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Energy transport experiments using the Vulcan petawatt laser facility PETER NORREYS, Rutherford Appleton Laboratory — The VULCAN PW laser was used to investigate and quantify the effects of transport inhibition in ultra-intense laser-plasma interactions. These experiments were performed as part of an international collaboration involving physicists from the UK, the USA and Japan. A variety of different cone-attached target geometries were used to investigate these effects. Both CH-Al-CH slabs, with and without CH cones, and Al-Cu-Al slabs, with and without Au cones, were irradiated. Energy transport was diagnosed using XUV, rear surface emission, and Cu K-alpha imaging, transverse probing, and Al K-shell X-ray emission spectroscopy. The transport patterns produced from irradiating CH-AL-CH slabs show ring structure visible in the XUV images of the rear surface. When the cone was added the ring structure disappeared. In all cases, the He-beta and He-gamma lines showed an unexpected high intensity. A new atomic physics model, incorporating a two-temperature electron distribution, has been constructed that qualitatively reproduces these features. Transport data inferred from interferometry measurements for cone-wire targets that confirm surface heating of the wire plasma will be reported. Results will also be presented where the background electron density is changed in CH-Al-CH slab geometries by the addition of a low density deuterated foam layer on the front surface.

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