ABSORPTION SPECTROSCOPY OF LOW-Z, LOW-DENSITY MATERIALS AT THE AWE ORION LASER FACILITY

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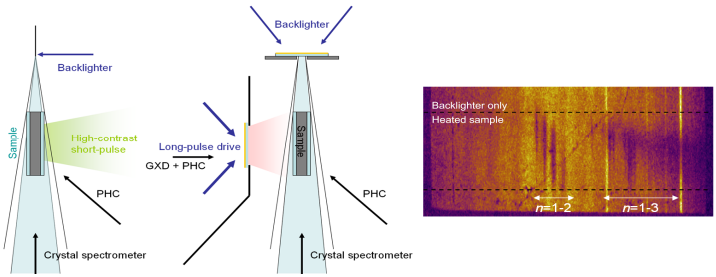
A series of experiments have been performed on the newly commissioned Orion Laser Facility, based at AWE Aldermaston, to study the properties of low-Z materials in a low-density, relatively low-temperature regime (typically a few to tens of mg/cc and tens of eV with the aim of exploring departures in this regime from ideal gas behaviour in models such as Thomas-Fermi. By measuring the change in material ionization and hence internal energy as a function of the material density we hope to be able to resolve differences between different equation-of-state models in this regime.

As the material temperature of interest is too low to enable the use of emission spectroscopy measurements, which have been successfully fielded on the Orion facility [1], we instead require the implementation and use of point-projection absorption spectroscopy to diagnose the sample at these conditions. While absorption spectroscopy has been used successfully in many prior laser-plasma experiments [2-5], this is the first time such a technique has been successfully trialled on this facility and enables us to use the high-contrast 2ω (527nm) short-pulse beamline of Orion [6] to make novel measurements on samples exploded to mg/cc densities using this capability.

In the first experiment we probed through aluminium samples, both radiatively-heated using a gold burnthrough foil and directly heated by the short-pulse laser, using a 1.4-1.7 keV point X-ray source. In a second follow-up experiment we have extended this technique into the X-ray Ultra-Violet regime using a grating spectrometer to probe samples of boron and magnesium fluoride. Results from both campaigns will be presented along with initial analyses.



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