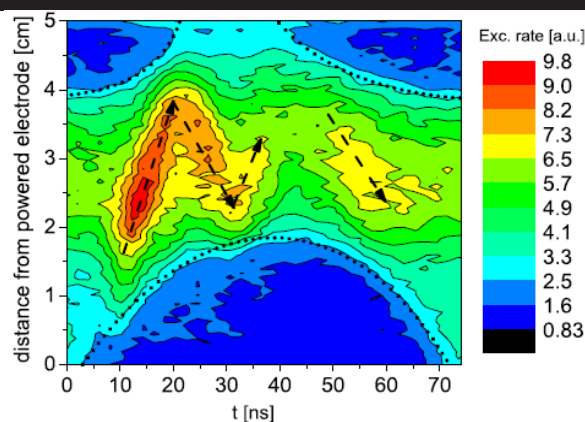


Uwe Czarnetzki

Institute for Plasma and
Atomic Physics
Faculty of Physics and Astronomy
Ruhr-University Bochum, Germany



Physics at the Edge Plasmas with dynamic sheaths

Department of Physics Colloquium

Plasmas generated by applying a radio-frequency potential across a gas at low pressure between two electrodes are called capacitively coupled plasmas (CCP). They find frequent application in semiconductor and solar-cell production and other fields of industry. The physics of CCPs is dominated by the non-linear dynamics of the space-charge sheaths in front of the electrodes. This dynamics determines the ion as well as the electron energy distribution function, provides the main stochastic electron heating mechanism, and is also essential for trapping of energetic electrons. If a certain asymmetry between the sheaths at the two electrodes exists, the non-linearity leads to self-generated high frequency current oscillations which can strongly enhance the electron heating. Usually the asymmetry results from the geometrical size of the electrodes. However, by applying non-sinusoidal waveforms the symmetry can be broken even in the case of geometrical symmetry. This so called “electrical asymmetry effect” provides a simple and elegant way of external control where in particular the ion energy can be adjusted. The underlying physics will be explained by experimental results, analytical models, and particle-in-cell/Monte-Carlo simulations.

