The laser plasma wakefield accelerator as a versatile radiation source

Prof. D.A. Jaroszynski
SUPA, Department of Physics, University of Strathclyde, G4 0NG, Glasgow, UK.
d.a.jaroszynski@strath.ac.uk

Abstract

The laser-plasma wakefield accelerator (LWFA) is creating a paradigm shift in accelerator technology: accelerators can now be shrunk by many orders of magnitude compared with conventional technology, simply by taking advantage of space charge fields in plasma. They can be considered as drivers of ultra-compact radiation sources. I will review recent progress at Strathclyde, which includes the production of femtosecond-duration, high-brightness electron bunches with kA peak currents and acceleration to ~1 GeV. I will show how they can be used as radiation sources with high peak brilliance and ultra-short pulse duration, down to ~100 attoseconds which are useful for developing LWFA-based compact XUV synchrotron sources. We will see that a table-top gamma ray source can produce more 10^8 photons in a few fs, with photon energies beyond 7 MeV. We will extend these concepts to show how an ultra-compact free-electron laser (FEL) based on wiggler-like motion of electrons in a LWFA produced ion channel can be constructed. As an example of the diversity of the LWFA we will also see that non-injected electrons can lead to the emission of unprecedented 10's of nC bunches with energies of 1-5 MeV, useful for pulsed radiolysis, THz sources and imaging applications. The LWFA is also a potential very compact driver of conventional FELs because of their unprecedented high peak currents.

Prof. Dino Jaroszynski FRSE FInstP

Director of the Scottish Centre for the Application of Plasma-based Accelerators, SCAPA

University of Strathclyde
Physics Department
Scottish Universities Physics Alliance (SUPA)
John Anderson Building
107 Rottenrow
Glasgow G4 0NG
Scotland, UK

Tel: +44 (141) 548 3057
FAX: +44 (141) 552 2891
mobile/cellphone: +44 7966152465
e-mail: D.A.Jaroszynski@strath.ac.uk
http://www.scapa.ac.uk
http://www.ngacdt.ac.uk
http://tops.phys.strath.ac.uk
http://phys.strath.ac.uk/alpha-x/
http://ppp.phys.strath.ac.uk