DPP11-2011-001590

Abstract for an Invited Paper
for the DPP11 Meeting of
the American Physical Society

High Flux Spatially Coherent X-ray Generation from Laser Wakefield Accelerators[1]

CHRIS MCGUFFEY[2], University of Michigan

Nonlinear plasma waves driven by existing ultra-intense short-pulse lasers can trap large numbers of electrons from the plasma (as many as 5×10^9) and accelerate them to $\sim GeV$ energy over $\sim 1\ cm$. The details of the trapping process and plasma wave structure dictate that the trapped electrons undergo transverse oscillatory motion on the microscopic scale of the plasma structure, resulting in short wavelength betatron radiation. These x-ray beams are presumed to retain the short-pulse characteristic of the laser, resulting in high peak flux, making the source a candidate for ultrafast temporally resolved imaging applications. Presented here are experimental studies of the scalings of fluence upon laser power, gas jet length, and electron beam parameters. The spectrum was directly measured by single hit spectroscopy to be broad and smooth with peak photon energy exceeding 10 keV. Additional measurements indicate that the beam source size can be as small as 1 μm and that the radiation exhibits spatial coherence. These two key characteristics allow advanced imaging capabilities including phase contrast imaging and tomography, as demonstrated by radiography studies of biological specimens. Collaborators: S. Kneip (Imperial College London), T. Matsuoka (Present affiliation: Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science), W. Schumaker, V. Chvykov, F. Dollar, M. Vargas, G. Kalintchenko, V. Yanovsky, A. Maksimchuk, A. G. R. Thomas, and K. Krushelnick (University of Michigan)

[1]This work was supported by the NSF (award PHY-0114336), the NSF/DNDO (award F021166), and the NRC (award 38-09-953).

[2]Present affiliation: The University of California, San Diego