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A two-photon laser induced fluorescence diagnostic with improved sensitivity, localization, and measurement rate. DREW ELLIOTT, EARL SCIME, ZACHARY SHORT, West Virginia Univ — A two-photon absorption laser induced fluorescence diagnostic has been developed for measuring neutrals in fusion plasmas. Implementation of this diagnostic on the HIT-SI3 spheromak has demonstrated the sensitivity of the diagnostic and shown that measurements taken over several plasma pulses are possible. These measurements yielded an unexpected loss of signal when complex collection optics were utilized. Simulations show that this loss of signal can be explained by chromatic aberrations caused by the disparate Kr and D emission. This loss of signal has been addressed with the development of a new calibration scheme involving xenon gas. The Xe calibration scheme emission occurs at 656.00 nm while the deuterium emission is 656.09 nm. This nearly identical emission allows for advanced optical techniques such as confocal collection/injection and spatial filtering to be employed without loss of signal. Spatial filtering has been demonstrated to decrease noise while improving measurement localization, while confocal collection/injection allows for probing and measuring to occur through one viewport. The Xe scheme also allows for a Doppler-free hydrogen measurement. Doppler-free measurements eliminate the need to scan the laser spectrally thus greatly increasing the rate of measurement.

Drew Elliott
West Virginia Univ

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