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Atomic kinetics of a neon photoionized plasma experiment at Z[1]

D.C. MAYES, R.C. MANCINI, R.P. SCHOENFELD, University of Nevada, Reno, J.E. BAILEY, G.P. LOISEL, G.A. ROCHAU, Sandia National Laboratories, ZAPP COLLABORATION — We discuss an experimental effort to study the atomic kinetics in neon photoionized plasmas via K-shell line absorption spectroscopy. The experiment employs the intense x-ray flux emitted at the collapse of a Z-pinch to heat and backlight a photoionized plasma contained within a cm-scale gas cell placed at various distances from the Z-pinch and filled with neon gas pressures in the range from 3.5 to 120 Torr. The experimental platform affords an order of magnitude range in the ionization parameter characterizing the photoionized plasma from about 5 to 80 erg*cm/s. Thus, the experiment allows for the study of trends in ionization distribution as a function of the ionization parameter. An x-ray crystal spectrometer capable of collecting both time-integrated and time-gated data is used to collect absorption spectra. The spectra show line absorption by several ionization stages of neon, including Be-, Li-, He-, and H-like ions. Analysis of these spectra yields ion areal-densities and charge state distributions, which can be compared with results from atomic kinetics codes. In addition, the electron temperature is extracted from level population ratios of nearby energy levels in Li- and Be-like ions, which can be used to test heating models of photoionized plasmas.

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Daniel Mayes
University of Nevada, Reno

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