

**Abstract Submitted for the 51st Annual Meeting
Division of Plasma Physics
November 2–6, 2009, Atlanta, Georgia**

Measurements of the Internal Magnetic Field and $n=3$ Level Populations of Injected Deuterium Using the B-Stark Motional Stark Effect Diagnostic on DIII-D,* N.A. Pablant, *UCSD*; K.H. Burrell, R.J. Groebner, D.H. Kaplan, *GA*; C.T. Holcomb, *LLNL*; D. Den Hartog, *U. Wisc.*; H.P. Summers, *U. Strathclyde* — We describe the latest results from the newly upgraded B-Stark diagnostic system installed on the DIII-D tokamak. This system is a version of a motional Stark effect (MSE) diagnostic based on the relative line intensities and spacing of the Stark-split D_α emission from injected neutral beams. We present a thorough study of the performance of the diagnostic in measuring the magnitude and direction of the internal magnetic field over a range of plasma conditions. Measurements were made with toroidal fields in the range 1.2–2.1 T and plasma currents in the range 0.5–2.0 MA. We also present results from a study of the level populations of the $n=3$ state of the injected deuterium neutrals over a range of plasma densities, $1.7\text{--}9.0 \times 10^{13} \text{ m}^{-3}$, and neutral beam voltages, 50–81 keV. These results are compared against the calculations from an atomic physics code, part of the ADAS package.

*Work supported in part by the US DOE under DE-FG02-07ER54917, DE-FC02-04ER54698, and DE-AC52-07NA27344.