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## Particle Acceleration - Laser Wakefield Experiments at U. Michigan

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Presented here is an overview of laser wakefield accelerator (LWFA) experiments at the University of Michigan using the HERCULES and Lambda-Cubed high power laser systems. In our experiments, up to GeV energy electrons are generated in a cm scale plasma based accelerator. We show how using multi-stage gas cells result in increased stability and reproducibility. Annular quasimonoenergetic electron beams with mean energy in the range 200 – 400 MeV and charge on the order of several pC were generated using laser wakefield acceleration in a two-stage gas cell. Generation of these annular beams is associated with transverse injection occurring on the density downramp between stages. This well-localized injection produces a bunch of electrons performing coherent betatron oscillations in the wakefield resulting in a significant increase in the X-ray yield. Such ultrafast X-rays may lead to tabletop synchrotron light sources. We also use a high repetition rate to investigate the coherent control of the plasma dynamics by feedback-optimized wavefront manipulation using a deformable mirror. The demonstration of coherent control for plasmas opens new possibilities for future laser-based accelerators and their applications.

### Oral or Poster Presentation

Poster

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