# Generation of MeV-GeV Energy electron beams using ultraintense lasers

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Abstract

Over the past decade, there has been spectacular progress in the generation of high-energy electron beams by the process of laser wakefield acceleration. Starting with the first demonstration in 2004, it has now been shown that multi-GeV energy electron beams can be produced using ultrashort, PW peak power laser pulses. I will discuss our work in this area over the last few years that includes the demonstration of tunable electron beams spanning 10 MeV to 800 MeV using a range of laser and plasma conditions. We have used single and structured targets to control the injection and acceleration process and determined the influence of laser parameters on the stability and controllability of the electron accelerator. The details of the acceleration mechanism are understood by the use of particle-in-cell simulations. While our primary goal in the development of the electron accelerator was to use it to drive a Compton x-rays source, we have independently explored others facets of the acceleration process, in particular the mechanisms for injection in order to limit the energy spread. The first ever measurement of the intrinsic emittance of the electron beam was performed using inverse-Compton scattering and showed that this parameter is amongst the lowest ever measured for a high-energy electron beam.

Key words: Intense laser, laser Wakefield acceleration,

Curriculum

Dr. Sudeep Banerjee is a Research Associate Professor in the Department of Physics and Astronomy at UNL. For nearly two decades, Dr. Banerjee's research has focused on the use of intense lasers. His work has mainly focused on the development of a state of the art high-power laser facility, generation of high-energy electron beams, understanding the mechanism that makes laser wakefield acceleration such an attractive research area, and the application of these electron beams to produce x-rays from an all-laser driven source. Prior to joining the University of Nebraska, Dr. Banerjee was a post-doctoral research fellow and senior research associate at the Center for Ultrafast Optical Sciences, University of Michigan where he studied the interaction of free-electrons with light and the generation of high-energy x-rays using the table-top-terawatt laser system. Dr. Banerjee obtained his masters degree from the Indian Institute of Technology, Kanpur (India) and his Ph.D. from the Tata Institute of Fundamental Research, Mumbai (India) and has been involved with research using high-power ultrashort laser systems for over two decades.

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