Abstract Submitted
for the GEC07 Meeting of
The American Physical Society

Plasma induced by Resonance Enhanced Multi-Photon Ionization (REMPI) in Inert Gas MIKHAIL SHNEIDER, ZHILI ZHANG, RICHARD MILES, Princeton University — We present a model for REMPI plasma evolution in the neutral inert gas (argon) during and after the ionizing laser pulse. The theory of REMPI breakdown is considered in 1D cylindrical geometry and includes time dependent continuity equations in the diffusion-drift approximation for plasma components: Rydberg atom states excited in 3 photon process, electrons, Ar+ and Ar2+ ions. The Poisson equation for potential and the electron heat transfer equation together with 1D gasdynamic Navier-Stokes equations are also included. Both ionization by REMPI and by collisions of bulk electrons with atoms are taken into account. Our study demonstrates the complete process of REMPI plasma generation and decay in the inert gas together with the gas dynamic equations. Plasma expansion represents a classical ambipolar diffusion. It is shown that gas becomes involved in the motion not only by the pressure gradient due to the heating, but also because of momentum transfer from the charged particles to gas atoms. Gas heating and momentum transfer from charged particles result in a weak shock or acoustic wave. The time dependence of the total number of electrons computed in the theory is in agreement with the results of the coherent microwave scattering experiment.

Mikhail Shneider
Princeton University

Date submitted: 15 Jun 2007 Electronic form version 1.4