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Measurement of Plasma density in High Intensity Discharge Lamps by THz Interferometry ALEX KIECKHAFER, JOHN CURRY, NIST — A THz interferometer has been constructed with the goal of directly measuring plasma electron densities in High Intensity Discharge (HID) lamp plasmas. The use of THz frequencies has several advantages. Primary of these is the ability to measure high densities. The 0.6 THz system constructed is capable of measuring densities up to $4x10^{15}$ cm^{-3}. Additionally, the short wavelength of 0.6 THz radiation will allow focal spot sizes smaller than a millimeter in diameter, thus enabling high spatial resolution measurements. The system also differs from traditional microwave interferometry in that heterodyning has been eliminated. In inductively driven lamps the plasma recombines twice per AC cycle, when the voltage drops below a critical value. This time-dependent phase shift of the THz beam will allow calculation of density as a function of time. Zero-points can be acquired during the measurement itself due to the twice-per-cycle recombination of the plasma. Detection using electro-optical or nonlinear optical methods can easily achieve the time resolution required for these measurements, while maintaining sufficient signal-to-noise levels for detection without the assistance of lock-in amplification.

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