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Extreme dynamic compression with a low energy laser pulse[1] MICHAEL ARMSTRONG, Lawrence Livermore Natl Lab, JONATHAN CROWHURST, JOSEPH ZAUG, HARRY RADOUSKY, LLNL — Recently, it was shown that the energy required for laser driven dynamic compression experiments varies as the third power of the compression time, where the compression time must be larger than the equilibration time in the sample. Traditional dynamic compression experiments typically have drive times greater than 10 ns, but a wide range of materials equilibrate on substantially faster time scales, which should enable such materials to be compressed on much shorter time scales. So, for materials which equilibrate on a sub-nanosecond time scale, ultrafast dynamic compression has the potential to substantially reduce the laser energy required to obtain highly compressed states of matter. This has been demonstrated for sub-Mbar pressures with <100 μJ energy laser drive pulses, where the laser drive energy per unit density change is as much as 10^9 smaller than longer time scale experiments. Although these results are promising, extreme pressures (up to 10 Mbar) have not yet been observed with table-top scale laser systems. Here we present results for ultrafast laser driven shock experiments using up to 500x more drive intensity than our previous work, which, by conventional scaling, should result in dynamic pressures previously only accessible to facility scale instruments.

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