LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

Séminaire LAL

Prof. D.A. Jaroszynski
(SUPA, Department of Physics, University of Strathclyde, UK)

Vendredi 18 janvier 2019 à 11h00

The laser plasma wakefield accelerator as a versatile radiation source

The interaction of intense laser pulses with matter is giving rise to opportunities for investigating new science with very compact accelerators and radiation sources. 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. Advances in LWFAs are reaching the point where they can be considered as drivers of ultra-compact radiation sources. After introducing the main concepts of the LWFA, we will review recent progress at Strathclyde, which includes the production of femtosecond-duration, high-brightness electron bunches with kilo-Ampère peak currents and acceleration to ≈1 GeV. We will show how they can be used as radiation sources with high peak brilliance and ultra-short pulse duration, down to ≈100 attoseconds. As one of the first allpications of the LWFA we will present experimental demonstrations of LWFA-based compact XUV synchrotron sources based on undulators. We will see that a table-top gamma ray source, based on wiggler-like betatron oscillation in the LWFA accelerating structure, can produce more 10^8 - 10^9 photons in a few femtoseconds, and in a spectral range that extends to gamma ray 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 fo 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, which may be useful for pulsed radiolysis and imaging applications. Furthermore, the femtosecond to attosecond duration bunches from a LWFA can lead to emission of coherent THz radiation with high efficiency, and over a broad spectral range of 1-100 THz. The LWFA is also a potential very compact driver of conventional FELs because of their unprecedented high peak currents. Because the LWFA and secondary sources based on them are intrinsically synchronised they provide powerful pump-probe tools for time resolved studies on sub-femtosecond time scales.

Salle 101 - Bât. 200, Orsay

Organisation : Reisaburo Tanaka (LAL) - seminaires@lal.in2p3.fr
LAL web : http://www.lal.in2p3.fr
Indico: https://indico.lal.in2p3.fr/category/31/

cnrs

UNIVERSITÉ PARIS SUD

université PARIS-SACLAY