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X/Gamma-ray emission from self-modulated wakefield accelerators

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An application of compact, high-gradient laser-wakefield accelerators is the development of novel light sources. They have potential for many applications, including high energy density sciences, where they can be used as probes to explore the physics of dense plasmas and warm dense matter. Our recent experimental and theoretical work shows that we can use three mechanisms to produce high energy x-rays and gamma-rays from a Self-Modulated Laser Wakefield Accelerator: Betatron motion of electrons, Bremsstrahlung and inverse Compton scattering. A series of experiments at the Lawrence Livermore National Laboratory, using the 1 ps 150 J Titan laser, have demonstrated low divergence electron beams with energies up to 300 MeV and 6 nCs of charge, and betatron x-rays with critical energies up to 20 keV. Additional experiments have also demonstrated that using Inverse Compton scattering and Bremsstrahlung we were able to generate gamma-rays with energies larger than 1MeV. Our results suggest that we will be able to develop SMLWFA-based light sources at large scale facilities for applications. This work was performed under the auspices of the U.S. Department of Energy by LLNL under Contract DE-AC52-07NA27344.

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