Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Analytical Model of Electron Thermal Effects on Interferometry-Polarimetry Measurements in Burning Plasmas V.V. MIRNOV, J.R. DUFF, University of Wisconsin-Madison and Center for Magnetic Self-Organization, D.L. BROWER, W.X. DING, University of California, Los-Angeles — The increasing accuracy of interferometric/polarimetric (I/P) diagnostics requires increasingly precise theoretical models for correctly interpreting experimental data. This is especially important for next step fusion devices like ITER and DEMO where various interferometric techniques will be used for direct real time feedback control of device operations with time resolution ≤ 1 msec. This determines the high accuracy ($\sim$1%) required for line-averaged I/P measurements in ITER. To address this issue we developed an iterative analytical technique designed to analyze electron thermal effects on the I/P measurements. This approach yields simple analytic expressions for fast real time feedback corrections when slowly operating ray tracing codes are not effective. Our previous linear in $\tau = T_e/m_e c^2 << 1$ calculations predicted (10-30)% thermal corrections for the interferometric phase, Faraday rotation and Cotton-Mouton effect at $T_e = 30$ keV. This lowest order approach is insufficient for 1% accuracy required by the ITER diagnostic specifications. We report here improved analytic model that includes quadratic terms in τ and new possibilities for advanced I/P measurements in plasma. *This work is supported by the U. S. DOE and NSF.

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Date submitted: 15 Jul 2011 Electronic form version 1.4