GAMMA RAY SOURCES BASED ON PLASMA WAKEFIELD ACCELERATORS

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Abstract

Advances in laser-plasma wake field accelerators (LWFA) have now reached the point where they can be considered as drivers of compact radiation sources covering an large spectral range. We present recent results from the Advanced Laser Plasma High-energy Accelerators towards X-rays (ALPHA-X) project. These include the first ultra-compact gamma ray source producing brilliant 10fs pulses of x-ray photons > 150keV. We present new opportunities for harnessing laser-driven plasma waves to accelerate electrons to high energies and use these as a basis for ultra-compact radiation sources with unprecedented peak brilliance and pulse duration. We have demonstrated a brilliant tabletop gamma ray source based on enhanced betatron emission in a plasma channel which produces > 10^9 photons per pulse in a bandwidth of 10-20%. We present results of a compact synchrotron source based on a LWFA and undulator and discuss the potential of developing an FEL based this technology. Finally we discuss the plans for the Scottish Centre for the Application of Plasma-based Accelerator (SCAPA), which is being set up to develop and apply compact radiation sources, laser-driven ion sources and LWFAs.

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