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Generation of relativistic ions, electrons and positrons in high-intensity short-pulse laser-solid interactions MATTHEW HILL, PETER ALLAN, COLIN BROWN, LAUREN HOBBS, STEVEN JAMES, KEVIN OADES, DAVID HOARTY, Plasma Physics Department, AWE, Reading, RG7 4PR, UK, HUI CHEN, Lawrence Livermore National Laboratory, Livermore, California 94550, USA — The newly-commissioned Orion laser facility at AWE Aldermaston can deliver intense (10^{21} W/cm^2), short (0.6 ps) laser pulses at 1ω (1 μ m) and 3×10^{20} W/cm^2 at 2ω with pulse contrasts of 10^7 and 10^{13}, respectively, in addition to ten 3ω, 500 J long-pulse ($\sim$ns) beams. All can be delivered to target synchronized to $\sim$ 20 ps. We report on the production and characterization of multi-MeV protons, ions, positrons and electrons at the Orion facility using 500 J, 0.6 ps, 1ω pulses and 100 J, 0.6 ps, 2ω pulses onto both thin (20 μ m) and thick (1 mm) gold targets. Laser intensities were scanned from 10^{19} to 10^{21} W/cm^2 by altering pulse energy and length while maintaining a consistent focal spot size of 10 μ. Particle energies were recorded by use of a magnetic and a Thomson spectrometer, with X-ray emissions imaged using a time-integrating pinhole camera in addition to time-integrating crystal spectrometers. The implications for future experiments such as investigations into electron transport mechanisms and proton heating are briefly discussed.

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