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Self Absorption of 394.4 and 396.15 nm Aluminum Transitions in Laser-Induced Plasma DAVID SURMICK, CHRISTIAN PARIGGER, University of Tennessee Space Institute — Transient plasma produced from a pulsed laser source is an advantageous laboratory method for studying Stark broadening parameters of atomic spectra through comparisons to known metrics such as Stark line widths and shifts of hydrogen. In performing such studies one aims to experimentally determine line width and shift parameters which requires independent measures of the electron number density and temperature. Such measurements are often complicated by non-equilibrium conditions including self absorption effects which cause distorted and broadened atomic line shapes. In this work, we seek to quantify the measured spatial and temporal dependence of two aluminum atomic transitions at 394.4 and 396.15 nm from the plasma following laser-induced breakdown near an aluminum alloy target. The self absorption effects are addressed by measuring the aluminum spectra with and without a duplicating mirror. The reflected plasma radiation is propagated through the plasma and is also imaged onto the spectrometer slit and detector arrangement. Initial measurements of the electron number density from the Al transitions indicate that self absorption behavior between the two lines may not be the same. The electron number density is found to be $1.92 \pm 0.21 \times 10^{18}$ cm^{-3} and $3.25 \pm 0.44 \times 10^{18}$ cm^{-3} for the 394.4 and 396.15 nm lines, respectively, from the primarily Stark broadened line profiles at a time delay of 0.3 μs following laser-induced optical breakdown accomplished with nanosecond pulsed, Q-switched Nd:YAG laser radiation.

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