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Shock waves in solids driven by ultra-fast laser heating[1] YASUHIKO SENTOKU, ANDREAS KEMP, RADU PRESURA, MICHAEL BAKEMAN, THOMAS COWAN, University of Nevada, Reno — We are studying heating of thin foils by ultra-intense laser irradiation using collisional two-dimensional particle-in-cell simulations. We find that the laser-generated hot electron population is confined laterally by resistive magnetic fields and heats the target beyond keV electron temperatures isochorically. Using this confinement one can excite controlled shock waves that compress the plasma even beyond solid density. Such shocks can be launched at material interfaces inside the target where jumps in the average ionization state and thus electron density lead to Gigabar pressure. They can propagate stably over picoseconds, and the ion thermal energy after the shocks can exceed 1 keV at compressed solid density. A significant enhancement of the thermal neutron yield compared to uniform targets can be expected. This mechanism might provide thermal neutron sources for fusion studies and such extreme plasmas have the potential to be a good testbed for high energy density physics.

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