Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Influence of collisions on spatial damping of electrostatic electron waves in a low-pressure plasma JENS OBERRATH, RALF PETER BRINKMANN, Theoretical Electrical Engineering, Ruhr-Universität Bochum — Electrostatic electron waves in a plasma can be excited in several ways. One possibility is a resonance effect, if any rf frequency is locally equal to the electron plasma frequency. In this region the energy of the electric field increases and has to disperse into the plasma. Therefore, a transport mechanism is needed which is given by electrostatic waves. These waves can be damped in time and space domain. After a short time period waves with temporal damping do not exist in the plasma anymore. Thus, we are interested in waves with spatial damping to describe the resonance effect for any length of time. This damping depends on collisions between the electrons and the neutral background gas. To investigate the influence of collisions on the damping we formulate a kinetic model for the electron behavior in the high frequency range of weakly ionized low-pressure plasmas with elastic collisions. We assume an isotropic collision term with a constant collision frequency because of the huge mass difference between electrons and neutrals. This allows the derivation of a dispersion relation from the linearized Boltzmann-Poisson system for homogeneous longitudinal waves, which is able to describe the influence of collisions on the wave propagation of electrons. In addition we find the relation for a Vlasov plasma as a special case which shows the spatial Landau damping.

Jens Oberrath
Theoretical Electrical Engineering, Ruhr-Universität Bochum

Date submitted: 10 Jun 2009 Electronic form version 1.4