Colloquium # 247

Title: *Laser Plasma Physics with GEKKO XII-LFEX at Osaka University*

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About the speaker : Prof. Kunioki Mima is a Professor at The Graduate School for the Creation of New Photonics Industries and a Guest Professor at the Institute of Fusion Nuclear, Universidad Politecnica de Mardid. He obtained his Graduate, Post Graduate as well as his Doctorate in Physics from faculty of science Kyoto University in the year 1968, 1970 and 1973 respectively. He worked as an assistant Professor in Department of Solid State Physics at Hiroshima University from 1973-1974. He also served as an Assistant Professor, Faculty of Engineering from 1975-1976 at Osaka University. He was an Assistant Professor at Institute of Laser Engineering, Osaka University from 1977-1978. He was a Director at Institute of Laser Engineering, Osaka University from 1995-1999 and 2005– 2009. He was also a Research Associate at Bell Telephone Laboratory, Murray Hill, N.J. USA and Research Associate at University of California, Los Angeles, USA. His other activities include being a Member of Osaka University Steering Committee during 1996-2000, Executive of the Japan Society of Plasma Science and Nuclear Fusion Research during 1998-2007, General Co-chair of IFSA International Conference from 2000-2009, JSPS-CAS Member of Steering Committee of Core- University Program on Plasma and Nuclear Fusion from 2005-2009, Member of Steering Committee of US-Japan collaboration program on Nuclear Fusion during 2005-2009, Member of Editorial Board of Nuclear Fusion at IAEA in the year 2005, Executive of the Laser Society of Japan in 2005, Member of Fusion Research Working Group under the Ministry of Education Science and Technology, Japan 2006, December-present Adjunct member of Japan Academy of Science. His fields of interest are Non– linear Plasma Physics, Laser Fusion, Magnetic Confinement Fusion and Relativistic Laser Plasma. Prof Mima has more than 430 papers and was awarded by various Institutes/Societies during his research career.

Abstract: The GEKKO XII laser system at ILE Osaka University has been upgraded by adding a new short pulse laser: LFEX laser which is 4 beam system and could deliver a picoseconds pulse with energy up to 5kJ. The GXII and LFEX lasers are synchonized with timing accuracy of 30ps. The focused laser intensity could reach 1021 W/cm2 on a solid target. The contrast ratio has been improved to 10-7. In order to futher improvement of the contrast ratio, the plasma mirror has been installed. The main research objectives of this laser system are the fast ignition and high enegy density science.

The critical issue of the fast ignition has been recognized to be the coupling efficiency of a short pulse laser to a hot spark. Namely, the ultra-intense short pulse laser plasma interaction (UISP-LPI) and the relativistic electron transport (RET) are critical for the fast ignition.

In the UISP-LPI, the generated relativistic electron energy is required to be no more than 5MeV, and in the RET, the diameter of the relativistic electron beam should be less than 50 μm. Recently, magnetized fast ignition (MFI) is proposed for improving the coupling efficiency of a heating laser to a core plasma. In the MFI, the external magnetic field is applied to reduce the hot electron energy and focus the dense hot electron flux to the core. The external magnetic field higher than 1 kT is generated by the laser driven coil and it is amplified by the implosion. The magnetic field at the tip of the cone is expected to reach about 10kT and the laser plasma interaction and the hot electron transport are modified. As the results of applying the external magnetic field, hot electron energy is efficiently converted into fast ion for the laser intensity of 1020W/cm2 which will contribute to the core heating because the nonlinear processes of the Weibel instability change drastically in the magnetized laser plasma and the collisionless shock ion acceleration becomes effective.

In the presentation, recent theory, simulation and experimental results on the MFI and the high energy density science by GXII-LFEX laser system at ILE Osaka University are reviewed and the prospects of the researches will be discussed.

Schedule:
Date: 24 th Febuary 2015
Time: 3:30 PM
Venue: IPR, Seminar Hall