AMO Seminar: 1:00 pm – 2:00 pm, Room 4138 on May 10th, 2013

Title: Laser-Plasma Acceleration of Electrons and Ions

Gennady Shvets, The University of Texas at Austin

Abstract: A remarkable revolution in laser-plasma acceleration has been taking place over the past decade, as new ideas of particle injection, focusing, and utilization are being experimentally tested. I will describe our recent research in two areas: (a) electron acceleration in tenuous plasmas, and (b) ion acceleration in laser-target interactions. I will describe the concept of "plasma bubble" acceleration, which is one of the most powerful recent ideas in plasma acceleration enabling accelerating fields much greater than the cold wavebreaking limit. Self-injection of plasma electrons into the bubble and conditions for generating mono-energetic electron beams will be discussed. Applications of bubble acceleration and self-injecton to recent Texas Petawatt experiments will be presented. I will also describe our recent work on laser-target interactions in the radiation pressure acceleration (RPA) regime. A simple analytic model of the accelerated target's structure and stability will be described. I will demonstrate that monoenergetic GeV-scale ion acceleration is only possible if target instabilities such as Rayleigh-Taylor-like target deformation is avoided by using structured plasma targets.

About the speaker

Gennady Shvets is a Professor of Physics at The University of Texas at Austin. He received his PhD in theoretical Plasma Physics from MIT in 1995 under Jonathan Wurtele's supervision; his thesis was titled "Interaction of Intense Lasers with Plasmas". He has been on the Physics faculty at the University of Texas at Austin since 2004. Previously he has held research positions at the Princeton Plasma Physics Laboratory and the Fermi National Accelerator Laboratory, and was on the faculty of the Illinois Institute of Technology. His research interests cover a wide range of theoretical and computational plasma physics topics, including ultra-intense laser-plasma interactions, plasma based accelerators of electrons and ions, interaction of the high intensity particle beams with plasmas in various contexts (high energy physics accelerators, astrophysical plasmas, and fast ignition), and high power vacuum electronics. He is the inventor of the concepts of super-radiant and Raman laser compression in plasmas, which is now considered one of the most promising pathways to exawatt lasers and beyond. Beyond plasma physics, his research interests include plasmonics and nano-photonics, and meta-materials, and their applications. His recent work in those areas deals with the applications of metamaterials and plasmonics to infrared light harvesting, thermal signature camouflage, solar thermo-photovoltaics, biosensing and molecular fingerprinting using metamaterial arrays, nanoscale lasers/"spasers", and sub-resolution imaging using nanoparticle labels. He is the author or coauthor of more than 140 papers in refereed journals, including Science, Nature Physics, Nature Materials, Nature Photonics, and Physical Review Letters. Dr. Shvets was a Department of Energy Postdoctoral Fellow in 1995-96. He was a recipient of the Presidential Early Career Award for Scientists and Engineers in 2000. He is a Fellow of the American Physical Society (APS) and Optical Society of America (OSA). His research is supported by various government agencies, including Department of Energy, National Science Foundation, Air Force Office of Scientific Research, Army Research Office, and Office of Naval Research.

Faculty Host: Enam Chowdhury