Non-perturbative Measurement of the *Local* Magnetic Field Using Pulsed Polarimetry for Fusion Reactor Conditions

Roger J Smith

(Practice for talk for High Temperature Plasma Diagnostic conference)

Abstract A novel diagnostic technique for the remote and non-perturbative sensing of the *local* magnetic field in reactor relevant plasmas is presented. Pulsed Polarimetry combines optical scattering with the Faraday effect. The polarimetric Lidar-like diagnostic has the potential to be a *local* B_{pol} diagnostic on ITER and can achieve spatial resolutions of *mm's* on HED plasmas using existing lasers. The Pulsed Polarimetry method is based on *non-local* measurements and subtle effects are introduced that are not present in either CW polarimetry or TS Lidar. Important features include the capability of measuring *local* T_e, n_e and $B_{||}$ simultaneously along the line of sight, a resiliency to refractive effects, a short measurement duration providing near instantaneous data in time and location for real-time feedback and control of MHD instabilities and the realization of a widely applicable internal magnetic field diagnostic for the MFE program. The technique improves for higher $n_eB_{||}$ product and higher n_e and is well suited for diagnosing the transient plasmas in the HED program. Larger devices such as ITER are also better suited to the technique, allowing longer pulse lengths and thereby relaxing key technology constraints making Pulsed Polarimetry a valuable asset for Next Step devices.