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Michigan Institute for Plasma Science and Engineering

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Room 1005 EECS

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Kinetics of Nanosecond Discharges at High Specific Energy Release

Recent progress in solid-state high power electronics has produced compact and reliable high voltage nanosecond (ns) generators for research and industry. High-voltage pulses 5-10 kV in amplitude and a few tens of ns in duration are capable of producing highly non-equilibrium low temperature plasmas over a wide range of pressure – 0.1 Torr to 15 bar. In these transient plasmas, reduced electric fields up to kTd (1 Td = 10^{-17} V cm^2), are typical at the propagating discharge front that initially produces the plasma. Behind the front the electric field stays high, hundreds of Td, producing high densities of excited states and radicals. This results in the high efficiency of ns discharges as a trigger for chemically active systems. At deposited energies of 0.5-1 eV/molecule, high rates of energy relaxation produce fast gas heating – thousands of K during tens of nanoseconds. Excitation densities can become so high that collisions of excited species with ions, other excited species and radicals become important. A review of plasma parameters in ns discharges, from fast ionization waves (FIWs) at low pressure to filamentary nanosecond surface dielectric barrier discharges (nSDBDs) at tens of bars will be given. Modifications of discharges leading to high energy release will be discussed, as well as their consequences for plasma diagnostics and potential applications.

About the Speaker: Dr. Svetlana Starikovskaia received the Ph.D. in Plasma Physics and Chemistry in 1993 from the Moscow Institute of Physics and Technology where she was also Senior Scientist and Professor. During this time, Dr. Svetlana Starikovskaia became one of the youngest Doctors of Science (D.Sc.) in Russia, receiving the Russian Federation Presidential Award for Young Doctors of Science. She is now Senior Researcher (Directrice de recherche) in the CNRS Laboratory for Physics of Plasma, French National Academy of Science. Her research interests include nanosecond pulsed discharges and fast ionization waves; kinetics of gases and plasmas at extreme thermodynamic nonequilibrium; kinetics of excited species and their influence of chemically nonequilibrium media and interaction of nonequilibrium plasmas with living cells. Dr. Starikovskaia is internationally recognized for her research in plasma assisted combustion for which she has written several review papers. Dr. Starikovskaia has authored more than 70 articles.