Science and Technology Facilities Council

Particle Physics

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# PPD Seminar

## Progress towards high-repetition-rate laser-plasma accelerators

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In a laser-plasma accelerator (LPA) the ponderomotive force of a short (~ 50 fs), intense (~1018 W / cm2) laser pulse drives a trailing plasma wave. The spatial variation of the electron density within this wave generates electric fields of order 100 GV / m, around three orders of magnitude larger than those used in conventional, radio-frequency accelerators. This electric field structure, the plasma wakefield, propagates at the speed of the laser, and hence can be used to accelerate particles to relativistic energies. Laser-plasma accelerators have generated electron bunches with energies as high as ~ 10 GeV, in accelerator stages only a few centimetres long. Their compact size, and the desirable properties of the bunches they generate – such as low emittance and femtosecond duration – would seem to make laser-driven accelerators ideally suited to applications such as driving compact light sources or enabling experiments in novel high-field science. However, many of these applications would require the LPA to operate at pulse repetition rates substantially higher than the few pulses per second typically achieved today. In this seminar I will briefly review the operation of laser-plasma accelerators and the state of the field, before discussing recent work by my group aimed at enabling GeV-scale LPAs to operate at kilohertz repetition rates: (i) the development of hydrodynamic optical-field-ionized (HOFI) plasma channels, and (ii) plasma-modulated plasma accelerators (P-MoPAs).

Suggest a Speaker

All Welcome