Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Internal Seminar

High rep. Rate 100 MeV and 1 GeV class electron accelerators at Eli - Alps and Imperial College London

Rakesh K Yembadi

Imperial College London - UK

The remarkable growth in laser technology towards delivering high repetition rate, high power, and ultra-short femtosecond pulses in a tabletop machine, especially the CPA (Chirped Pulse Amplification) technique in 1985 propelled the Laser Plasma Particle acceleration (LPPA) research. These developments constitute the advancement of LPPA closer to real-world industrial, medical, and research applications like x-ray imaging, tomography, ultrafast electron diffraction, femtochemistry, ultrafast spectroscopy, and x-ray, electron, and ion radiography. The secondary particle beams like short pulse electrons and x-rays generated from the LPPA were of great interest in applications like the production of undulator radiation, betatron soft x-rays for probing, inverse Compton scattering hard x-ray emission, bremsstrahlung and electron beam lasing in an undulator, etc.

Laser wakefield acceleration (LWFA) is one of the electron acceleration techniques that is promising and has been explored for more than three decades because of its ability to deliver the most high-quality electron beams among all the LPPA schemes. A table-top university scale electron source which would translate into a bright X-ray source is an invaluable tool to probe ultrafast processes. For eg. a 1 GeV electron LPPA upon improvements and modifications in the experimental geometry would emit ~ 100 keV, ~ a few tens of fs x-ray pulses which are comparable to synchrotron sources in terms of brightness.

In the first part of my presentation, I will discuss the basics of LPPA, followed by the commissioning of 100 MeV and 1 GeV class electron accelerators at Eli - Alps and Imperial College London. Optical guiding in the plasma channels is another scheme to improvise these accelerators which would be discussed as well.

Tuesday, May 14th 2024

14:30 Hrs

Seminar Hall, TIFR-H