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Distinguished Lecture Series

EM-Plasma Interactions: Innovations in High-Power Microwaves and Highly Efficient Plasma Generators



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Tuesday, September 17, 2024
11:00 a.m. - 12:00 p.m.
Location: TSRB 118 Auditorium

Abstract: Semiconductor devices have traditionally been used as high-frequency tuning elements. Other technologies have also been utilized, including MEMS, liquid crystals, and ferrite materials. However, these technologies face limitations in tuning range and power handling—both crucial for most emerging systems. Cold plasma offers a promising alternative in this regard. By precisely controlling plasma's internal parameters like electron density, its dielectric permittivity and conductivity can be uniquely tuned, making it highly adaptable and reconfigurable for high-frequency applications, particularly in high-power environments. Cold plasmas are also vital in many other fields, such as material processing, electric propulsion, food and water decontamination, semiconductor fabrication, particle acceleration, and medical treatments. However, generating stable plasmas is not trivial due to the need for energy-hungry sources. With their ability to store and amplify electromagnetic energy, microwave resonant structures can create energy-efficient plasmas, even with milliwatts range of power. These plasmas also offer other advantages, such as higher ionization and dissociation rates, increased electron density, enhanced production of reactive species, and lower temperatures. This talk will review our research on electromagnetic-plasma interactions, focusing on high-power microwaves and efficient microwave plasma sources.

Bio: Abbas Semnani is an Associate Professor of Electrical Engineering and the Director of the Adaptive Radiofrequency and Plasma Lab (ARPL) at the University of Toledo. Before joining UToledo in 2019, he spent seven years at Purdue University, focusing on the physics and applications of plasma–electromagnetic interactions. His research interests include high-power microwaves, tunable and compact antennas, reconfigurable RF electronics, and microwave plasma sources and applications. Dr. Semnani received the 2019 IEEE MTT-S 'Tatsuo Itoh' Best Paper Award, the NASA Glenn Faculty Fellowship in 2022, and the NSF CAREER Award in 2024.

Host: Nima Ghalichechian