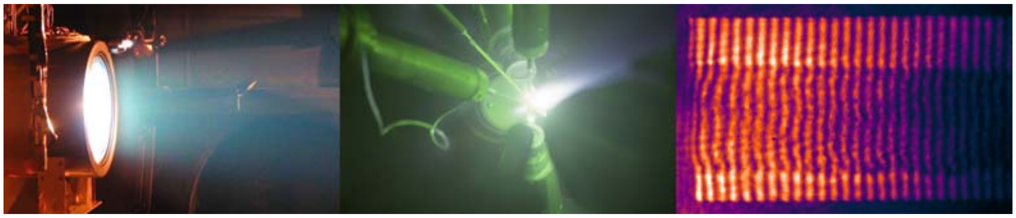

Michigan Institute for Plasma Science and Engineering Seminar

Mode Switching in Relativistic Magnetrons and Hysteresis

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Wednesday, 16 March 2011 - 4:00 pm
Room 1303 EECS Building

Abstract

Electron flow in relativistic magnetrons has been studied for decades. It is responsible for the generation of very high power levels of microwave radiation, and the physics of this type of crossed-field flow has also been used to describe the cylindrical electrosphere in pulsars. The A6 relativistic magnetron invented by Bekefi at MIT in the mid-to-late 1970's is known to suffer from mode competition. For the accelerator parameters available at the University of New Mexico, at a fixed cathode radius mode competition in an A6 magnetron takes place between the π-mode and $2\pi/3$-mode when the applied DC magnetic field is near the critical field of about 4.5 kG. Using particle-in-cell computer simulations we show that the introduction of a relatively low-power external RF signal can eliminate this mode competition to achieve stable single mode operation. The mechanical analogy of the situation at the critical magnetic field is the bifurcation of modes that occurs for a system of two stable states separated by a saddle point. In addition, the introduction of an external RF signal during magnetron operation leads to mode switching during the pulse, adding frequency agility to the source. Furthermore, hysteresis is observed to be associated with mode switching during magnetron operation. These processes and the electron flow associated with them will be discussed.

About the Speaker: **Dr. Edl Schamiloglu is the Gardner-Zemke Professor of Electrical and Computer Engineering at the University of New Mexico. He received his Ph.D. at Cornell University's Laboratory of Plasma Studies in 1988. He has coauthored 80 articles in archival journals and two books. He is a Fellow of the IEEE, a Senior Editor of the IEEE Transactions on Plasma Science, and an Associate Editor of the Journal of Electromagnetic Waves and Applications. He was the General Chair of the 2007 IEEE Pulsed Power and Plasma Science Conference (combined Pulsed Power and ICOPS).**