Michigan Institute for Plasma Science and Engineering Seminar

Microwave-Driven Breakdown: From Dielectric Surface Multipactor to Ionization Discharge

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Abstract

High-power microwave-driven breakdown in the vicinity of a dielectric window is theoretically and experimentally examined across a wide range of conditions. At low pressures, a single-surface multipactor absorbs about 2% of the microwave energy and has a mean energy, ε, of 100s eV. At 10-50 Torr for L-band radiation, a transition occurs from a single surface multipactor to a detached ionization discharge. Above 50 Torr, the multipactor disappears and the discharge forms a sheath, with ε below 10 eV. Simple scaling laws fit results in the low and high pressure regimes. Experiments demonstrate a variable statistical delay time, followed by a rapid breakdown. UV illumination of the dielectric surface reduces the statistical delay time, making onset of breakdown more consistent. Experiments recently demonstrated arrays of plasma filaments aligned along electric field lines, spaced ≤ ¼ wavelength at low pressure, coalescing into more continuous diffuse plasmas at higher pressure. A 1D drift-diffusion fluid model combined with an analytic model for EM was able to demonstrate the propagation and spacing mechanisms.

About the Speaker: **John P. Verboncoeur received a BS in Engr. Science from the Univ. of Florida and the MS and PhD in Nuclear Engr. from the Univ. of California - Berkeley (UCB) in 1992 where he was a DOE Fusion Energy Fellow. After being at Lawrence Livermore Natl. Lab., he joined the faculty in Nuclear Engr. at UCB in 2001. In 2011 he joined Michigan State University as Professor of Elect. & Comp. Engr. John's research is in theoretical and computational plasma physics with applications from low temperature plasmas to accelerators. He coauthored the UCB PIC-Monte Carlo codes used by >1000 researchers. He has 65 journal articles and has taught many mini-courses on plasma simulation.**