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High Temporal and Spatial Resolution Electron Density Diagnostic for the Edge Plasma based on Stark Broadening ABDULLAH ZAFAR, Oak Ridge National Lab, ELIJAH MARTIN, Oak Ridge National Laboratory, STEVE SHANNON, North Carolina State University, RALPH ISLER, JOHN CAUGHMAN, Oak Ridge National Laboratory — Passive spectroscopic measurements of Stark broadening have been reliably used to determine electron density for decades. However, a low-density limit (~10^{14} cm^{-3}) exists due to Doppler and instrument broadening of the spectral line profile. A synthetic electron density diagnostic 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 by using an active laser based technique. The diagnostic approach outlined here greatly reduces both of these broadening contributions using Doppler-free saturation spectroscopy (DFSS), allowing access to lower density regimes. The measured profile is then fit to a fully quantum mechanical model including the appropriate electric and magnetic field operators. The modeling and experimental results for this active spectroscopic technique are presented for a magnetized ($\leq$5 T), low-density (10^{11}-10^{13} cm^{-3}) plasma. Details of applying DFSS to the plasma edge are also discussed.

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