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Energy deposition of highly relativistic laser pulses into solid and near solid density high Z plasmas[1] REED HOLLINGER, ADAM MOREAU, SHOUJUN WANG, ALEX ROCKWOOD, YONG WANG, Colorado State University, GABI CAPELUTO, University of Buenos Aires, VURAL KAYMAK, ALEXANDER PUKHOV, Heinrich-Heine-Universitat Dusseldorf, VYACHESLAV SHLYAPTSEV, JORGE ROCCA, Colorado State University — The irradiation of near solid density, high Z nanostructure arrays at moderately relativistic intensities ($a_o = 1$) offers nearly complete absorption of the laser light, which penetrates deep into the array [1]. As the intensity increases, however at highly relativistic intensities ($a_o = 20$), the wires explode before the peak of the laser pulse forming a plasma exceeding even the relativistically corrected electron density, on the order of 10^{23} electrons/cc. Despite the formation of this supercritical density surface, the laser energy is still deposited deep into the nanowires by accelerated high energy electrons that ionize gold up to Au^{+69} (Ne-like Au). Ionized K shell spectroscopy of buried Ni tracers reveals the heat penetration depth in solid density Au slab targets and near solid density Au nanowire plasmas is >1 micron and >5 micron, respectively. These experimental results are in agreement with fully relativistic three dimensional particle in cell simulations. [1] M.A. Purvis et al Nature Photonics 7, 796 (2013)

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