Contribution ID: **136**   Type: **oral presentation**

Experimental progress on staged laser-plasma acceleration

Thursday, 15 August 2013 13:55 (25 minutes)

Laser-plasma accelerators (LPAs) [1] have produced GeV electron beams (e-beams) from cm-scale devices, demonstrating that LPAs have great potential for reducing accelerator size and cost [2]. LPA experiments performed to date utilize a single laser that drives the wakefield for injection and acceleration. For applications such as high-energy accelerators, LPA designs will rely on sequencing multiple acceleration stages, each driven by its own laser [3]. We present recent progress on the experiment staging two LPA modules at the LOASIS Program at Lawrence Berkeley National Laboratory. The experiment utilizes a 40 TW class laser which is split into two laser pulses. The first laser drives the first LPA module to produce an e-beam. The second laser drives the second LPA module and accelerates the e-beam from the first LPA. Excited wakefields in the second LPA module are diagnosed through spectral redshifting of the drive laser, which is an indicator of the efficiency of laser energy transfer into the plasma through the generation of coherent plasma wakefields [4].

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APS member ID

61021793

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Session Classification: Accelerators, Detectors, and Computing

Track Classification: Accelerators, Detectors, and Computing