

FDITE160 Advanced experimental laser-plasma physics

Description:

Significant advances in laser technology are likely to continue to be achieved for some years to come, hopefully leading to further enhancements in extremely short and high-intensity pulses and a sizable jump in the achieved power. Powerful lasers make relativistic plasmas in laboratories. These developments, in which the ELI-ALPS is playing a leading role, will surely simulate the emergency of new ideas and more advance diagnostic developments, for measuring the effects not even thought of today.

Lecture course will be about the advancements in the Experimental High Power Laser-Plasma Research and Applications: Introduction to the Frontiers.

Topics:

- 1st Introduction: Overview, Scientific area, opportunities and grand challenges
 - 2nd Basic high field science, high energy-density science and lab. Astrophysics
 - 3rd Laser concept: Ultrashort Laser Pulse Generation, Realisation of parameters and development
 - 4th Interaction of intense laser pulses with matter: absorption, ionization, free electrons, laser plasma generation
 - 5th Problem of diagnostic of the dense, relativistic plasmas
 - 6th Laser based x-ray sources, coherent and incoherent radiations
 - 7th Laser accelerators: Principles of electron generation in a hot dense plasma, laser-wake field acceleration of electrons
 - 8th Laser accelerators: Principles of ion acceleration in plasmas, light pressure, target normal sheath acceleration (TNSA) of ions/protons, and other mechanisms.
 - 9th Optical methods probing of the dense plasmas - Interferometry, shadowgraphy, polarimetry
 - 10th X-ray diagnostic of the dense plasmas - x-ray spectroscopy, x-ray probing and shadowgraphy, methods of formation and analysis of the x-ray images of the plasmas
 - 12th Particle diagnostic: Spectroscopic methods of diagnosing energetic particles - ions, electrons, neutrons
 - 13th Particle diagnostic: passive and active detectors
 - 14th Particle diagnostic: Ion-induced Nuclear Reactions, detection Using Nuclear Activation; nuclear pyrometry method
 - 15th Relativistic plasma fields diagnostic: Proton deflectometry and Radiography
 - 16th New perspectives of advanced, compact laser-driven ion accelerators.
- Summary and featuring of the high field Petawatt laser laboratory at ELI, Lab tour at ELI