SEMINAR NOTICE

Department of Physics and Engineering Physics
University of Saskatchewan

SPEAKER: Dr. Ivan Romadanov
Princeton Plasma Physics Laboratory, New Jersey

TOPIC: *Plasma for Microelectronics applications and beyond: devices, physics, and advanced diagnostics.*

DATE: Tuesday October 22nd, 2024

TIME: 3:30-4:30 p.m.

PLACE: ***Physics 103 & online.***

Zoom:
https://usask-ca.zoom.us/j/9799737072?pwd=aVRwcUUyNE1GWmZQM3JmV2tJMEZRQT09&omn=9799737072

Abstract:

Low temperature plasmas are essential in many industry and research applications. For example, semiconductor manufacturing requires uniform plasma conditions for atomic layer manipulation on large surfaces (wafers). Minor deviations can significantly impact production yields [1], emphasizing the need for improved understanding and control of plasma mechanisms. There is a growing demand for non-invasive, real-time, spatially resolved, species-specific plasma diagnostics. However, adapting these lab-developed diagnostics for use on reactors used for microelectronic production faces challenges like limited optical access, reflective surfaces, emissions, and hazardous gases.

The focus of this presentation is on diagnostics developed at Princeton Plasma Physics Laboratory (PPPL), particularly, Doppler-shift based laser-induced fluorescence (LIF) [2] and challenges in adapting this diagnostic for industrial applications. The proposed solution involves the use of structured light [3] in plasma spectroscopy, specifically employing Laguerre-Gaussian laser beams. The Annular Beam Confocal LIF (ABC-LIF) [4], designed on these principles, addresses issues like limited plasma access. Wavelength Modulation (WM) LIF spectroscopy, which improves the analysis of complex VDF signals [5], will also be discussed.

Examples of applications of LIF diagnostics for studies of various plasma sources, including Penning discharge [6], electron beam device [7], and an industrial plasma source provided by PPPL's industrial partner, will be presented. These sources share common challenges, such as plasma oscillations affecting their properties [8].

Finally, the development of an in-situ diagnostic for material erosion during plasma operation will be covered. This diagnostic employs a long-distance microscope paired with a shape-from-focus algorithm, achieving resolutions of 10s of from distances up to 1 m [9]. It provides critical insights into material- plasma interactions, particularly valuable in fields like electric propulsion testing.

Coffee and cookies available in the physics lounge Phys 177 at 3:00pm for those attending the seminar.