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12.11 Using L-shell X-ray Spectra to Determine Conditions of Non-LTE Plasmas

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K-shell x-ray spectra of Li- to H-like ions have long been used to determine plasma conditions. The ratio of integrated line intensities is used to determine the temperature. At the density of Non-LTE plasmas ($n \sim 10^{21}$) the K-shell spectrum is not very sensitive to density. We propose using the L-shell emission of open L-shell ions (C- to Li-like) as an alternative to determine both temperature and density of NLTE plasmas. First, the L-shell models of a mid-Z material need to be verified against the temperatures obtained using a K-shell spectrum of a low-Z material. A buried layer platform is being developed at the OMEGA laser to study the open L-shell spectra of Non-LTE plasmas of mid-Z materials. Studies have been done using a 250 μm diameter dot composed of a layer of 1200 \AA thick Zn between two 600 \AA thick layers of Ti, in the center of a 1000 μm diameter, 13 μm thick beryllium tamper. Lasers heat the target from both sides for up to 3 ns. The size of the emitting volume vs time was measured with x-ray imaging (face-on and side-on) to determine density. The temperature was measured from the Ti K-shell spectra. The use of this platform for the verification of atomic L-shell models is discussed.

Primary author(s) : MARLEY, Edward (Lawrence Livermore National Laboratory)

Co-author(s) : LIEDAHL, Duane (Lawrence Livermore National Laboratory); SCHNEIDER, Marilyn (Lawrence Livermore National Laboratory); KEMP, Gregory (Lawrence Livermore National Laboratory); FOORD, Mark (Lawrence Livermore National Laboratory); HEETER, Robert (Lawrence Livermore National Laboratory); JARROTT, Leonard (Lawrence Livermore National Laboratory); WIDMANN, Klaus (Lawrence Livermore National Laboratory); MAUCHE, Chris (Lawrence Livermore National Laboratory); EMIG, James (Lawrence Livermore National Laboratory)

Presenter(s) : MARLEY, Edward (Lawrence Livermore National Laboratory); LIEDAHL, Duane (Lawrence Livermore National Laboratory); SCHNEIDER, Marilyn (Lawrence Livermore National Laboratory); KEMP, Gregory (Lawrence Livermore National Laboratory); FOORD, Mark (Lawrence Livermore National Laboratory); HEETER, Robert (Lawrence Livermore National Laboratory); JARROTT, Leonard (Lawrence Livermore National Laboratory); WIDMANN, Klaus (Lawrence Livermore National Laboratory); MAUCHE, Chris (Lawrence Livermore National Laboratory); EMIG, James (Lawrence Livermore National Laboratory)

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