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The Motional Stark Effect (MSE) Diagnostic for the National Spherical Torus Experiment (NSTX)

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The adoption of the motional Stark effect (MSE) polarimetry diagnostic is due to its very good temporal and spatial resolution of the q-profile, combined with its exceedingly good accuracy. This has resulted in many important scientific contributions towards our understanding of stability and transport. Despite the success of MSE on mid to large size devices, with magnetic fields above 1 Tesla, it has not been implemented on low field or small experiments. This is due to the large expense of a neutral beam and/or the inability of the technique to work at magnetic fields below 0.75 Tesla. Two approaches are being developed to remedy this; (1)MSE-LIF using laser-induced fluorescence (LIF), with a small diagnostic neutral beam, and (2)MSE-CIF using collsionally induced fluorescence (CIF) to allow the MSE technique to function at significantly lower magnetic fields than previously demonstrated. This work describes the implementation of the MSE-CIF diagnostic on NSTX which views the heating beam with 8 inch collection optics, imaged onto a fiber array. The optical system is configured to maximize the polarization fraction by reducing the Doppler broadening from the heating beam. In addition, a spectral filter with high throughput and high resolution is required to achieve the necessary signal-to-noise. This can be achieved with a wide field Lyot filter. This will permit MSE data to be obtained at magnetic fields >0.3 Tesla. A wide field tunable birefringent filter has been designed and tested that has the required throughput with a bandwidth of ~ 0.07 nm.