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Student Excellence Award Finalist: Extending Stark Broadening Measurements to Low Electron Densities Using Active Spectroscopy in Helium 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 diagnose electron density for decades. Due to Doppler and instrument broadening, these passive techniques are limited to n_e measurements of $\geq 10^{14}$ cm^{-3} for most atomic transitions. At Oak Ridge National Laboratory, a diagnostic approach has been implemented that leverages active spectroscopy to overcome this limitation. The diagnostic technique is based on measuring the spectral line profile of the $2^1P \rightarrow 6^1D$ He transition using Doppler-free saturation spectroscopy (DFSS), a laser-based absorption technique that significantly diminishes Doppler broadening and eliminates instrument broadening. The spectrum is then fit to quasi-static Stark broadening model to extract the electron density. Using this approach, n_e has been successfully diagnosed via Stark Broadening measurements in a low density ($10^9 - 10^{12}$ cm^{-3}), low temperature (5-10 eV), magnetized (500-900 G), He plasma in the mTorr pressure range. Experimental results will be presented for π and σ-polarizations and compared to Langmuir probe measurements. Crossover resonances (an artifact of the diagnostic) and collisional effects are also addressed along with their impact on the measurements

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