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Michigan Institute for Plasma Science and Engineering

Wednesday
February 26, 2014
4:00 pm
Room 1017
Dow Building

Dr. Cameron Geddes

Lawrence Berkeley National Lab

Laser Plasma Accelerators and MeV Photon Sources

Laser-plasma accelerators (LPAs) produce GeV electron beams in centimeters, using the plasma wave driven by radiation pressure of an intense laser. Such compact high-energy linacs are important to applications ranging from future high energy physics to monochromatic sources of MeV photons for nuclear material security, for which beam quality and efficiency are crucial. Operation principles of LPAs and photon source applications will be reviewed. Recent experiments will be discussed which use the beat between 'colliding' lasers to control injection. Control over the laser optical mode and plasma profile extended the acceleration distance producing electrons above 200 MeV from 10 TW. Colliding pulse injection into this high energy structure was used to control bunch quality, producing bunches with energy spreads below 1.5% FWHM and divergences of 1.5 mrad. Separate experiments recently demonstrated 0.1 mm-mrad emittance from self injected LPAs using betatron radiation. The combination of low energy spread and emittance with production of 200 MeV energies from 10 TW lasers, now transportable, is important to applications including MeV photon and other light sources, and to high energy LPAs for HEP.

About the Speaker: Dr. Geddes is a staff scientist in the LOASIS program of Lawrence Berkeley National Laboratory, investigating use of laser driven plasma waves to build compact next generation particle accelerators and photon sources. These accelerators sustain much higher accelerating fields than conventional devices. Applications include extending the future reach of high energy physics accelerators, and compact sources of near-monochromatic MeV photons for nuclear interrogation. Geddes received the Ph.D. in 2005 at the University of California, Berkeley, supported by the Hertz Fellowship, receiving the Hertz and APS Rosenbluth dissertation prizes for the first laser plasma accelerator producing monoenergetic beams. He received the B.A. from Swarthmore College in 1997, and the APS Apker and Swarthmore Elmore prize for thesis work on Spheromak equilibria. Previous research has included Thomson scattering measurement of driven waves in inertial confinement fusion plasmas, wave mixing , small aspect Tokamaks, and nonlinear optics.