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An Electron Density Diagnostic Based on Doppler-free Measurement of Stark Broadening[1] ABDULLAH ZAFAR, North Carolina State University, ELIJAH MARTIN, Oak Ridge National Laboratory, STEVE SHANNON, North Carolina State University — Passive spectroscopic measurements of Stark broadening have been reliably used to determine electron density for decades. However, a low-density limit (˜1013 cm-3) exists due to Doppler and instrument broadening of the spectral line profile. A synthetic diagnostic for measuring electron density capable of high temporal (ms) and spatial (mm) resolution is currently under development at Oak Ridge National Laboratory. The diagnostic is based on measuring the Stark broadened, Doppler-free, spectral line profile of a Balmar series transition using a laser-based technique. The diagnostic approach outlined here greatly reduces line broadening using Doppler-free saturation spectroscopy (DFSS), allowing access to Stark broadening regimes at lower densities than previously realized. This technique has been successfully employed to measure spectral data in an electron cyclotron resonance (ECR) source for an electron density range of 1011-1012 cm-3. Theoretical modeling continue to improve as diagnostic artifacts, such as crossover peaks, are better understood and captured in the simulations. Details of diagnostic implementation and agreement between experimental data and theoretical results is discussed.

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