporates advances in high transmission (>90%) narrow bandpass filters, filter temperature tuning and avalanche photodiode detectors. In addition to enabling a factor of 5-10x improvement in background estimation using wavelength interpolation, the system allows for simultaneous measurement of the orthogonally polarized sigma and pi MSE emission. The factor $\sim$ 3x increase in signal collection and real-time background subtraction will enable MSE measurements in higher density, higher power plasmas and across transients with improved time resolution without beam modulation. The detection system is designed to be remotely operable and largely device independent. Initially, it will be deployed on C-Mod to enable MSE measurements in Advanced-Tokamak plasmas under development there. This work is supported by USDoE awards DE-FC02-99ER54512 and DE-AC02-09CH11466.

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