Michigan Institute for Plasma Science and Engineering Seminar

Physics of Low Pressure Inductive Discharges

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Room 1200 EECS Building

Abstract

The basics and recent advances in the physics of low pressure Inductively Coupled Plasmas (ICPs) are reviewed. In these discharges, the interaction of an electromagnetic field with plasma electrons is frequently governed by electron thermal motion rather than by electron-atom collisions. A variety of new phenomena such as a wave phase bifurcation, phase velocity reversal, a second current layer and negative power absorption have been found in experiments and interpreted in terms of nonlocal electrodynamics. Nonlinear effects induced by the rf Lorentz force, such as the 2nd harmonic polarization in the skin layer and second harmonic current circulating around the main discharge current as well the modification of the spatial distribution of the plasma caused by ponderomotive forces have been demonstrated in ICP under discharge conditions typical for industrial applications. Direct measurements of the rf electric field and current density in the plasma have made it possible to distinguish between collisional and stochastic (collisionless) electron heating.

About the Speaker: **Dr. Valery Godyak received the M.S. in physics-electronics from St. Petersburg Technical University and the Ph.D. in plasma physics from Moscow State University (Russia). He was an Asst. Professor in the Physics Department at the Ryazan Radio University, worked in the Laboratory of Fusion Engineering at the Institute of Electro-Physical Apparatus and in the Physics Department at the Moscow State University, where he was a Team Leader, conducting basic research on rf discharges. In 1984, he immigrated to the U.S. and joined GTE Corporation (presently OSRAM Sylvania), where he held the position of the Corporate Scientist, retiring in 2008. His research interests are gas discharge physics, interaction of rf fields with bounded plasmas, electron kinetics and plasma electrodynamics, plasma diagnostics, light source science and technology, plasma devices for material processing and plasma system design. Dr. Godyak is a Fellow of the APS and of the IEEE, and is a member of the Serbian Academy of Technical Science. He was awarded with the "OSRAM STAR", "SIEMENS International Innovation Competition" and "OSRAM Sylvania Innovation" awards. He is a winner of the James Clerk Maxwell Prize for Plasma Physics.**