Seminar

Institute for Plasma Research

Title : Laser Photodetachment for the electron density and negative ion density measurements using Hairpin probe in the SPIN-eX Plasma device

Speaker: Dr. Nageswara Rao Epuru
Institute for Plasma Research, Gandhinagar

Date : 15th February 2021 (Tuesday)

Time : 03.30 PM

Venue : Online - Join the talk:
https://meet.ipr.res.in/Dr.NageswaraRao_PDF_ExtensionTalk

Abstract :

Laser-induced photodetachment is an invasive technique to determine the negative ion density and temperature in an electronegative plasma [1-3]. The role of the laser pulse is to supply photon energy to knock the electrons from the negative ions, hence converting the negative ions into electron neutral pairs. The newly created electrons are then detected using electrostatic probe placed inside the laser beam path. The experimental setup consists of a double pulsed Nd:YAG laser (EKSPLA NL300) operated in its second harmonic of 532 nm (FWHM ~6 ns, ~10 Hz and 400 mJ energy) whose corresponding photon energy (2.33 eV) is suitable to photo-detach the negative ions of O_2 - (0.44 eV) and O- (1.46 eV). In the MPD section, this technique was established and biased hairpin probe was operated in the time resolved mode for measuring the electron density during pulsed laser photodetachment of negative ions in oxygen plasma. In this talk, I will discuss the detailed experimental scheme and preliminary results of laser photodetachment obtained for the first time using a combination of pulsed laser and a hairpin probe. The temporal evolution of the electron density (Ne) increased rapidly from 0 to 2 microseconds at the centre of the laser beam and fall to the background level in several microseconds. From this, the negative ion density (n-), electronegativity (α) and negative ion temperature were calculated at 50 W RF power, 1.6 Pa gas pressure [4].

References :
[1] J. Conway, N. Sirse and S. K. Karkari, Plasma Sources Sci. Technol. 19 065002 (2010).
[2] M. Bacal, Rev. Sci. Instrum., 71(11), 3981-4006 (2000).
[3] M. Hasani, Z. Marvi and J. Beckers, J. Phys. D: Appl. Phys., 54 495202 (2021).
[4] A. K. Pandey, Jay K. Joshi and S. K. Karkari, Plasma Sources Sci. Technol., 29, 015009(2020).