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Creation of ultra-high energy density matter using nanostructured targets J. PARK, RICCARDO TOMMASINI, R. LONDON, H. CHEN, Lawrence Livermore National Laboratory, R.C. HOLLINGER, C. BARGSTEN, V. SHLYAPTSEV, M. CAPELUTO, D. KEISS, A. TOWNSEND, Department of Electrical and Computer Engineering, Colorado State University, Fort Collins, Colorado, J.J. ROCCA, Department of Electrical and Computer Engineering, Department of Physics, Colorado State University, Fort Collins, Colorado, V. KAYMAK, A. PUKHOV, Heinrich-Heine-Universitat Duesseldorf, Germany, M. HILL, AWE plc, Reading RG7 4PR, United Kingdom — Recent experiments have demonstrated that trapping of 60 femtosecond laser pulses of relativistic intensity deep within ordered nanowire arrays can create a new ultra-hot plasma regime. [1] Here we report on the experiments at the Titan laser at the Lawrence Livermore National Laboratory that aim to scale these results by two orders of magnitude in laser energy. Preliminary analysis of the Titan results show that sub-picosecond laser irradiation of vertically aligned nanostructures of Au, Ag and Ni produces an increase of a factor greater than 1.6 in the suprathermal electron temperatures and an increase by a factor of 3 in the conversion efficiency into continuum x-rays, both with respect to flat targets of the same composition. K_α radiation from nanowire array targets also shows an increase between 3x and 5x over flat targets. The nanowire array targets reflected a 5x smaller fraction of the laser energy, indicating significantly larger absorption of the laser pulse. This work performed under the auspices of the U. S. Department of Energy by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344, by the Office of Fusion Energy Sciences, U.S Department of Energy, and by the Defense Threat Reduction Agency grant HDTRA-1-10-1-0079.
[1] M. A. Purvis, et al., Nature Photonics 7, 796 (2013)

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