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Optical Emission Measurements of Electron Temperatures and Metastable Number Densities in a DC/RF Magnetically Confined Xe Plasma[1] VINCENT M. DONNELLY, University of Houston, PIERRE BAELE, YEVGENY RAITSES, Princeton Plasma Physics Laboratory — We report optical emission studies of a Penning type RF/DC discharge in 0.27 mTorr Xe plus traces of other rare gases. Emissions from selected Paschen 2p levels of Xe and trace Ne, Ar, and Kr were used to determine electron temperature[2] (T_e) and metastable number densities. Measurements were made as a function of distance from the center of the discharge chamber at several magnetic field strengths. Emission was viewed along a line-of-sight axis parallel or perpendicular to the axis of the magnets and 2 MHz RF inductively-coupled plasma source. T_e values were 1- 3 eV, depending on the magnetic field, and were generally in good agreement with Langmuir probe measurements at 35 and 150 Gauss. Rare gas metastable number densities were derived from emission intensities from levels that were excited largely by electron impact from the ground state (e.g. Xe $2p_3$), $1s_5$ (e.g. Xe $2p_6$) or $1s_3$ (e.g. Xe $2p_4$). The peak fraction of Xe $1s_5$ varied from 0.005 at 435 Gauss to 0.001 at 35 Gauss. Intense Xe^+ emission down the center of the discharge at high magnetic fields indicates a second population of high energy electrons.

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[2]V. M. Donnelly, J. Phys. D.: Appl. Phys. **37**, R217 (2004).

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