Seminar

Institute for Plasma Research

Title : Laser photo-detachment based negative ion diagnostics development - Status update

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Time : 03.00 PM

Venue : Committee Room 3, (New Building), IPR

Abstract :

Cavity ring down spectroscopy (CRDS) is a laser based absorption spectroscopy which can quantitatively detect the atomic and molecular species in parts per billion (ppb) or parts per trillion (ppt). In a conventional CRDS technique, laser pulse is injected into a high finesse optical cavity containing the sample to be examined and the decay transient of the laser pulse is monitored with a suitable detector that measures the light intensity transmitted through one of the cavity mirror. Recently CRDS has been used as a diagnostic technique for H^- negative ion detection in an inductively coupled negative ion source where the negative ions are produced in very small amount (~10^{10} cm-3 or less within 10^{12} cm^{-3} plasma density). The CRDS technique is independent to light intensity and so it is insensitive to laser shot to shot power fluctuations and also insensitive to RF induced noise. However it measures the line integrated density within the mirror cavity volume. In a negative ion source, H- formation depends on plasma parameters due to its collision based production and destruction mechanisms. Therefore, the plasma parameters need to be measured. A time resolved Langmuir probe system is developed to study the temporal evolution of plasma parameters during the experimentation period to study the correlation of dynamics of negative ions with respect to that of plasma. For this purpose an analysis algorithm has been written in LabVIEW and later incorporated with the system hardware for real time data analysis. The software is developed for both real time as well as post hoc analysis of Langmuir probe data and is normally applicable for low temperature, non-magnetized, collisionless plasmas. The unprocessed LP data contains significant noise level and so noise filtration is adopted. In present case, Savitzky-Golay (SG) noise filtering method is used for data conditioning for its ability to preserve the area under the signal curve. The analysis software is implemented in ROBIN data acquisition setup to study the plasma evolution in ROBIN in-situ, to optimize the operational parameter regime. The CRDS system is developed on a table top experimental system which will be incorporated in ROBIN system to study the correlation of negative ions dynamics with that of plasma.