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Optical plasma diagnostics: understanding the Ar emission spectrum[1] JOHN B. BOFFARD, R.O. JUNG, CHUN C. LIN, A.E. WENDT, University of Wisconsin-Madison — Optical emission spectroscopy (OES) provides a simple, non-invasive method of learning about many important plasma parameters (e.g. electron temperature, number densities). Measurements of Ar spectra in the 350-1200 nm wavelength range made on an inductive coupled plasma system under a range of operating conditions are compared to calculated emission spectra based on a radiation model that combines an electron energy distribution function (eedf) and number densities of ground state and Ar($3p^5 4s$) atoms with experimentally measured electron-impact excitation cross sections. Comparisons of the experimental and calculated spectra provide a quantitative assessment of the role of many processes in shaping the emission spectrum and thereby demonstrate how OES results can be utilized to extract plasma parameters. Examples include using radiation trapping of the $1s_x - 2p_y$ emission array to measure metastable densities which are compared to white-light absorption measurements; using electron-induced collisional de-excitation of the $5p_5$ level to measure electron density; and using variations in cross sections for excitation from the ground and metastable levels into $3p_x$ levels to obtain information on the electron temperature and shape of the eedf.

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