LASER PLASMA TABLE-TOP SIMULATION OF NUCLEAR SHOCK WAVE PRECURSORS

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We describe a laboratory scale experimental simulation of nuclear shock wave precursors. In the experiment a pulse from the 1.5 kJ, 5 nsec, 1054 nm NRL Pharos III Laser is focused through an evacuated path onto a thin foil located at the edge of a chamber filled with 1 atm of Argon gas. A 1 -mm diameter area of the laser-irradiated foil heats rapidly, creating a multikilobar, hemispherical shock wave which propagates through the Argon. The expanding shock wave is positioned to pass over a 5 cm by 5 cm tantalum foil which is preheated with a fast risetime «50 msec) current pulse. The heating creates a thin (mm), highly uniform, 300OK hot layer (corresponding to > 3 x sound speed at room temperature) within which the precursor develops. The layer temperature profile is obtained spectroscopically by black body fit. The Formation, propagation, detailed wave structure, and decay of the shock wave precursor propagating within this layer was measured with a combined folded-wave interferometer and a dark-field shadowgraphy diagnostic. Pressure fields are also determined from the optical diagnostics. The results of these experiments as well as advantages and Potential applications of the technique for cost effective simulation will be presented.