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ABSORPTION AND THERMAL TRANSPORT WITH 12PS UV LASER PULSES

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We have used the SPRITE Raman amplified KrF laser at the Rutherford-Appleton Laboratory, to irradiate solid planar targets with 12ps pulses at 268nm, with irradiances up to 1017 Wcm-2. The ASE pre-lase level is below 10-10 of the main pulse intensity, thus the laser interacts with a solid surface. The absorption of the pulses by aluminium foils was measured as a function of angle of incidence and intensity. This was achieved with an Ulbricht sphere to measure light scattered out of the cone of incidence, and a photodiode to measure directly backscattered light. The absorbed fraction measured was up to 50% and can be explained by a combination of collisional and resonance absorption processes. At irradiances of 5×10^{16} Wcm-2, the P-polarised absorption showed a peak at 100 incident angle, implying a scalelength of around 3.5 microns at critical density. This is in quite good agreement with a 1-D simulation with the MEDUSA hydrocode.

In order to gain information on the lateral transport effects when the laser focal spot is reduced from 40 to 10 microns, we have measured the burnthrough times with layered targets consisting of an aluminium layer buried in plastic, and supported on an SiO2 substrate. This was done by measuring the hydrogenic emission from Al and Si with a fast X-ray streak camera with approximately 3ps resolution. For focal spots less than 20 microns (I $>5\times10^{16}$Wcm-2) a significant increase in burnthrough time is noted. The burnthrough times for focal spots larger than 20 microns is in reasonable agreement with 1-D simulation. Both sets of measurements show agreement with 1-D modelling at smaller focal spots than expected, i.e D/L < 10, where L is scalelength and D is focal spot diameter. This may be due to the effect of the *Nx*T generated B-field, which can restrict the lateral expansion of the plasma corona, and inhibit lateral thermal transport. Rough estimates suggest B-fields of several Megagauss can be generated during the pulse, leading to strong modification of transport as well as resonance absorption.